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June 29, 1998

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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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;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ 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.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
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AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 468)

JUNE 29, 1998

51
LIFE SCIENCES (GENERAL)

19980051210

An ecological life support system for fish for 100-day experiments

Taub, Frieda B., Washington, Univ., Seattle, USA; Howell-Kuebler, Alexis, Washington, Univ., Seattle; Nelson, Marjorie, Washington, Univ., Seattle; Carrasquero, Jose, Washington, Univ., Seattle; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 107-116; In English

Contract(s)/Grant(s): NAS2-13227; Copyright; Avail: Aeroplus Dispatch

An aquatic habitat of 1.7 L was designed to support three adult fish (medaka, Oryzias latipes) for 100 days with minimal exchange of water. The Aquatic Habitat consisted of a specimen chamber (800 ml), biofilter chamber and associated tubing (250 ml), and a microbial control chamber (650 ml), filled with water. Fish were fed daily. The water was oxygenated via a hollow fiber oxygenator. The liquid flow rate was 30 ml/min and the air flow as 100 ml/min. Six units were established. Fish mortalities, when they occurred, were often associated with failures of the water flow system and lack of oxygen being supplied from the oxygenator. The bacterial community, from three 'Bio-Chem Stars' inoculated from a medaka aquarium, transformed ammonia and prevented toxic conditions from occurring. The bacteria were grazed by protozoa, rotifers, nematodes, oligochaetes, and ostracods in all habitats. In three of six habitats, Daphnia and amphipods had been purposely introduced; their survival was variable. Biofilm and settled particulates accumulated during the experiment and eventually exceeded the weight of the fish. of six units, two supported the initial fish through the whole experiment, another experienced fish mortalities, but replacement fish survived, and three units did not support fish survival for the 100 days. Our results demonstrated the feasibility of the system, but many improvements are needed such as improved water flow and oxygen monitoring to assure prompt corrective action.

Author (AIAA)

Closed Ecological Systems; Fishes; Survival

19980051236

The search for blood substitutes

Nucci, Mary L., USA; Abuchowski, Abraham; Scientific American; Feb. 1998; ISSN 0036-8733; Volume 27, no. 2, pp. 72-77; In English; Copyright; Avail: Aeroplus Dispatch

Work being done on artificial substitutes for whole blood is discussed. Attention is given to substitutes based on hemoglobin and substitutes based on totally synthetic chemicals. The applications of these substitutes are considered along with safety considerations.

AIAA

Blood; Substitutes; Life Sciences; Chemical Compounds; Diseases; Antigens

19980051264

Molecular circadian oscillators - An alternative hypothesis

Roennebrg, Till, Inst. fuer Medizinische Psychologie, Germany; Merrow, Martha, Inst. fuer Medizinische Psychologie, Germany; Journal of Biological Rhythms; Apr. 1998; ISSN 0748-7304; Volume 13, no. 2, pp. 167-179; In English; Copyright; Avail: Aeroplus Dispatch

Results from experiments in different organisms have shown that elements of input pathways can themselves be under circadian control and that outputs might feed back into the oscillator. In addition, it has become clear that there might be redundancies in the generation of circadian rhythmicity, even within single cells. In view of these results, it is worth reevaluating our current working hypotheses about the pacemaker's molecular mechanisms and the involvement of single autoregulatory genes. On one

hand, redundancies in the generation of circadian rhythmicity might make the approach of defining a discrete circadian oscillator with the help of single gene mutations extremely difficult. On the other hand, many examples show that components of signal transduction pathways can indeed be encoded by single genes. The authors have constructed a model placing an autoregulatory gene and its products on an input pathway feeding into a separate oscillator. The behavior of this model can explain the majority of results of molecular circadian biology published to date. In addition, it shows that different qualities of the circadian system might be associated with different cellular functions that can exist independently and, only if put together, will lead to the known circadian phenotype.
Author (AIAA)
Circadian Rhythms; Cells (Biology); Biofeedback; Genes; Molecular Biology

19980051266
The suprachiasmatic nucleus - A 25-year retrospective
Weaver, David R., Massachusetts General Hospital, Boston, USA; Journal of Biological Rhythms; Apr. 1998; ISSN 0748-7304; Volume 13, no. 2, pp. 100-112; In English; Copyright; Avail: Aeroplus Dispatch

This report traces the important steps forward in our understanding of the circadian clock in the suprachiasmatic nucleus (SCN). Attention is given to the discovery of the discovery of the SCN as the circadian pacemaker in rodents, refined assessment of the effects of destruction of the SCN, SCN oscillations in vivo, in vitro electrophysiology of the SCN, and recent findings regarding mutations affecting the circadian clock as well as oscillatory properties of individual SCN neurons.
Author (AIAA)
Human Performance; Circadian Rhythms; Sleep; Electrophysiology; Neurons

19980054771
Recognizing facial expressions in image sequences using local parameterized models of image motion
Black, M. J., Xerox Palo Alto Research Cent., USA; Yacoob, Y.; International Journal of Computer Vision; Oct, 1997; ISSN 0920-5691; Volume 25, no. 1, pp. 23-48; In English; Copyright; Avail: Issuing Activity

This paper explores the use of local parametrized models of image motion for recovering and recognizing the non-rigid and articulated motion of human faces. Parametric flow models (for example affine) are popular for estimating motion in rigid scenes. We observe that within local regions in space and time, such models not only accurately model non-rigid facial motions but also provide a concise description of the motion in terms of a small number of parameters. These parameters are intuitively related to the motion of facial features during facial expressions and we show how expressions such as anger, happiness, surprise, fear, disgust, and sadness can be recognized from the local parametric motions in the presence of significant head motion. The motion tracking and expression recognition approach performed with high accuracy in extensive laboratory experiments involving 40 subjects as well as in television and movie sequences.
EI
Image Motion Compensation; Computer Vision; Optical Flow (Image Analysis); Recognition; Cognition; Imagery; Mathematical Models

19980055545
Biotechnology Facility - An ISS microgravity research facility
Gonda, Steve R., NASA Johnson Space Center, USA; Tsao, Yow-Min, KRUG Life Sciences, USA; Jan. 1998; In English
Report No.(s): AIAA Paper 98-0256; Copyright; Avail: Aeroplus Dispatch

The purpose of the International Space Station's Biotechnology Facility (BTF) is to furnish the support structure and integration capabilities for the individual modules in which biotech experiments are to be run. The BTF also furnishes a capability for human-tended, repetitive, long-duration biotechnology experiments in microgravity. Typical investigations conducted by the BTF will encompass cell science and tissue engineering, protein crystal growth, and bioseparations.
AIAA
Microgravity; International Space Station; Biotechnology; Research Facilities; Long Duration Space Flight

19980055717
Application of the extreme low-shear regime of simulated microgravity to insect-cell cultivation
Cowger, Nancy, Louisiana, Tulane Univ., New Orleans, USA; O'Connor, Kim, Louisiana, Tulane Univ., New Orleans; Jan. 1998; In English
Contract(s)/Grant(s): NAG9-826
Report No.(s): AIAA Paper 98-0461; Copyright; Avail: Aeroplus Dispatch

There is a shift from necrosis to apoptosis when batch cultures of Spodoptera frugiperda are grown in the extreme low-shear regime of NASA's High-Aspect Rotating-Wall Vessel (HARV) vs a shaker flask. The NASA vessel was developed for the cultivation of animal cells in an environment that simulates microgravity on Earth. Fluorescence microscopy with the DNA stains acridine orange and ethidium bromide showed that 33 percent of S. frugiperda cells were apoptotic in the HARV when the viability was 50 percent, while cells grown in shaker flask had no more than 11 percent apoptotic cells at the same viability. We believe that the shift to apoptosis in the HARV is primarily the result of reduced hydrodynamic forces.
Author (AIAA)
Microgravity; Insects; Cells (Biology); Shear Stress

19980056673
Worms bask in extreme temperatures
Cary, S. C., Delaware, Univ., Lewes, USA; Shank, T., Rutgers Univ., USA; Stein, J., Diversa Corp., USA; Nature; Feb. 05, 1998; ISSN 0028-0836; Volume 391,, no. 6667, pp. 545, 546; In English; Copyright; Avail: Aeroplus Dispatch

A colony-dwelling polyachete worm that inhabits deep-sea hydrothermal vent chimneys has been found to routinely experience temperatures above 80 C and thermal gradients of 60 C or more over its body length. Such 'Pompeii worms' and their associated microflora offer a unique opportunity for discovering biochemical adaptations to extreme conditions.
AIAA
Ocean Temperature; Temperature Gradients; Vents; Body Temperature; Marine Biology

19980056675
Three-dimensional preservation of algae and animal embryos in a Neoproterozoic phosphorite
Xiao, Shuhai, Harvard Botanical Museum, USA; Knoll, Andrew H., Harvard Botanical Museum, USA; Zhang, Yun, Beijing Univ., China; Nature; Feb. 05, 1998; ISSN 0028-0836; Volume 391,, no. 6667, pp. 553-558; In English; Copyright; Avail: Aeroplus Dispatch

Phosphorites of the late Neoproterozoic (570 +/- 20 Myr BP) Doushantuo Formation, southern China, preserve an exceptional record of multicellular life from just before the Ediacaran radiation of macroscopic animals. Abundant thalli with cellular structures preserved in 3D detail show that latest-Proterezoic algae already possessed many of the anatomical and reproductive features seen in the modern marine flora. Embryos preserved in early cleavage stages indicate that the divergence of lineages leading to bilaterians may have occurred well before their macroscopic traces or body fossils appear in the geological record. Discovery of these fossils shows that the early evolution of multicellular organisms is amenable to direct palaeontological inquiry.
Author (AIAA)
Marine Biology; Algae; Embryos; Cells (Biology); Organisms; Paleontology

19980056954
Physicochemical surface characteristics of brevibacterium linens
Kiely, L. J., Univ. of Wisconsin-Madison, USA; Olson, N. F.; Mortensen, G.; Colloids and Surfaces B: Biointerfaces; Sep 30, 1997; ISSN 0927-7765; Volume 9, no. 6, pp. 297-304; In English; Copyright; Avail: Issuing Activity

The physicochemical surface characteristics and interfacial behavior of two strains of Brevibacterium linens (BL-MGE and BL-9174), that may enhance cheese flavor, were assessed. Cell surface hydrophobicity was determined by measuring the contact angle of a variety of polar and non-polar wetting agents on lawns of the bacterial cells. The contact angles obtained were used to calculate the cell surface free energy components gamma(sup LW), gamma(sup AB), gamma(+) and $gamma(-). The Lifshitz van der Waals component and the Lewis acid-base component were approximately 35 mJ m(sup -2) and 22 mJ m(sup -2), respectively, for both strains. Under conditions of physiological pH and low ionic strength, neither strain exhibited affinity for an octyl ligand in hydrophobic interaction chromatography. This occurred despite a favorable free energy of interfacial interaction which was attributable almost entirely to favorable acid-base interactions between cells and octyl-sepharose. The nature of surface functional groups was evaluated using X-ray photoelectron spectroscopy. Excluding H, the mean percentage of atomic fraction for C, O, N and P for BL-MGE was 57.7, 37.8, 3.9 and 0.6%, respectively and 61.0, 31.8, 7.0 and 0.2%, respectively for BL-9174.
Author (EI)
Lewis Base; Bacteria; Surface Properties; Interfaces; Free Energy

19980057329
Crepuscular rhythms of EEG sleep-wake in a hystricomorph rodent, Octodon degus
Kas, Martien J. H., Stanford Univ., USA; Edgar, Dale M., Stanford Univ., USA; Journal of Biological Rhythms; Feb. 1998; ISSN 0748-7304; Volume 13, no. 1, pp. 9-17; In English

Contract(s)/Grant(s): F49620-95-1-0388; NIH-AG-06490; NIH-AG-11084; Copyright; Avail: Aeroplus Dispatch

This study examined the circadian sleep-wake rhythms in Octodon degus by means of electroencephalogram (EEG) analysis. Recordings were made from animals housed with or without running wheels in the cages. In a 24-h light-dark (LD) cycle (LD 12:12), sleep and wake patterns were highly fragmented under both conditions, except for crepuscular timed episodes of waking. Without running wheels, sleep bout lengths averaged 3.7 +/- 0.1 min, and total sleep time was 37.6 +/- 3.7 percent per 24 h. Although the percentage of total wakefulness was similar during the light phase (63.4 +/- 2.4 percent) and dark phase (61.5 +/- 2.8 percent), measures of locomotor activity (LMA) and body temperature were generally greater during the day than during the night. Without running wheels, EEG slow wave activity (SWA) in nonrapid eye movement (NREM) sleep exhibited a circadian waveform that was elevated only during the light phase. SWA peaked at Zeitgeber Time 7 (ZT 7) (several hours after the dominant waking episode at ZT 23), then declined across the later half of the light phase and into the dark phase. Voluntary wheel running did not alter daily total sleep time, the duration of average sleep bouts, or maximum sleep bouts, but it increased the episode of waking, LMA, and body temperature at ZTs 11-12. Under these conditions, NREM sleep and SWA exhibited crepuscular patterns, with elevated SWA during the day and night.

Author (AIAA)

Circadian Rhythms; Physical Exercise; Sleep; Physiological Responses; Body Temperature

19980057330

In vitro circadian rhythms of the mammalian suprachiasmatic nuclei - Comparison of multi-unit and single-unit neuronal activity recordings

Prosser, Rebecca A., Tennessee, Univ., Knoxville, USA; Journal of Biological Rhythms; Feb. 1998; ISSN 0748-7304; Volume 13, no. 1, pp. 30-38; In English

Contract(s)/Grant(s): NIH-MH-53317; Copyright; Avail: Aeroplus Dispatch

The circadian clock in the mammalian suprachiasmatic nuclei (SCN) expresses 24-h rhythms when isolated in vitro. Numerous studies have demonstrated that recordings of SCN single-unit neuronal activity (SUA), when expressed as a population rhythm, can be used to reliably estimate SCN circadian clock phase in vitro. The main disadvantage of this technique is its laborious nature. Thus, the present experiments were designed to investigate whether in vitro multi-unit neuronal activity (MUA) recordings from the SCN could reliably substitute for SUA recordings. The results show that an MUA rhythm can be recorded from rat SCN for three days in vitro but that this rhythm is extremely variable; times of peak MUA in control experiments vary by 7 to 9 h each day. They also show that several serotonergic agents previously shown to consistently advance the SUA rhythm 2 to 3 h when applied during the day induce apparent advances in the MUA rhythm in some experiments; in other cases, however, there appears to be a delay or no change in the phase of the rhythm. Thus, the mean change in time of peak seen after these treatments was an advance of about 1 h. Finally, the results show that glutamate and optic chiasm stimulation applied during early subjective night can induce apparent delays in the MUA rhythm.

Author (AIAA)

Circadian Rhythms; Brain Circulation; Chiasms; Neurons; Serotonin

19980057331

Entrainment of rat circadian rhythms by the melatonin agonist S-20098 requires intact suprachiasmatic nuclei but not the pineal

Redman, Jennifer R., Monash Univ., Australia; Francis, Andrew J. P., Monash Univ., Australia; Journal of Biological Rhythms; Feb. 1998; ISSN 0748-7304; Volume 13, no. 1, pp. 39-51; In English; Copyright; Avail: Aeroplus Dispatch

S-20098 is a potent nonindolic melatonin agonist that has been shown to entrain free-running circadian rhythms. The current experiments examined the role of the suprachiasmatic nuclei (SCN) and of the pineal gland in the entrainment of circadian rhythms by S-20098. First, daily injections of S-20098 (1 and 10 mg/kg s.c.) were administered to SCN- and sham-lesioned rats. At both dose levels, circadian effects were noted in all sham-lesioned animals. Locomotor activity and body temperature rhythms in 3 of 5 sham-lesioned rats were entrained by the daily injections. In SCN-lesioned rats, S-20098 had no synchronizing or entraining effects at either dose level. These results show that S-20098 exerts its entraining effects on circadian rhythms via the circadian pacemaker located in the SCN. Second, the effects of daily injections of S-20098 (10 mg/kg s.c.) were examined in pinealectomized, sham-pinealectomized, and intact rats. All rats receiving S-20098, irrespective of surgical treatment, showed circadian changes. Rhythms in 81 percent of these animals entrained to daily administration of the compound, indicating that entrainment induced by S-20098 does not depend on an intact pineal. When injected with 10 mg/kg S-20098, 69 percent of rats, irrespective

of surgical treatment, showed long-term modifications of free-running period that still were evident several weeks after administration ceased.
Author (AIAA)
Circadian Rhythms; Chiasms; Pineal Gland; Surgery

19980057332
Melatonin rhythm onset in the adult Siberian hamster - Influence of photoperiod but not 60-Hz magnetic field exposure on melatonin content in the pineal gland and in circulation
Yellon, Steven M., Loma Linda Univ., USA; Truong, Huy N., Loma Linda Univ., USA; Journal of Biological Rhythms; Feb. 1998; ISSN 0748-7304; Volume 13, no. 1, pp. 52-59; In English
Contract(s)/Grant(s): NIH-ES-06137; Copyright; Avail: Aeroplus Dispatch
To determine the relationship between pineal melatonin production and its appearance in circulation, the rising phase of the pineal and serum melatonin rhythm was studied in the adult Siberian hamster. Melatonin concentrations increased in the pineal gland and in serum at 1.50 and 1.75 h, respectively, relative to lights off in long days (16 h of light/day) and at 2.00 and 2.75 h, respectively, in short days (10 h of light/day). Thus, a photoperiod-dependent melatonin rise in circulation lagged production by the pineal gland by 0.50 h, a delay of 0.75 h in short-day hamsters versus 0.25 h in long-day hamsters. Following initiation of this rise, concentrations that were typical of the nighttime peak were achieved within 2 h of melatonin rhythm onset, regardless of photoperiod. to determine whether clock control of the rising phase of the melatonin rhythm, in the absence of photoperiod cues, may be disrupted by perturbations in the ambient magnetic field, hamsters in constant darkness were acutely exposed to a 1-Gauss, 60-Hz magnetic field for 15 min or were daily exposed to this treatment for 14 or 21 days. Neither the melatonin rise in pineal content or circulation during subjective night was affected by acute or chronic magnetic field exposures; testes regression similarly occurred in sham and daily magnetic field-exposed hamsters in constant darkness.
Author (AIAA)
Circadian Rhythms; Magnetic Fields; Pineal Gland; Blood Circulation; Magnetic Effects

19980057333
A model for circadian rhythms in Drosophila incorporating the formation of a complex between the PER and TIM proteins
Leloup, Jean-Christophe, Bruxelles, Univ. Libre, Belgium; Goldbeter, Albert, Bruxelles, Univ. Libre, Belgium; Journal of Biological Rhythms; Feb. 1998; ISSN 0748-7304; Volume 13, no. 1, pp. 70-87; In English; Copyright; Avail: Aeroplus Dispatch
The authors present a model for circadian oscillations of the Period (PER) and Timeless (TIM) proteins in Drosophila. The model for the circadian clock is based on multiple phosphorylation of PER and TIM and on the negative feedback exerted by a nuclear PER-TIM complex on the transcription of the per and tim genes. Periodic behavior occurs in a large domain of parameter space in the form of limit cycle oscillations. These sustained oscillations occur in conditions corresponding to continuous darkness or to entrainment by light-dark cycles and are in good agreement with experimental observations on the temporal variations of PER and TIM and of per and tim mRNAs. Birhythmicity (coexistence of two periodic regimes) and aperiodic oscillations (chaos) occur in a restricted range of parameter values. The results are compared to the predictions of a model based on the sole regulation by PER. Both the formation of a complex between PER and TIM and protein phosphorylation are found to favor oscillatory behavior.
Author (AIAA)
Circadian Rhythms; Biological Models (Mathematics); Proteins; Biochemistry; Time Dependence

19980058099
Protein synthesis in fast and slow muscles of developing cockerels loaded with 2G for 3 weeks
Kita, Fumio, Nihon Univ., Japan; Koike, Katsuya, Nihon Univ., Japan; Metori, Koichi, Nihon Univ., Japan; Takahashi, Shushichi, Nihon Univ., Japan; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 145-148; In English; Copyright; Avail: Aeroplus Dispatch
Protein synthesis rate, RNA activity and protein content were investigated in different types of slow muscle (soleus) and fast muscle (extensor digitorum longus; EDL) in similar experimental conditions. It is believed that slow and fast muscle will show different responses to hypergravity. Young cockerels were raised standing vertically in a centrifuge and lived in a hypergravity (2G) environment for three weeks. At the end of the three weeks, the soleus and EDL muscles in their legs were immediately removed and the protein and RNA extracted. The fractional rate of protein synthesis in the muscles was determined. The feed intake of centrifuged cockerels was reduced on the first day but recovered on the second day. Thus, the growth curve was parallel although 2G-loaded cockerels were smaller in size. In a slow muscle (soleus) the protein synthesis rate, protein content and muscle

mass were significantly increased after 2G loading. While EDL protein synthesis rate and RNA activity decreased, muscle mass and protein content had no significant change in the 2G loading group. Soleus, which supports the body against gravity, apparently responded to hypergravity, while EDL may be repressed in protein turnover under the same condition.
Author (AIAA)
Microgravity; Muscles; Protein Synthesis; High Gravity Environments; Musculoskeletal System

19980058180

The stress reaction induced by intensive noise exposure in rats

Zheng, Suxian, Inst. of Space Medico-Engineering, China; Qian, Weiquan, Inst. of Space Medico-Engineering, China; Wang, Baozhen, Inst. of Space Medico-Engineering, China; Shi, Xiufeng, Inst. of Space Medico-Engineering, China; Liang, Zhenfu, Inst. of Space Medico-Engineering, China; Hu, Zhengyuan, Inst. of Space Medico-Engineering, China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 333-336; In Chinese; Copyright; Avail: Aeroplus Dispatch

To study the effects of sustained intensive noise on rats, fifty Sprague-Dawley male rats were randomly divided into control and 1, 3, 7, and 14-day noise exposure groups (120 dBSPL broadband noise, 2 h daily). The results showed that after noise exposure, the ACTH level and the corticosterone level in the blood serum increased, but the content of DA in diencephalon decreased; the weight of the adrenal glands increased, while that of the thymus and spleen decreased. The weight change of the adrenal glands and thymus became maximum after 7-d exposure. The serum ACTH level and the DA content in diencephalon decreased; the latter reached its lowest value, and the weight of the adrenal glands and thymus returned to normal level after 14-d exposure. These results indicated that the acute response began to decrease after 7-d exposure, and the response turned into a chronic inhibitory state after 14-d exposure.
Author (AIAA)
Noise (Sound); Adrenocorticotropin (ACTH); Corticosteroids; Physiological Responses; Organ Weight

19980058878

Transition and transit time distributions for time dependent reactions with application to biochemical networks

Moran, Federico, Stanford Univ., USA; Vlad, Marcel O.; Ross, John; Journal of Physical Chemistry B; Nov 06, 1997; ISSN 1089-5647; Volume 101, no. 45, pp. 9410-9419; In English; Copyright; Avail: Issuing Activity

Temporal aspects of the dynamic behavior of biochemical pathways in stationary states are described by a transition time tau, which is the ratio of the sum of the pool concentrations of chemical intermediates to the flux for a given stationary state. A related variable is introduced, the transit time theta, which is defined as the age of intermediates at the time of leaving system. The solution of the evolution equations for the distribution function is reduced using the method of characteristics.
EI
Temporal Distribution; Time Dependence; Transit Time; Metabolism; Biochemistry; Partial Differential Equations; Enzymes; Kinetics; Green'S FUNCTIONS

19980059788

Effect of regular anisotropic permanent bending on the diffusional spinning and fluorescence polarization anisotropy of short DNA fragments studied by Brownian dynamics simulation

Allison, Stuart A., Georgia State Univ., USA; Schurr, J. Michael; Macromolecules; Nov 17, 1997; ISSN 0024-9297; Volume 30, no. 23, pp. 7131-7142; In English; Copyright; Avail: Issuing Activity

The effects of regular permanent bends on the rotational Brownian motions of flexurally and torsionally deformable DNA models are investigated by Brownian dynamics simulations. Directionality of the permanent bends is maintained by anisotropic bending terms in the intersubunit potential. The effects of such bends on the effective hydrodynamic radius for diffusional spinning and on the fluorescence polarization anisotropy (FPA) are determined by comparing simulated results for three different model potentials. The FPA of the A-model indicates significantly less depolarization than is obtained for the I-model at any given time. The A-model FPA curves can be satisfactorily reproduced by suitably parametrizing the I-model so that (1) the effective hydrodynamic radius for azimuthal rotation is increased to emulate the effect of permanent bends; (2) the dynamic bending rigidity is chosen to emulate the short-time bending amplitude of the A-model; and (3) the rotational diffusion coefficient for end-over-end tumbling is chosen to reflect the total persistence length, including the effect of permanent bends.
EI
Brownian Movements; Deoxyribonucleic Acid; Anisotropy; Molecular Dynamics; Computerized Simulation

19980060254

Effect of highly toxic components of a rocket fuel on the germination of seeds of some species of vascular plants ***Vliyanie vysokotoksichnykh komponentov raketnogo topliva na vskhozhest' semyan nekotorykh vidov sosudistykh rastenij***

Yarmishko, V. T., RAN, Botanicheskij Inst., Russia; Yarmishko, M. A., RAN, Botanicheskij Inst., Russia; Pimkin, V. G., Rossijskij Nauchnyj Tsentr 'Prikladnaya Khimiya', Russia; Rossijskaya Akademiya Nauk, Izvestiya, Seriya Biologicheskaya; Dec. 1997; ISSN 0002-3329, no. 6, pp. 746-749; In Russian; Copyright; Avail: Aeroplus Dispatch

Results of an experimental study of the effect of various concentrations of 1,5-diazobicyclo(3,1,0)hexane on the germinating power of seeds of pine, European spruce, blueberry, and lettuce are reported and discussed. The results provide no unambiguous evidence of a negative effect of this rocket fuel component, particularly in low concentrations, on the germinating power of the seeds of these species.

AIAA

Rocket Propellants; Toxicity; Germination; Seeds; Plants (Botany)

19980061373

Modelling ecologically specialized biological visual systems

Wiebe, K. J., Univ. of Alberta, Canada; Basu, A.; Pattern Recognition; Oct, 1997; ISSN 0031-3203; Volume 30, no. 10, pp. 1687-1703; In English; Copyright; Avail: Issuing Activity

Computer vision is a broad area in artificial intelligence (AI) usually utilizing digital images. Digital image compression techniques are required to overcome significant storage and transmission problems in this area. A strong understanding of image characteristics enhances the effectiveness of these and many other image processing operations. Traditional methods typically maintain constant resolution throughout an image. However, a survey of the various visual systems present in the animal kingdom demonstrates the potential of variable resolution (VR) compression methods. The authors model several animate visual systems and outline novel image compression techniques based on foveated vision. Interesting variations on the simple fovea are presented, motivated by similar variations present in animate visual systems; specifically multiple, moving and weighted foveae as well as visual streaks. Techniques for the efficient modelling of fovea movement are also described.

Author (EI)

Computer Vision; Artificial Intelligence; Data Compression; Image Processing; Image Analysis

19980061420

Contrast attenuation coefficient as a parameter enabling determination of range of visibility in smoke

Sychta, Zygmunt, Technical Univ. of Szczecin, Poland; Fire and Materials; Sep-Oct, 1997; ISSN 0308-0501; Volume 21, no. 5, pp. 205-211; In English; Copyright; Avail: Issuing Activity

The contrast attenuation coefficient characterizes smoke production properties of a material. These properties are closely connected with a contrast of luminance of a scene observed in a smoky medium, the range of visibility, and mass concentration in an environment volume. The range of visibility determines a person's chances of moving about in a fire zone. This paper presents considerations on conditions of visibility in smoky compartments, a method of the contrast attenuation measurement and test results for some materials.

Author (EI)

Attenuation Coefficients; Smoke; Visibility; Attenuation; Mathematical Models

19980061702

Characteristics of the amperometric oxygen sensor

Pham, Ai Quoc, Lawrence Livermore Natl. Lab., USA; Glass, Robert S.; Journal of the Electrochemical Society; Nov, 1997; ISSN 0013-4651; Volume 144, no. 11, pp. 3929-3934; In English; Copyright; Avail: Issuing Activity

Some important characteristics of the amperometric oxygen sensor are examined. The emphasis is on the influence of electrode polarization on sensor behavior. The theoretical framework describing the operation of the amperometric sensor is discussed and the operational characteristics and observations of anomalous behavior in light of that framework are described.

EI

Electrical Measurement; Gas Detectors; Oxygen; Numerical Analysis; Electrical Resistivity

19980061791

Effects of color difference of prints on visual acuity

Chen, Tai-Lioan, Natl. Tsing Hun Univ., Taiwan, Province of China; Yu, Chi-Yuang; Kung Yeh Kung Chieng Hsueh K'an/Journal of the Chinese Institute of Industrial Engineers; Jan, 1997; ISSN 1017-0669; Volume 14, no. 1, pp. 107-114; In Chinese; Copyright; Avail: Issuing Activity

The study investigated the effect of color difference on visual acuity and used the relationship between them to construct a scale to predict the sizes of letters or symbols. Color difference is characterized by the distance between colors in CIELAB 1976 color space. Visual acuity is characterized by 50% minimal separable visual angle using Landolt-C. Twenty subjects with normal color vision were tested on 342 test sheets printed with colors colored Landolt-Cs and background. The result demonstrated that MSVA is approximately inverse log-linearly related to CIELAB color difference. Based on this finding, the CIELAB 1976 color space and its color difference formula can be used as a scaled for quantifying color contrast to accurately predict the sizes of color texts or symbols.

Author (EI)

Color Photography; Visual Acuity; Color Vision; Approximation

19980062033

Detecting perceptually parallel curves: Criteria and force-driven optimization

Ip, Horace H. S., City Univ. of Hong Kong, Hong Kong; Wong, W. H.; Computer Vision and Image Understanding; Nov, 1997; ISSN 1077-3142; Volume 68, no. 2, pp. 190-208; In English; Copyright; Avail: Issuing Activity

We have developed several theorems for the detection of parallel curves in the continuous space. In this paper, we studied issues in carrying the continuous algorithm to the discrete case and also the perceptual characteristics leading to human recognition of parallelism. by formulating these properties in terms of several distinctive forces, we developed a force-driven model as a new optimization strategy to perform correspondence establishment between points in the matching curves. This force-driven mechanism provides a good coupling (or correspondence matching) result, which is the prerequisite for the correct detection of parallelism between curves. Convergence of the algorithm and implementation efficiency are also investigated and discussed. Experimental results on the relative weightings of these forces also shed light on the perceptual priority imposed by the human vision system.

Author (EI)

Computer Vision; Recognition; Optimization; Algorithms; Mathematical Models

19980062271

Modelling of polarisation mode dispersion in singlemode fibres

Elbers, J. -P., Universitaet Dortmund, Germany; Glingener, C.; Duser, M.; Voges, E.; Electronics Letters; Oct 23, 1997; ISSN 0013-5194; Volume 33, no. 22, pp. 1894-1895; In English; Copyright; Avail: Issuing Activity

Polarisation mode dispersion is commonly simulated by using a birefringent waveplate model. In contrast to several publications which assume a Maxwell probability density function, we found that the differential group delay is, to a good approximation, Rayleigh distributed.

Author (EI)

Optical Fibers; Probability Density Functions; Monte Carlo Method; Computerized Simulation

19980063845

Axial curvature and the skew ray error in corneal topography

Klein, Stanley A., Univ. of California at Berkeley, USA; Optometry and Vision Science; Nov, 1997; ISSN 1040-5488; Volume 74, no. 11, pp. 931-944; In English; Copyright; Avail: Issuing Activity

Background. Many intuitions about corneal shape are based on corneas with axial symmetry. In that case, the corneal normal intersects the axis of symmetry and there is an unambiguous definition for axial curvature. If, however, the corneal normal is not in the meridional plane, at least three definitions are available. The present paper defines, analyzes, and makes quantitative comparisons among the different definitions of axial curvature. When Placido rings are used as targets, current algorithms incur an error (the skew ray error) because the axial curvature that is measured is different from the axial curvature used for corneal reconstruction. Methods. A cylindrical coordinate system is used that greatly simplifies the visualization and mathematics of skew rays. In the process of handling the axial curvature for different shapes, we develop a number of convenient formulas for handling ellipsoids and bispheres such as occur in keratoconus and photorefractive keratectomy (PRK). We also develop a simple approach based on vector cross-products for calculating axial curvature for an arbitrarily placed axis. Results. The skew error is calculated for ellipsoidal and keratoconic corneas, and for corneas that have undergone decentered PRK ablation. For reasonable ellipsoidal

and PRK corneas, the skew ray error is found to be negligible. However, for keratoconus and for decentered views of PRK corneas the error can be substantial. The implications of the skew ray ambiguity for instantaneous curvature are also discussed. Conclusions. The formalism developed in this paper facilitates the interpretation of axial curvature maps for corneas that are not axially symmetric. The skew ray error is negligible except for a small class of distorted corneas.
Author (EI)
Vision; Algorithms; Computation; Vectors (Mathematics); Error Analysis

19980063978

Portable microwave system for woodworm disinfestation of artistic painted boards

Bini, M., IROE-CNR, Italy; Andreuccetti, D.; Ignesti, A.; Olmi, R.; Priori, S.; Vanni, R.; Journal of Microwave Power and Electromagnetic Energy; 1997; ISSN 0832-7823; Volume 32, no. 3, pp. 180-187; In English; Copyright; Avail: Issuing Activity

A prototype of a portable microwave system suitable for treating small and delicate wooden objects is described. The system used a commercial magnetron, radiative applicator, and a non-contact thermometer to monitor the temperature of the painted surface. A flow of air is blown through the applicator to cool the irradiated surface. A treatment bench was set up to heat painted boards in controlled conditions. The applicator is placed on the rear side of the board, while the painted side is monitored by means of an infrared thermometer to maintain its temperature below safe levels. The results concerning the effect of microwave heating on several specimens infested by woodworms in all metamorphical stages are discussed.
EI
Microwaves; Magnetrons; Temperature Control; Infrared Detectors

19980064316

Influence of space flight factors on intact and regenerating limb skeletal muscle in newts ***Vliyanie faktorov kosmicheskogo poleta na intaktnye i regeneriruyushchie skeletnye myshtsy konechnostej u tritonov***

Tuchkova, S. Ya., RAN, Inst. Biologii Razvitiya, Russia; Rossijskaya Akademiya Nauk, Izvestiya, Seriya Biologicheskaya; Aug. 1997; ISSN 0002-3329, no. 4, pp. 400-406; In Russian; Copyright; Avail: Aeroplus Dispatch

The influence of space flight factors on the structure of two skeletal muscles of the hindlimbs was studied in newts. Degenerative-atrophic changes took place in both muscles of the flight group animals. Comparative quantitative analysis of ultrastructural changes of the muscle tissue has shown that, after space flight, the rate of structural defects of the muscle was twice that in animals of the synchronous and laboratory control groups. But these changes were reversible: within 10 days, the structure of the muscle fibers was practically normalized. The influence of space flight on repair regeneration of the hindlimb skeletal muscle was also studied: the muscle was minced and placed back in its bed 14 days before the flight. Under these conditions, the repair regeneration of the muscle was not suppressed, but a trend towards its delay was found.
Author (AIAA)
Space Flight; Musculoskeletal System; Tissues (Biology); Physiological Effects; Postflight Analysis; Regeneration (Physiology)

19980064317

Antioxidant vitamin diet decreases the rate of chromosomal damage and genic mutation in irradiated mice ***Vitaminno-antioksidantnaya dieta snizhaet uroven' khromosomnykh povrezhdenij i chastotu gennykh mutatsij u obluchennykh myshej***

Fomenko, L. A., RAN, Inst. Teoreticheskoj i Ehksperimental'noj Biofiziki, Russia; Bezlepkina, T. A., RAN, Inst. Teoreticheskoj i Ehksperimental'noj Biofiziki, Russia; Anoshkin, A. N., RAN, Inst. Teoreticheskoj i Ehksperimental'noj Biofiziki, Russia; Gaziev, A. I., RAN, Inst. Teoreticheskoj i Ehksperimental'noj Biofiziki, Russia; Rossijskaya Akademiya Nauk, Izvestiya, Seriya Biologicheskaya; Aug. 1997; ISSN 0002-3329, no. 4, pp. 419-424; In Russian; Copyright; Avail: Aeroplus Dispatch

Two different methods were used to study the effect of the antioxidant vitamins mixture (AVM) containing beta-carotene, alpha-tocopherol, ascorbic acid, rutin, and microelements zinc and selenium on mouse resistance to acute and chronic irradiation. Micronucleus test demonstrated that a daily dietary supplement of AVM reliably decreased the rate of chromosomal damage, namely, X-ray-induced micronuclei in the bone marrow polychromatophilic erythrocytes of aging mice, but did not induce micronuclei formation in the young mice. Assay for somatic mutations in the hypoxanthine-guanine phosphoribosyl transferase (HPRT) locus showed that AVM significantly decreased the rate of genic mutations in mouse splenocytes after chronic irradiation.
Author (AIAA)
Radiation Damage; Vitamins; Antioxidants; Diets; Chromosomes; Genes

19980064318

Where to look for a magnetoreceptor ***Gde iskat' magnitoretseptor***

Zagal'skaya, E. O., RAN, Inst. Biologii Morya, Russia; Maksimovich, A. A., RAN, Inst. Biologii Morya, Russia; Rossijskaya Akademiya Nauk, Izvestiya, Seriya Biologicheskaya; Aug. 1997; ISSN 0002-3329, no. 4, pp. 473-483; In Russian; Copyright; Avail: Aeroplus Dispatch

The possible mechanisms and the structure of magnetoreception in birds, insects, fish, reptiles, and mammals are discussed on the basis of recent published data in magnetobiology. The existing magnetoreception theories are summarized. It is noted that, although the mechanism of magnetoreception is yet to be determined, the main direction of the reasearch aimed at solving this problem have been established.

Author (AIAA)

Receptors (Physiology); Biological Models (Mathematics); Electromagnetic Fields; Magnetic Effects; Geomagnetism

19980064319

The role of osteoclasts in maintenance of calcium homeostasis in newts ***Rol' osteoklastov v podderzhanii gomeostaza kal't-siya u tritonov***

Berezovskaya, O. P., NANU, Inst. Zoologii, Ukraine; Rodionova, N. V., NANU, Inst. Zoologii, Ukraine; Grigoryan, Eh. N., RAN, Inst. Biologii Razvitiya, Russia; Mitashov, V. I., RAN, Inst. Biologii Razvitiya, Russia; Rossijskaya Akademiya Nauk, Izvestiya, Seriya Biologicheskaya; Aug. 1997; ISSN 0002-3329, no. 4, pp. 495-499; In Russian; Copyright; Avail: Aeroplus Dispatch

The intensity of osteoclastic resorption and calcium content were investigated in intact limb bones of the newts flown onboard biosatellite Cosmos-2229 after amputation of their forelimbs and tail. X-ray microanalysis has shown an increase of calcium content in the bones on the 20th day after operation. Histological study revealed activated osteoclastic resorption on the inner surface of long bones. The newts exposed to weightlessness after the operation had the same level of bone mineralization as the operated ground control ones, but the number of polynuclear osteoclasts increased to a lesser extent.

Author (AIAA)

Calcium Metabolism; Homeostasis; Limbs (Anatomy); Biosatellites; Bone Mineral Content

19980064320

Role of gravity in evolution of living systems - Biomechanical and energetic aspects ***Rol' sily tyazhesti v ehvolyutsii zhivykh sistem - Biomekhanicheskie i ehnergeticheskie aspekty***

Tairbekov, M. G., Inst. Mediko-Biologicheskikh Problem, Russia; Klimovitskij, V. Ya., Inst. Mediko-Biologicheskikh Problem, Russia; Oganov, V. S., Inst. Mediko-Biologicheskikh Problem, Russia; Rossijskaya Akademiya Nauk, Izvestiya, Seriya Biologicheskaya; Oct. 1997; ISSN 0002-3329, no. 5, pp. 517-530; In Russian; Copyright; Avail: Aeroplus Dispatch

Possible pathways of the origin and development of adaptive mechanisms in the living systems of various levels of organization are considered from the positions of biomechanics and bioenergetics. Main attention is paid to the specific feature of functional rearrangements in the living organisms during change of habitat, at the stage of their exit from water to land. The following problems of interaction between the living systems and gravity during evolution are discussed: cellular level of organization and transition to multicellularity, formation and improvement of the skeletal and skeletal-motor systems in plants and animals, and thermal homeostasis of the living organisms in the gravity field. We showed a leading role of gravity in organization of the morpho-functional status of the living organisms during their evolution.

Author (AIAA)

Gravitational Effects; Biological Evolution; Adaptation; Biodynamics; Cells (Biology); Organisms

19980064322

Nitric oxide as a factor of the antihypoxic effect of adaptation to exercise ***Oksid azota kak faktor antigipoksicheskogo ehf-fekta adaptatsii k fizicheskoj nagruzke***

Ajmasheva, N. P., RAMN, NII Obshchej Patologii i Patofiziologii, Russia; Zenina, T. A., RAMN, NII Obshchej Patologii i Patofiziologii, Russia; Manukhina, E. B., RAMN, NII Obshchej Patologii i Patofiziologii, Russia; Malyshev, I. Yu., RAMN, NII Obshchej Patologii i Patofiziologii, Russia; Mikoyan, V. D., RAN, Inst. Khimicheskoj Fiziki, Russia; Kubrina, L. N., RAN, Inst. Khimicheskoj Fiziki, Russia; Vanin, A. F., RAN, Inst. Khimicheskoj Fiziki, Russia; Rossijskaya Akademiya Nauk, Izvestiya, Seriya Biologicheskaya; Oct. 1997; ISSN 0002-3329, no. 5, pp. 634-638; In Russian; Copyright; Avail: Aeroplus Dispatch

It is known that adaptation to exercise enhances the organism resistance to acute hypoxia. However, the mechanisms of this cross-protective effect have been insufficiently studied. The analysis of literature suggests that NO may play a role in the development of the antihypoxic effect of adaptation to exercise. The aim of the present study was to test this hypothesis: first, by evaluating the influence of NO donor and NO-synthase inhibitor on the antihypoxic effect of adaptation to exercise and, second, by evaluating

the changes of NO production in acute hypoxia and after a course of adaptation to exercise. It was shown that the NO donor could both reproduce and considerably (three times) potentiate the antihypoxic effect of adaptation to exercise. At the same time, the NO-synthase inhibitor completely suppressed the development of the protective antihypoxic effect of adaptation. After adaptation to exercise, the cerebral NO production was unchanged, while the hepatic NO production doubled. Acute hypoxia induced a biphase change in tissue NO production; initial increase (twofold in the brain) preceded a decrease (by 25 percent in liver and 37 percent in the brain as compared to the control). Therefore, the increased NO production following adaptation to exercise can underlie the antihypoxic effect of such an adaptation.
Author (AIAA)
Nitric Oxide; Physical Exercise; Hypoxia; Adaptation; Organisms; Physiological Responses

19980064478
Fundamental gravitational research and emerging technologies - The connection
Ross, Muriel D., NASA Ames Research Center, USA; Smith, Jeffrey, NASA Ames Research Center, USA; Montgomery, Kevin, Sterling Software, Inc., USA; Cheng, Rei, Sterling Software, Inc., USA; Linton, Samuel, Sterling Software, Inc., USA; 1998, pp. 822-828; In English; Copyright; Avail: Aeroplus Dispatch

Life Sciences basic research, particularly in the unique area of neuronal plasticity, would seem to be an unlikely source of computer-based technologies. Nevertheless, basic research into the neuronal plasticity of sites of communication (synapses) between gravity-sensing cells and neurons carrying messages to the brain has resulted in technologies of interest to the scientific and medical communities. It has also led to the establishment of a National Institute for Biocomputation that will be a partnership between federal, academic, and industrial partners to provide cutting edge resources for the work. This report describes the current state of the art of the technologies developed in the Biocomputation Center, and the objectives of the new National Institute in the realm of technology facilitation and transfer.
Author (AIAA)
Life Sciences; Research and Development; Neurons; Nerves; Technology Transfer

19980064586
Method of spectral recognition for medicament Kanamycini colour inspection
Song, Guilan, Beijing Inst. of Technology, China; Tang, Shunqing; Zhu, Zhengfang; Wang, Chengfen; Guangxue Jishu/Optical Technique; July, 1997; ISSN 1002-1582, no. 4, pp. 32-34, 40; In Chinese; Copyright; Avail: Issuing Activity

This paper presents a method of spectral recognition for medicament Kanamycini inspection. The method breaks through the traditional CIE color measurement pattern, substitutes spectral feature and nonfixed view-field pattern for tristimulus value and its fixed aperture color measurement pattern, respectively. A good discriminant function is developed, it is suitable to examine medicament color standard. The experimental results are satisfactory.
Author (revised by EI)
Optical Data Processing; Color Vision; Colorimetry; Spectrometers; Inspection; Medical Science

19980064596
Advanced imaging microscope tools applied to microgravity research investigations
Peterson, L., NASA, USA; Samson, J., NASA, USA; Conrad, D., NASA, USA; Clark, K., Michigan, Univ., Ann Arbor; 1998, pp. 647; In English; Copyright; Avail: Aeroplus Dispatch

The inability to observe and interact with experiments on orbit has been an impediment for both basic research and commercial ventures using the Shuttle. In order to open the frontiers of space, the Center for Microgravity Automation Technology has developed a unique and innovative system for conducting experiments at a distance, the 'Remote Scientist'. The Remote Scientist extends laboratory automation capability to the microgravity environment. While the Remote Scientist conceptually encompasses a broad spectrum of elements and functionalities, the development approach taken is to establish a baseline capability that is both flexible and versatile and to incrementally augment the baseline with additional functions over time. A series of ground-based experiments have been performed to validate the bioreactor, the force transducer, the translation carriage, and the image acquisition capabilities of the Remote Scientist. The bioreactor is capable of sustaining 3D tissue culture growth over time.
Author (AIAA)
Microgravity; Research and Development; Microscopes; Imaging Techniques; Aerospace Sciences

19980064600

Antibiotic production in space

Klaus, David, BioServe Space Technologies, USA; Brown, Robert, BioServe Space Technologies, USA; Cierpik, Kim, BioServe Space Technologies, USA; 1998, pp. 633-637; In English

Contract(s)/Grant(s): NAGW-1197; Copyright; Avail: Aeroplus Dispatch

A wide variety of previous experiments have indicated that the space flight environment has a positive influence on the proliferation of microorganisms. Based on this premise, it was hypothesized that the production of secondary metabolites (specifically antibiotics) would also be increased as a consequence of the enhanced growth. Pilot studies performed on board two Shuttle missions to date have indicated that microbial antibiotic production was significantly increased in space-grown colonies relative to comparable, matched ground controls. The practical application of these preliminary findings is being investigated. The empirical data are being analyzed in an attempt to establish specific gravity-dependent cause and effect relationships. An analytical model is being developed to further establish how physical principles might give rise to the various physiological responses observed to be altered in space. The envisioned commercial applications stemming from the unique knowledge of how gravity affects natural processes range from developing methods for increasing terrestrial pharmaceutic production efficiency to, ultimately perhaps, the design of economically feasible, space-borne fermentation and bioprocessing platforms.

Author (AIAA)

Antibiotics; Space Manufacturing; Market Research

19980064602

Benefits attained from space flight in pre-clinical evaluation of candidate drugs

Stodieck, Louis S., BioServe Space Technologies, USA; Bateman, Ted, BioServe Space Technologies, USA; Ayers, Reed, BioServe Space Technologies, USA; Ferguson, Virginia, BioServe Space Technologies, USA; Simske, Steve, BioServe Space Technologies, USA; 1998, pp. 627-632; In English

Contract(s)/Grant(s): NAGW-1197; Copyright; Avail: Aeroplus Dispatch

One of the important milestones in drug development is the successful completion of preclinical evaluation. During this phase, drug candidates must be shown to be safe, yet effective as a treatment of the target disease or disorder. Critical for preclinical testing is the availability of biomedical test models that adequately mimic the target disease. A good model will: allow confident prediction of a drug's effects before expensive clinical trials are begun, provide convincing data for use in an FDA new drug application, and minimize the time required for testing. Space flight may offer a completely unique and new set of biomedical models for use in pharmaceutical testing. This paper highlights some examples of recent experiments done in space to test new compounds for Chiron, (Emmeryville, CA) and discusses the importance of the International Space Station to greatly expand such commercial opportunities.

Author (AIAA)

Space Flight; Medical Science; Pharmacology

19980064603

Model system for studies on bone matrix formation by osteogenic cells in microgravity

Quinton, Todd M., BioServe Space Technologies, USA; Fattaey, Heideh K., BioServe Space Technologies, USA; Motaffaf, Farzaneh, BioServe Space Technologies, USA; Johnson, Terry C., BioServe Space Technologies, USA; 1998, pp. 622-626; In English; Copyright; Avail: Aeroplus Dispatch

We have isolated a reversible inhibitor of cellular growth (CeReS-18) that could be important in cell contact inhibition and thus may mimic the signals involved in growth confluency. Preliminary experiments with osteogenic cells have revealed the potential capability of CeReS-18 to inhibit these cells in a reversible manner. We are developing a series of studies, designed at the cellular level, to quantitatively measure the production of bone matrix by osteogenic cells propagated in culture. The use of CeReS-18 would facilitate the study of several factors being assessed regarding matrix formation, including the rate of cell population density, hormone induction events, calcium availability, and cell cycle arrest. The studies are being conducted in a manner that will allow comparable measurements in the microgravity environment with flight hardware designed and deployed by BioServe Space Technologies.

Author (AIAA)

Microgravity; Cells (Biology); Bone Mineral Content

19980064604

Autonomous Biological System - A unique method of conducting long duration space flight experiments for pharmaceutical and gravitational biology research

Anderson, G. A., Paragon Space Development Corp., USA; MacCallum, T. K., Paragon Space Development Corp., USA; Poynter, J. E., Paragon Space Development Corp., USA; Klaus, D., BioServe Space Technologies, USA; 1998, pp. 616-621; In English; Copyright; Avail: Aeroplus Dispatch

Paragon Space Development Corporation (SDC) has developed an Autonomous Biological System (ABS) that can be flown in space to provide for long-term growth and breeding of aquatic plants, animals, microbes and algae. The system functions autonomously and in isolation from the spacecraft life support systems and with no mandatory crew time required for function or observation. The ABS can also be used for long-term plant and animal life support and breeding on a free flyer spacecraft. The ABS units are a research tool for both pharmaceutical and basic space biological sciences. Development flights in May of 1996 and September 1996 through January 1997 were largely successful, showing both that the hardware and life systems are performing with beneficial results, though some surprises were still found. The two space flights, plus the current flight now on Mir, are expected to result in both a scientific and commercially usable system for breeding and propagation of animals and plants in space.
Author (AIAA)

Long Duration Space Flight; Research and Development; Biology; Pharmacology; Space Commercialization

19980064608

Capabilities of the Commercial Plant Biotechnology Facility to support plant activities on the International Space Station

Zhou, Weijia, Wisconsin, Univ., Madison, USA; Bula, R. J., Wisconsin, Univ., Madison; 1998, pp. 593-601; In English
Contract(s)/Grant(s): NAGW-975; Copyright; Avail: Aeroplus Dispatch

A Commercial Plant Biotechnology Facility (CPBF) for the International Space Station (ISS) has been developed by the Wisconsin Center for Space Automation and Robotics (WCSAR) that would support plant growth for long time periods in reduced gravity and have a large plant growing volume. The CPBF integrates proven ASTROCULTURE technologies developed by WCSAR, state-of-the-art environment control software, and fault tolerance and recovery technologies together to increase overall system efficiency, reliability, robustness, flexibility, and user friendliness. The CPBF consists of six major subsystems: the temperature control system, the humidity control system, the lighting control system, the fluid nutrient delivery system, the atmospheric control system, and the information (data and video) management system. This paper describes the characteristics and the performances of the temperature, humidity, and lighting systems. Evaluation of other subsystems are being conducted.
Author (AIAA)

Crop Growth; Plants (Botany); Biotechnology; International Space Station

19980064609

Commercial products developed from plant oils produced in microgravity

Draeger, Norman A., Wisconsin, Univ., Madison, USA; 1998, pp. 586-592; In English
Contract(s)/Grant(s): NCC8-129; Copyright; Avail: Aeroplus Dispatch

Plant oils have a wide variety of uses, including food preparation, lubricants and fuels, and in specialty materials. They are environmentally responsible, renewable resources which also represent a significant commercial opportunity for growers and processors. Exploiting plant oils to their maximum potential will benefit greatly from a thorough understanding of the formation and storage of these materials in plants, and how these processes depend upon all elements of the plant growth environment, including the effects of gravity.
Author (AIAA)

Microgravity; Space Commercialization; Plants (Botany); Oils; Crop Growth

19980064610

Space flight research leading to the development of enhanced plant products - Results from STS-94

Stodieck, Louis S., BioServe Space Technologies, USA; Hoehn, Alex, BioServe Space Technologies, USA; Heyenga, A. G., NASA Ames Research Center, USA; 1998, pp. 578-585; In English
Contract(s)/Grant(s): NAGW-1197; Copyright; Avail: Aeroplus Dispatch

A flight investigation was conducted on the Shuttle mission STS-94 to establish the initial experimental conditions necessary to test the hypothesis that the exposure of certain plant forms to an adequate period of microgravity may divert the cell metabolic expenditure on structural compounds such as lignin to alternative secondary metabolic compounds which are of commercial interest. Nine species of plants were grown for 16 d in the Astro/Plant Generic Bioprocessing Apparatus (Astro/PGBA) under well-controlled environmental conditions. Approximately half of the plant species exhibited significant growth comparable with

synchronous ground controls. The other flight plant species were stunted and showed signs of stress with the cause still under investigation. For the plants that grew well, analyses are under way and are expected to demonstrate the potential for space flight biotechnology research.
Author (AIAA)
Crop Growth; Space Processing; Plant Stress

19980064612
Impact of accelerated plant growth on seed variety development
Christophersen, Eric, Christophersen & Associates, USA; 1998, pp. 574-577; In English; Copyright; Avail: Aeroplus Dispatch

The commercial lives of agricultural seed products have steadily declined in recent years. The introduction of genetically engineered crop seeds in 1966 has accentuated that trend. Widespread grower demand for genetically engineered seed requires competitive response by industry followers in order to avert market share losses to the industry leaders. Limitations on plant transformation technology, regulatory requirements, and patent impediments require companies to rapidly convert transformed lines into elite commercial products. Massive multigenerational backcrossing efforts are required to distribute genetically engineered traits into a broad product mix. Significant incidents of expression failures, or 'gene silencing', have occurred unexpectedly, requiring product substitution strategies. First-to-market strategies, competitive response, broad germplasm conversion, and rescue of product failures all share the element of urgency. Technologies which reliably accelerate product development rates can expect favorable reception by commercial seed developers. A growth chamber which dramatically accelerates the rate of plant growth is described.
Author (AIAA)
Crop Growth; Seeds; Genetic Engineering

19980064613
Production of potato minitubers using advanced environmental control technologies developed for growing plants in space
Britt, Robert G., American Ag-Tec International, Ltd., USA; 1998, pp. 569-573; In English; Copyright; Avail: Aeroplus Dispatch

Development of plant growth systems for use in outer space have been modified for use on Earth as the backbone of a new system for rapid growth of potato minitubers. The automation of this new biotechnology provides for a fully controllable method of producing pathogen-free nuclear stock potato minitubers from tissue cultured clones of varieties of potato in a biomanufacturing facility. These minitubers are the beginning stage of seed potato production. Because the new system provides for pathogen-free minitubers by the tens-of-millions, rather than by the thousands which are currently produced in advanced seed potato systems, a new dimension in seed potato development, breeding, and multiplication has been achieved. The net advantage to Earth-borne agricultural farming systems will be the elimination of several years of seed multiplication from the current system, higher quality potato production, and access to new potato varieties resistant to diseases and insects, which will eliminate the need for chemical controls.
Author (AIAA)
Crop Growth; Potatoes; Environmental Control; Space Processing

19980064623
Preparing the way, Space Life Sciences Outreach
Atchison, Duncan, Lockheed Martin Corp., USA; Grymes, Rosalind A., NASA Ames Research Center, USA; 1998, pp. 816-821; In English; Copyright; Avail: Aeroplus Dispatch

The research conducted by the Space Life Sciences seeks to understand the effects of gravity and the space environment on living systems and monitor and mitigate these effects in space explorers. Just as the Space Life Sciences research programs are enabling humans to live and work in space, Space Life Sciences Outreach is collaborating with a variety of partners to prepare lifelong learners (K-100+) to live and work in the 21st century. Our mission is to facilitate a greater understanding of the benefits that result from the nation's investment in NASA's Space Life Sciences through proactive partnerships focused on educating and communicating with the American public.
Author (AIAA)
Life Sciences; Gravitational Effects

19980064628

Commercial biotechnology processing on International Space Station

Deuser, Mark S., SHOT, Inc., USA; Vellinger, John C., SHOT, Inc., USA; Hardin, Juanita R., SHOT, Inc., USA; Lewis, Marian L., Alabama, Univ., Huntsville; 1998, pp. 793-797; In English

Contract(s)/Grant(s): NCC8-132; Copyright; Avail: Aeroplus Dispatch

Commercial biotechnology processing in space has the potential to eventually exceed the $35 billion annual worldwide market generated by the current satellite communications industry. The International Space Station provides the opportunity to conduct long-term, crew-tended biotechnology research in microgravity to establish the foundation for this new commercial biotechnology market. Industry, government, and academia are collaborating to establish the infrastructure needed to catalyze this biotechnology revolution that could eventually lead to the production of medical and pharmaceutical products in space. The biotechnology program discussed herein is evidence of this collaborative effort, with industry involvement from Space Hardware Optimization Technology, Inc., government participation through the NASA Commercial Space program, and academic guidance from the Consortium for Materials Development in Space at the University of Alabama in Huntsville. Blending the strengths and resources of each collaborator creates a strong partnership, which offers enormous research and commercial opportunities.

Author (AIAA)

Biotechnology; Space Commercialization; International Space Station

19980064634

Resistance to chemical disinfection under conditions of microgravity

Marchin, George L., BioServe Space Technologies, USA; 1998, pp. 765-768; In English

Contract(s)/Grant(s): NAGW-1197; Copyright; Avail: Aeroplus Dispatch

Preliminary experiments aboard the MIR Space Station with Pseudomonas aeruginosa suggest that the longer bacteria are retained in microgravity, the more resistant they become to chemical disinfection. This phenomenon is probably due to additional time to develop resistant biofilms on the interior of the FPA. To partially solve these problems we have developed additional disinfecting materials to use in conjunction with polyiodide-containing resin beads. One of these materials, carbon beads coated with 3-trimethoxy silylpropyl dimethyloctadecyl ammonium chloride (Dow-Corning 5700), acts synergistically with polyiodide resin disinfectants. Carbon beads so treated are still able to remove aqueous iodine from the water stream while providing an additional level of chemical disinfection. This additional capability prevents contamination of the carbon beads with heterotrophic bacteria and insures that bacteria surviving iodine disinfection are efficiently devitalized.

Author (AIAA)

Microgravity; Antiseptics

19980064636

Microgravity effects on magnetotactic bacteria

Urban, James E., BioServe Space Technologies, USA; 1998, pp. 761-764; In English

Contract(s)/Grant(s): NAGW-1197; Copyright; Avail: Aeroplus Dispatch

To resolve if magnetosomes respond to gravity in addition to magnetism, we used Magnetospirillum magnetotacticum, a well-studied magnetotactic bacterium isolated in the Northern Hemisphere, to examine magnetotactic behavior in the absence of gravity. Experiments to compare the orientation of Magnetospirillum magnetotacticum to North or South Pole magnets were conducted in normal gravity and in the microgravity environments aboard the Space Shuttle and Space Station MIR. In each of the microgravity situations studied, bacteria were impaired in their ability to orient to magnets, suggesting that on Earth the bacteria use magnetosomes to respond to gravity. These experiments could have significant commercial utility and could lead to the use of magnetosomes to direct biodegrading bacteria to contaminated aquifers or soils and likewise could be used to direct and localize bacteria used in element leaching and microbial mining.

Author (AIAA)

Microgravity; Magnetite; Bacteria

19980064642

Benzoporphyrin derivative and light-emitting diode for use in photodynamic therapy - Applications of space light-emitting diode technology

Whelan, Harry T., Wisconsin, Medical College, Milwaukee, USA; Houle, John M., Wisconsin, Medical College, Milwaukee; Bajic, Dawn M., Wisconsin, Medical College, Milwaukee; Schmidt, Meic H., Wisconsin, Medical College, Milwaukee; Reichert, Kenneth W., II, Wisconsin, Medical College, Milwaukee; Meyer, Glenn A., Wisconsin, Medical College, Milwaukee; 1998, pp. 729-735; In English

Contract(s)/Grant(s): NASW-4997; NAS8-97277; Copyright; Avail: Aeroplus Dispatch

Photodynamic therapy (PDT) is a cancer treatment modality that recently has been applied as adjuvant therapy for brain tumors. Benzoporphyrin Derivative Monoacid Ring A (BPD) is a new, second-generation photosensitizer that can potentially improve PDT for brain tumors. BPD has a major absorption peak at 690 nm, which gives it two distinct advantages over Photofrin. First, longer wavelengths of light penetrate brain tissue more easily so that larger tumors could be treated, and second, the major absorption peak means that a larger fraction of the drug is activated upon exposure to light. In the first part of this project we studied the tumoricidal effects of BPD in vitro using 2A9 canine glioma and U373 human glioblastoma cell cultures. Using LEDs with a peak emission of 688 nm as a light source, cell kill of up to 86 percent was measured in these cell lines by tumor DNA synthesis reduction. The effectiveness of BPD against tumor cells in vitro thus established, we have taken the first step toward determining its effectiveness in vivo. The second part of this project consisted of experiments performed to determine the maximum tolerated dose of both BPD and LED light.

Author (AIAA)

Light Emitting Diodes; Photosensitivity; Cancer; Medical Science; Porphyrins

19980064851

Effect of microgravity on Escherichia coli and MS-2 bacteriophage disinfection by iodinated resins

Marchin, George L., Kansas State Univ., Manhattan, USA; Silverstein, Joann, Colorado, Univ., Boulder; Brion, Gail M., Kentucky, Univ., Lexington; Acta Astronautica; Jan. 1997; ISSN 0094-5765; Volume 40, no. 1, pp. 65-68; In English

Contract(s)/Grant(s): NAGW-1197; Copyright; Avail: Aeroplus Dispatch

The purpose of the experiments reported here, which were conducted on STS 50, was to examine and compare the disinfecting properties of iodinated resins under conditions of unit gravity and microgravity. In the first experiment, the disinfecting properties of a small amount of triiodide and pentaiodide resin beads were compared against a concentrated suspension of the bacterium Escherichia coli. In the second experiment, the disinfecting activity of a triiodide resin was investigated against the nonpathogenic coliphage MS-2. The experiments demonstrated the effectiveness of iodinated resins against E. coli and MS-2 bacteriophage in microgravity. The pentaiodide resin appears to be the more effective bactericide.

AIAA

Microgravity; Bacteria; Iodine Compounds; Synthetic Resins; Space Shuttle Payloads

19980065453

The architecture of life

Ingber, Donald E., Harvard Medical School; Children's Hospital, USA; Scientific American; Jan. 1998; ISSN 0036-8733; Volume 27, no. 1, pp. 48-57; In English; Copyright; Avail: Aeroplus Dispatch

The knowledge of a set of common building rules that govern the design of organic structures is essential for understanding life's fundamentals. Despite centuries of study, little is known about how groups of molecules join together to create living cells and tissues. Here, the concept of tensegrity, which refers to a system that stabilizes itself mechanically because of the way in which tensional and compressive forces are distributed and balanced within the structure, is examined as a common form of architecture that governs a variety of natural systems, including carbon atoms, water molecules, proteins, viruses, cells, tissues, and even humans and other living creatures.

AIAA

Cells (Biology); Structural Stability; Organic Compounds

19980065707

Enhancement of phenol biodegradation by south magnetic field exposure

Jung, Jongtai, Junior Coll. of Inchon, Republic of Korea; Sofer, Samir; Journal of Chemical Technology and Biotechnology; Nov, 1997; ISSN 0268-2575; Volume 70, no. 3, pp. 299-303; In English; Copyright; Avail: Issuing Activity

Microbial pellets in the presence of south pole magnetic fields demonstrate enhanced oxidation of phenol. Earlier work at 0.49 tesla indicates qualitatively that a unipolar north magnetic field inhibits and a south magnetic field accelerates phenol oxidation rates of an alginate immobilized, mixed bacterial culture bioreactor. This work demonstrates further enhancement by exposure during phenol oxidation at 0.15 and 0.35 tesla, as well as by exposure during acclimation of the free microorganisms prior to immobilization. The enhancement of biodegradation is function of magnetic field strength and time of exposure. Enhancement is greatest at 0.15 tesla and indicates the existence of an optimum south magnetic field strength.

Author (EI)

Magnetic Fields; Phenols; Biodegradation; Oxidation; Bacteria

19980066813

Low gravity and inertial effects on the growth of E. coli and B. subtilis in semi-solid media

Kacena, M. A., Colorado, Univ., Boulder, USA; Leonard, P. E., Colorado, Univ., Boulder; Todd, P., Colorado, Univ., Boulder; Luttges, M. W., Colorado, Univ., Boulder; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1104-1108; In English

Contract(s)/Grant(s): NAGW-1197; Copyright; Avail: Aeroplus Dispatch

Several published experimental results have shown that cultures of suspended bacteria exhibit increased growth in the spaceflight environment. To test whether these differences were due to fluid mechanics and not cellular effects, E. coli and B. subtilis were grown on agar cultures under static, agitated, and rotated conditions in the laboratory, and under low-gravity conditions on four Space Shuttle flights. Growth experiments were terminated with glutaraldehyde, and individual cells were counted after quantitative elution from the agar. The spaceflight results, in conjunction with static, rotation, and agitation experiments indicate that E. coli and B. subtilis cultures on agar, unlike their suspension grown counterparts, do not experience heightened final cell concentration when the inertial environment is changed. This finding points to fluid dynamics and extracellular transport phenomena and not cellular dynamics as the most likely cause of previously reported increases in bacterial growth in microgravity.

Author (AIAA)

Microgravity; Inertia; Bacteria; Semisolids; Space Shuttle Missions; Culture Techniques

19980067906

Effect of hyperbaric oxygen on intercellular adhesion molecule-1 (ICAM-1) expression in murine lung

Shinomiya, Nariyoshi, National Defense Medical College, Japan; Suzuki, Shinya, Undersea Medical Center, Japan; Hashimoto, Akio, Undersea Medical Center, Japan; Ito, Masataka, Undersea Medical Center, Japan; Takaai, Yoshitaka, Undersea Medical Center, Japan; Oiwa, Hiromichi, Nihon Univ., Japan; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 1-7; In English; Copyright; Avail: Aeroplus Dispatch

We investigate the toxic effect of hyperbaric oxygen (HBO) via analysis of ICAM-1 on the pulmonary vascular endothelial cells and leukocyte function. Mice were exposed to HBO at 3 ATA of PO2 for 3, 4, or 6 h. Expression of ICAM-1 was serially observed by immunohistochemical analysis. The oxidative metabolic activity of the leukocytes was measured after HBO exposure. After HBO exposure, an increase in the number of pulmonary interstitial leukocytes (PILs) and bronchoalveolar lavage (BAL) was observed at 72 and 48 h, respectively. Manifestations of ICAM-1 were strongly enhanced immediately after HBO exposure, and this enhancement lasted for 24 h. This suggests the importance of enhanced expression of adhesion molecules in the generation of pulmonary oxygen toxicity. However, we could not detect increased chemiluminescence activity in the early phase in the BAL cells and PILs. It is concluded that manifestations of ICAM-1 were enhanced from the very early stage after HBO, but neither accumulation of leukocytes in the lung nor increase in the chemiluminescence activity was observed at this phase. Therefore, activation of inflammatory leukocytes in pulmonary oxygen toxicity may occur only after prolonged (more than 4 h) or repetitive exposures to HBO.

Author (AIAA)

Oxygen Tension; Hyperbaric Chambers; Lungs; Toxicity; Pulmonary Lesions; Physiological Effects

19980069549

Floating frogs - Magnets help living organisms defy gravity

Wu, Corinna, USA; Science News; Dec. 06, 1997; ISSN 0036-8423; Volume 152, no. 23, pp. 362, 363; In English; Copyright; Avail: Aeroplus Dispatch

Experiments are reported in which a live frog was successfully levitated using a powerful magnet. The results of these experiments are examined in relation to the possibility of simulating zero gravity to provide a low-cost substitute for experiments that are now possible only in outer space.

AIAA

Magnetic Suspension; Antigravity; Weightlessness Simulation; Floating

19980069572

Carbon isotopic fractionation associated with lipid biosynthesis by a cyanobacterium - Relevance for interpretation of biomarker records

Sakata, Susumu, Indiana, Univ., Bloomington, USA; Hayes, John M., Indiana, Univ., Bloomington; McTaggart, Andrew R., Indiana, Univ., Bloomington; Evans, Ronald A., Indiana, Univ., Bloomington; Leckrone, Kristen J., Indiana, Univ., Bloomington; Togasaki, Robert K., Indiana, Univ., Bloomington; Geochimica et Cosmochimica Acta; Dec. 1997; ISSN 0016-7037; Volume 61,, no. 24, pp. 5379-5389; In English

Contract(s)/Grant(s): NAGW-5107; Copyright; Avail: Aeroplus Dispatch

In the study reported here, cultures of cyanobacterium Synechocystis UTEX 2470 were grown, and isotopic compositions of individual biomolecules related to sedimentary biomarkers were determined. The objectives were to determine the distribution of C-13 among various products and to investigate biochemical factors controlling isotopic fractionations. The materials and methods used and geochemical implications of the results are discussed.

AIAA

Biosynthesis; Lipids; Carbon Isotopes; Cyano Compounds; Bacteria; Organic Compounds

19980069846

The induction of Fos-like proteins in the suprachiasmatic nuclei and intergeniculate leaflet by light pulses in degus (Octodon degus) and rats

Krajnak, Kristine, Michigan, Univ., Ann Arbor; Kentucky, Univ., Lexington, USA; Dickenson, Lia, Michigan, Univ., Ann Arbor; Lee, Theresa M., Michigan, Univ., Ann Arbor; Journal of Biological Rhythms; Oct. 1997; ISSN 0748-7304; Volume 12, no. 5, pp. 401-412; In English; Copyright; Avail: Aeroplus Dispatch

The ability of light to induce immunostaining for Fos in the SCN (suprachiasmatic nuclei) and IGL (intergeniculate leaflet) was compared in diurnal rodents, Octodon degus (degus), and nocturnal rats. Degus and rats were either maintained in constant darkness or exposed to a 1-h light pulse at circadian time (CT) 4 or 16. Degus exhibit robust phase shifts at each of those circadian hours, whereas rats demonstrate phase shifts only at CT 16. In degus, exposure to a 1-h light pulse at CT 16 resulted in an increase in the number of Fos-immunopositive (Fos+) cells in the ventrolateral SCN. by contrast, a 1-h light pulse at CT 4 resulted in a decrease in the number of Fos+ cells in the dorsomedial portion of the SCN. In rats, a light pulse presented at CT 16 resulted in an increase in Fos+ cells throughout the SCN, and a pulse at CT 4 had no effect on Fos staining. Both degus and rats showed increases in Fos expression in the IGL after light exposure at CTs 4 and 16. The authors conclude that light pulses presented at times that produce phase shifts in activity rhythms also alter Fos expression in the SCN and IGL of degus. Although these effects of light exposure on Fos expression are not identical in diurnal and nocturnal rodents, it is likely that Fos and other immediate early genes are part of the pathway mediating the effects of light in both diurnal and nocturnal rodents.

Author (AIAA)

Proteins; Nuclei; Cells (Biology); Immune Systems; Physiological Responses

19980069952

The use of different biological objects in long-term space flights

Mashinsky, A. L., Inst. of Biomedical Problems, Russia; Nechitailo, G. S., Research and Design Inst. of Biological Equipment, Russia; Jul. 1997; In English

Report No.(s): SAE Paper 972300; Copyright; Avail: Aeroplus Dispatch

Life-support systems in modern spacecraft are based on the reserves of different components and their partial physical and chemical regeneration. In many countries, work is in progress on the creation of closed ecological life-support systems involving the use of biological species of different phylogenetic levels. In the known ground-based ecological systems, as many as several thousand biological species are used to support the human life functions; in the two-year experiment in the Bioshere-2 complex in Arizona, more than 4000 species were used. Today, many specialists consider it possible to use a limited number of species in a closed ecological system. These are, first of all, microorganisms, plants (higher and lower), aqueous animals, and birds. However, there is no closed ecological system so far which could be used as a prototype for long-term space flight. This is explained by incomplete understanding of the role and function of such a system, by complexity of technical approaches for its realization, by insufficient knowledge of the behavior of species in space flights in which specific factors (cosmic radiation, disturbance of circadian rhythms, etc.) is combined with the action of a factor which cannot be simulated on the Earth, namely microgravity.

Author (AIAA)

Long Duration Space Flight; Life Support Systems; Ecosystems; Microgravity; Weightlessness; Regeneration (Physiology)

19980069953

Comparison studies of candidate nutrient delivery systems for plant cultivation in space

Goins, Gregory D., Dynamac Corp., USA; Levine, Howard G., Dynamac Corp., USA; Mackowiak, Cheryl L., Dynamac Corp., USA; Wheeler, Raymond M., NASA Kennedy Space Center, USA; Carr, Jim D., NASA Johnson Space Center, USA; Ming, Douglas W., NASA Johnson Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972304; Copyright; Avail: Aeroplus Dispatch

A reliable nutrient delivery system is essential for long-term cultivation of plants in space. At the Kennedy Space Center, a series of ground-based tests are being conducted to compare candidate plant nutrient delivery systems for space. to date, our major

focus has concentrated on the porous tube plant nutrient delivery ASTROCULTURE system, and a zeoponic plant growth substrate. The merits of each system are based upon the performance of wheat supported over complete growth cycles. to varying degrees, each system supported wheat biomass production and showed distinct patterns for plant nutrient uptake and water use.
Author (AIAA)
Nutrients; Cultivation; Plants (Botany); Life Support Systems; Long Duration Space Flight

19980069955

Accommodating rodents during extended microgravity missions

Eodice, Michael T., NASA Ames Research Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972306; Copyright; Avail: Aeroplus Dispatch

This study examines the current state of the art in rodent habitats as well as the next-generation of rodent habitats currently under development at NASA-Ames. Space Shuttle missions are currently limited in duration to just over two weeks. In contrast to this, future life science missions aboard the Space Station may last months or even years. This will make resource conservation and utilization critical issues in the development of rodent habitats for extended microgravity missions. Emphasis is placed on defining rodent requirements for extended space flights of up to 90 days, and on improving habitability and extending the useful performance life of rodent habitats.
Author (AIAA)
Rodents; Microgravity; Long Duration Space Flight; Gravitational Physiology

19980070025

Gene-based detection of microorganisms in environmental samples using PCR

Glass, John I., Alabama, Univ., Birmingham, USA; Lefkowitz, Elliot J., Alabama, Univ., Birmingham; Cassell, Gail H., Alabama, Univ., Birmingham; Wechser, Mark, Perkin-Elmer, Applied Biosystems Div., USA; Taylor, Theresa B., Perkin-Elmer, Applied Biosystems Div., USA; Albin, Michael, Perkin-Elmer, Applied Biosystems Div., USA; Paszko-Kolva, Christine, Perkin-Elmer, Applied Biosystems Div., USA; Roman, Monsi C., NASA Marshall Space Flight Center, USA; Jul. 1997; In English
Contract(s)/Grant(s): NAGW-5081
Report No.(s): SAE Paper 972424; Copyright; Avail: Aeroplus Dispatch

Contaminating microorganisms pose a serious potential risk to the crew's well being and water system integrity aboard the International Space Station (ISS). We are developing a gene-based microbial monitor that functions by replicating specific segments of DNA as much as 10 exp 12 x. Thus, a single molecule of DNA can be replicated to detectable levels, and the kinetics of that molecule's accumulation can be used to determine the original concentration of specific microorganisms in a sample. Referred to as the polymerase chain reaction (PCR), this enzymatic amplification of specific segments of the DNA or RNA from contaminating microbes offers the promise of rapid, sensitive, quantitative detection, and identification of bacteria, fungi, viruses, and parasites. We envision a small instrument capable of assaying an ISS water sample for 48 different microbes in a 24-h period. We report on both the developments in the chemistry necessary for the PCR assays to detect microbial contaminants in ISS water, and on progress towards the miniaturization and automation of the instrumentation.
Author (AIAA)
Microorganisms; Water Quality; International Space Station; Genes; Deoxyribonucleic Acid

19980070420

Modelling of nonlinear dynamics of photosynthetic reaction centers

Goushcha, A., Ukrainian National Academy of Sciences, Div. of Physics of Biological Systems, Ukraine; Kapoustina, M., Ukrainian National Academy of Sciences, Div. of Physics of Biological Systems, Ukraine; Kharkyanen, V., Ukrainian National Academy of Sciences, Div. of Physics of Biological Systems, Ukraine; Journal of Technical Physics; 1997; ISSN 0324-8313; Volume 38, no. 2, pp. 283-287; In English; Copyright; Avail: Aeroplus Dispatch

This work presents the self-consistent stochastic description of electron transfer macromolecules ensemble and shows the importance of nonlinear dynamical effects in experimentally observed relations. That electron-conformational interaction approach was used in the model which describes both the photomobilized electron transfer kinetics and structure conformational transitions. The effective potential concept was introduced for the reaction center system description.
Author (AIAA)
Photosynthesis; Electron Transfer; Stochastic Processes; Self Consistent Fields; Proteins; Photoexcitation

19980070573

Analysis of sedimentation of immobilized cells under normal and hypergravity

Nagel, U., Bochum, Ruhr-Univ., Germany; Watzke, D., Bochum, Ruhr-Univ., Germany; Naugebauer, D.-Ch., Bochum, Ruhr-Univ., Germany; Machemer-Roehnisch, S., Bochum, Ruhr-Univ., Germany; Braeucker, R., Bochum, Ruhr-Univ., Germany; Machemer, Hans, Bochum, Ruhr-Univ., Germany; Microgravity - Science and Technology; 1997; ISSN 0938-0108; Volume 10, no. 1, pp. 41-52; In English; Copyright; Avail: Aeroplus Dispatch

Sedimentation is part of the swimming behavior of cells in the gravity field. Determinations of sedimentation are indispensable for the isolation of graviresponses of cells (gravitaxis, gravikinesis). Using a low-speed microscope centrifuge, we have determined the sedimentation rates of various protozoan cells (Paramecium tetraurelia, Paramecium caudatum, Tetrahymena pyriformis, Didinium nasutum, and Loxodes striatus) as a function of acceleration up to 7 g, iron uptake, deciliation, two different immobilization agents (NiCl2, MnCl2), and Ca(2+)-Mg(2+) composition of the experimental solution. The experimental results suggest a linear relationship between sedimentation rate and acceleration up to 2 g intercepting the origin (zero sedimentation rate at 0 g). Beyond 2 g, the sedimentation curves tend to depart from linearity, depending on cell shape and size, state of feeding, immobilization procedure, and time passed since the onset of sedimentation. The time-dependence of observed mean values of sedimentation rate rises with acceleration due to a continuing loss of faster-sedimenting cells from the observed field. The original sedimentation velocity distribution of a cell sample can be calculated from the data.
Author (AIAA)

High Gravity Environments; Cells (Biology); Immobilization; Gravitational Fields; Microorganisms

19980070574

Gravitactic orientation in the flagellate Euglena gracilis

Haeder, Donat-P., Erlangen-Nuernberg, Univ., Germany; Porst, Markus, Erlangen-Nuernberg, Univ., Germany; Tahedl, Harald, Erlangen-Nuernberg, Univ., Germany; Richter, Peter, Erlangen-Nuernberg, Univ., Germany; Lebert, Michael, Erlangen-Nuernberg, Univ., Germany; Microgravity - Science and Technology; 1997; ISSN 0938-0108; Volume 10, no. 1, pp. 53-57; In English; Copyright; Avail: Aeroplus Dispatch

Gravitactic orientation was studied in the unicellular photosynthetic flagellate, Euglena gracilis, at different accelerations between 0 and 0.43 g during a recent TEXUS experiment on a sounding rocket. The threshold for gravitaxis was found to be below 0.12 g. Above the threshold, the precision of orientation increased with the acceleration. Long tracks analyzed at high spatial and temporal resolution during the reorientation maneuvers of Euglena showed that the cells accelerate during reorientation. The most pronounced directional changes are encountered when the cells swim perpendicularly to the gravivector of the Earth. The angular change is closely related to the calculated signal strength, and the response follows the sine rule.
Author (AIAA)

Cells (Biology); Bacteria; Gravitational Effects; Sounding Rockets; Spaceborne Experiments; Spacecraft Maneuvers

19980070575

Growth characteristics of E. coli and B. subtilis cultured on an agar substrate in microgravity

Kacena, Melissa, Colorado, Univ., Boulder, USA; Todd, Paul, Colorado, Univ., Boulder; Microgravity - Science and Technology; 1997; ISSN 0938-0108; Volume 10, no. 1, pp. 58-62; In English
Contract(s)/Grant(s): NAGW-1197; Copyright; Avail: Aeroplus Dispatch

Previous spaceflight experimentation has shown that suspension cultures of bacteria exhibit increased growth in the weightless, space-flight environment. to the contrary, the E. coli and B. subtilis cells grown on solid agar did not experience a heightened final cell concentration when cultured in space. It does, however, appear that changes in other growth characteristics of bacteria might occur when grown under various gravitational conditions. In order to further analyze the growth characteristics of bacteria under different gravitational environments, E. coli and B. subtilis were cultured on agar under several inertial loadings: static 1 g, clinorotated, and reduced gravity aboard Space Shuttle mission STS-63. Several different growth durations were chosen to better examine the first three stages of bacterial growth: lag phase, log phase, and saturation phase. After appropriate growth periods the cultures were terminated and the fixed bacteria were resuspended from the agar; individual cells were counted. An initial plot of the growth curve was established. Growth kinetic values were obtained. It is concluded that E. coli and B. subtilis cultured on agar have a shortened lag phase duration when grown in space flight and in clinostats. Saturation cell concentration, lag phase cell concentration, and growth rate appear to remain unchanged by gravitational environments.
Author (AIAA)

Microgravity; Bacteria; Cells (Biology); Spaceborne Experiments; Cell Division

19980070824

Validation of BURNSIM predictions against human and pig skin burns

Knox, Ted, USAF, Armstrong Lab., USA; Perry, Chris, USAF, Armstrong Lab., USA; Buhrman, John, USAF, Armstrong Lab., USA; Bonetti, Dena, USAF, Armstrong Lab., USA; 1997, pp. 176-188; In English; Copyright; Avail: Aeroplus Dispatch

The interactive burn prediction model BURNSIM has been incorporated into a larger crew casualty model, ORCA, requiring documentation of BURNSIM's validation. This request prompted us to pull together several previously unpublished studies of BURNSIM's ability to accurately predict both human and porcine (pig) burns. This paper discusses the degree to which BURNSIM's predicted depth matches data published by various authors for either the human or the pig case. With some databases, it was possible to estimate whether the predictions were in the low, middle or high percentile of observed data and to determine the radiant energy required to generate burn at three different severity levels each with probabilities of 1.0, 2.5, and 5.0 percent. Exposure levels ranged from 0.68 to 56.0 cal/sq cm at 6 times from 0.25 to 10.0 seconds.

Author (AIAA)

Skin (Anatomy); Burns (Injuries); Human Performance; Flight Crews; Computerized Simulation

19980071404

The complete genome sequence of the hyperthermophilic, sulphate-reducing archaeon Archaeoglobus fulgidus

Klenk, Hans-Peter, Inst. for Genomic Research, USA; Clayton, Rebecca A., Inst. for Genomic Research, USA; Tomb, Jean-Francois, Inst. for Genomic Research, USA; White, Owen, Inst. for Genomic Research, USA; Nelson, Karen E., Inst. for Genomic Research, USA; Ketchum, Karen A., Inst. for Genomic Research, USA; Dodson, Robert J., Inst. for Genomic Research, USA; Gwinn, Michelle, Inst. for Genomic Research, USA; Hickey, Erin K., Inst. for Genomic Research, USA; Peterson, Jeremy D., Inst. for Genomic Research, USA; Nature; Nov. 27, 1997; ISSN 0028-0836; Volume 390,, no. 6658, pp. 364-370; In English; Copyright; Avail: Aeroplus Dispatch

Archaeoglobus fulgidus is the first sulfur-metabollizing organism to have its genome sequence determined. Its genome of 2,178,400 base pairs contains 2,436 open reading frames (ORFs). The information processing systems and the biosynthetic pathways for essential components have extensive correlation with their counterparts in the archaeon Methanococcus jannaschii. The genomes of these two Archaea indicate dramatic dlfferences in the way these organisms sense their environment, perform regulatory and transport functions, and gain energy. In contrast to M. jannaschii, A. fulgidus has fewer restriction-modification systems, and none of its genes appears to contain inteins. A quarter of the A. fulgidus genome encodes functionally uncharacterized yet conserved proteins, two-thirds of which are shared with M. jannaschii. Another quarter of the genome encodes new proteins indicating substantial archaeal gene diversity.

Author (AIAA)

Archaebacteria; Deoxyribonucleic Acid; Thermophiles; Genetics

19980071405

Structure and function of the vertebrate magnetic sense

Walker, Michael M., Auckland, Univ., New Zealand; Diebel, Carol E., Auckland, Univ., New Zealand; Haugh, Cordula V., Auckland, Univ., New Zealand; Montgomery, John C., Auckland, Univ., New Zealand; Pankhurst, Patricia M., Auckland, Univ., New Zealand; Green, Colin R., Auckland, Univ., New Zealand; Nature; Nov. 27, 1997; ISSN 0028-0836; Volume 390,, no. 6658, pp. 371-376; In English; Copyright; Avail: Aeroplus Dispatch

Some vertebrates can navigate over long distances using the Earth's magnetic field, but the sensory system that they use to do so has remained a mystery. Here we describe the key components of a magnetic sense underpinning this navigational ability in a single species, the rainbow trout. We report behavioral and electrophysiological responses to magnetic fields and identify an area in the nose of the trout where candidate magnetoreceptor cells are located. We have tracked the sensory pathway from these newly identified candidate magnetoreceptor cells to the brain and associated the system with a learned response to magnetic fields.

Author (AIAA)

Sensory Perception; Magnetic Fields; Fishes

19980071411

Mobility of photosynthetic complexes in thylakoid membranes

Mullineaux, Conrad W., Univ. College, UK; Tobin, Mark J., CLRC Daresbury Lab., UK; Jones, Gareth R., CLRC Daresbury Lab., UK; Nature; Nov. 27, 1997; ISSN 0028-0836; Volume 390,, no. 6658, pp. 421-424; In English; Copyright; Avail: Aeroplus Dispatch

Using fluorescence recovery after photobleaching (FRAP) and a scanning confocal microscope, we have made direct measurements in vivo of the lateral diffusion of light-harvesting complexes and reaction centers in the thylakoid membranes of the

cyanobacterium Dactylococcopsis salina. We find that the phycobilisomes (the accessory light-harvesting complexes of cyanobacteria) diffuse quite rapidly, but that photosystem II is immobile on the timescale of the measurement, indicating that the linkage between phycobilisomes and photosystem II is unstable. We propose that the lateral diffusion of phycobilisomes is involved in regulation of photosynthetic light-harvesting (state 1-state 2 transitions). The mobility of the phycobilisomes may also be essential to allow the synthesis and repair of thylakoid membrane components.
Author (AIAA)
Photosynthesis; Blue Green Algae; Cell Membranes (Biology)

19980071535
Geochemical constraints on chemolithoautotrophic metabolism by microorganisms in seafloor hydrothermal systems
McCollom, Thomas M., Washington Univ., USA; Shock, Everett L., Washington Univ., USA; Geochimica et Cosmochimica Acta; Oct. 1997; ISSN 0016-7037; Volume 61,, no. 20, pp. 4375-4391; In English
Contract(s)/Grant(s): NSF OCE-92-20337; Copyright; Avail: Aeroplus Dispatch

The present thermodynamic mixing calculations imply that vent habitats whose geochemical environment is dominated by hydrothermal fluid/seawater mixing favor chemosynthetic oxidative reactions at temperatures of 30-50 C, and reductive reactions at higher temperatures. While sulfide oxidation furnishes the largest amount of energy available for primary productivity, the removal of a large portion of the H2S by the presence of mineral precipitation can allow other autotrophic reactions to increase their role in potential primary production.
AIAA
Geochemistry; Metabolism; Microorganisms; Hydrothermal Systems; Ocean Bottom; Marine Chemistry

19980071781
Brain-behavior relations in primates and cetaceans - Implications for the ubiquity of factors leading to the evolution of complex intelligence
Marino, Lori, Emory Univ., USA; 1997, pp. 553-560; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes the results of a project aimed at addressing questions about the evolution of intelligence by utilizing comparisons of brain-behavior relations in cetaceans (dolphins and whales) and primates. Three specific questions were asked. First, have any cetaceans reached a hominid level of encephalization? Second, are cetacean-primate comparisons of brain organization useful for grappling with the differences that are bound to exist between any extraterrestrial organism and ourselves? Third, are there similarities in brain-behavior relations in cetaceans and primates that suggest behavioral evolution is shaped by general factors? Brain and body weights for cetacean and primate species were collected and compared with each other and with data on brain organization and social behavior. The results revealed that a hominid level of encephalization is not unique in mammalian history. Furthermore, cetacean-primate comparisons can be useful in understanding the different ways in which information processing systems can be organized. Finally, a comparison of the relation between encephalization and social group size in primates and cetaceans preliminarily suggests that similar mental capacities can be achieved through different independent evolutionary paths and that there may be factors common to behavioral evolution in all intelligent organisms.
Author (AIAA)
Brain; Biological Evolution; Intelligence; Extraterrestrial Life; Behavior

19980072515
Time and time again - The phylogeny of melatonin as a transducer of biological time
Cassone, Vincent M., Texas A & M Univ., College Station, USA; Natesan, Arjun K., Texas A & M Univ., College Station; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 489-497; In English; Copyright; Avail: Aeroplus Dispatch

The circadian secretion of melatonin is a critical component in circadian and seasonal rhythms in many vertebrate species. This hormone is produced by photoreceptors and cell types derived from photoreceptors in vertebrate retinas and pineal complexes via circadian regulation of the biosynthetic enzymes arylalkylamine N-acetyltransferase and hydroxyindole-O-methyltransferase at both transcriptional and posttranscriptional levels. The question of whether other multicellular animals and organisms from other taxa produce melatonin in a homologously regulated pathway is at this point unclear, but preliminary evidence suggests that vertebrate and insect melatonin are produced by convergent or parallel phylogenies. In vertebrates, the role of melatonin in behavioral and systems physiology follows two phylogenetic patterns. First, the circadian regulation of visual system structures, including the hypothalamic suprachiasmatic area, the inner retina, and retinorecipient and integrative visual structures, is a primitive characteristic among vertebrate species. Second, the relative loss of visual regulation and the presence of melatonin binding in

the pars tuberalis of the adenohypophysis among mammals is a derived characteristic because these characteristics are present in this group only.
Author (AIAA)
Circadian Rhythms; Activity Cycles (Biology)

19980072517
Melatonin receptors - Molecular biology of a new family of G protein-coupled receptors
Reppert, Steven M., Massachusetts General Hospital, Boston, USA; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 528-531; In English; Copyright; Avail: Aeroplus Dispatch

A family of high-affinity, G protein-coupled receptors for the pineal hormone melatonin has been cloned from vertebrates. These recombinant receptors exhibit similar affinity and pharmacological characteristics to each other and to endogenous receptors, as defined with the melatonin agonist 2-(125I)iodomelatonin (125I-Mel). Two mammalian melatonin receptor subtypes have been identified by molecular cloning studies. The mammalian Melba melatonin receptor is expressed in most sites containing 125I-Mel binding. This includes the hypothalamic suprachiasmatic nucleus and hypophyseal pars tuberalis, presumed sites of the circadian and some of the reproductive actions of melatonin, respectively. The mammalian Mel(1b) melatonin receptor is expressed in the retina and the brain and may mediate the reported effects of melatonin on retinal physiology in some mammals. A third receptor subtype, the Mel(1c) melatonin receptor, has been cloned from zebra fish, Xenopus, and chickens, but not from mammals. Molecular cloning of a melatonin receptor family now makes possible gene targeting to precisely determine the physiological role(s) of each receptor subtype.
Author (AIAA)
Molecular Biology; Chemoreceptors; Proteins

19980072518
Commentary - What does melatonin do and how does it do it?
Menaker, Michael, Virginia, Univ., Charlottesville, USA; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 532-534; In English; Copyright; Avail: Aeroplus Dispatch

Melatonin's roles in the circulation of body temperature and as a mediator of the reproductive effects of the seasonally varying photoperiod are explored. Consideration is given to gaps in our understanding of melatonin, such as where and how this hormone acts on the reproductive system and, at a different level, whether or not melatonin affects reproduction in mammals that do not breed seasonally.
AIAA
Molecular Biology

19980072520
Photic entrainment of the mammalian rhythm in melatonin production
Illnerova, Helena, Czech Academy of Sciences, Czech Republic; Sumova, Alena, Czech Academy of Sciences, Czech Republic; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 547-555; In English; Copyright; Avail: Aeroplus Dispatch

This review summarizes studies on the photic entrainment of the circadian rhythm in the rat's pineal melatonin production, namely, that of the rhythm in N-acetyltransferase (NAT) activity, and compares the NAT rhythm resetting with preliminary results on the resetting of an intrinsic rhythmicity in the suprachiasmatic nucleus (SCN) of the hypothalamus, namely, with the entrainment of the rhythm in the light-induced c-fos gene expression. Phase delaying of the NAT rhythm after various light stimuli proceeds within one day with almost no transients, whereas during phase advancing of the rhythm only the morning NAT decline is phase-advanced within one day, and the evening rise phase shifts through transients. A light stimulus encompassing the middle of the night may phase-delay the evening NAT rise, phase-advance the morning decline, compress the rhythm waveform, and eventually lower its amplitude. The data indicate that the resetting of the rhythm in melatonin production in the rat's pineal gland reflects changes in the SCN functional state and suggest that the underlying SCN pacemaking system is complex.
Author (AIAA)
Mammals; Circadian Rhythms; Biochemistry; Light (Visible Radiation)

19980072523
Circadian entrainment and phase shifting in mammals with melatonin
Redman, Jennifer R., Monash Univ., Australia; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 581-587; In English; Copyright; Avail: Aeroplus Dispatch

Circadian effects of exogenous melatonin, whereby daily administration induces entrainment or phase shifts, have been demonstrated in both nocturnal and diurnal mammals. In Long-Evans rats, as used in early studies, effects occur reliably when melatonin is administered late in the subjective day. A second period of sensitivity to melatonin, late in the subjective night, is evident in certain strains of mice and the diurnal Funambulus pennanti. This late night to early morning sensitive phase previously had been identified in human subjects. Different circadian responses to melatonin also may occur between rat strains. Circadian effects of melatonin in hamsters are diverse and vary with strain, developmental age, and method of administration. Characteristics of melatonin binding sites within the suprachiasmatic nuclei vary both between and within species, as do profiles of endogenous melatonin rhythms. These differences may explain the variations in circadian responses to melatonin.
Author (AIAA)
Circadian Rhythms; Phase Shift; Mammals; Diurnal Variations; Nocturnal Variations

52
AEROSPACE MEDICINE

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

19980048994 Advisory Group for Aerospace Research and Development, Aerospace Medical Panel, Neuilly-Sur-Seine, France
Injury Prevention in Aircraft Crashes: Investigative Techniques and Applications ***La Prevention des Lesions Lor des Accidents d'Avions: Les Techniques d'Investigation et Leurs Applications***
Feb. 1998; 100p; In English, 24-25 Nov. 1997, Farnborough, Madrid, UK, Spain; Also announced as 19980048995 through 19980049001
Report No.(s): AGARD-LS-208; ISBN 92-836-1068-7; Copyright Waived; Avail: CASI; A05, Hardcopy; A02, Microfiche

This Lecture Series addresses a critical aspect of the investigations related to the factors implied in the prevention of potential injuries among aircraft occupants as a consequence of impact and post-crash fires, heat and toxic fumes. It comprises a review of the critical aspects of injury prevention. The topics covered included a description of the acceleration vectors involved, how they may have an influence on the aircraft, and how the acceleration forces might be tolerated by the aviator. In addition, the physical analysis of impact and crash survivability is discussed, focusing on what happens during a mishap. Furthermore a review is made on how to evaluate the tolerable deceleration forces and occupiable space required to sustain life. A part of this LS is devoted to answering questions such as, when did the injury occur, the nature of the forces that produced the injury, and their relationship to a mishap. Injury types related to the thermal and intrusive impact of the deceleration forces are also discussed, as are aspects related to the collection of medical information that would help identify the potential causes and the effects of an individual; in particular, the way in which the occupant moves in response to the forces applied. These forces may have a profound effect upon the nature and severity of the injury. This Lecture Series, sponsored by the Aerospace Medicine Panel of AGARD, has been implemented by the Consultant and Exchange Program.
Author
Aircraft Accidents; Aircraft Accident Investigation; Crashworthiness; Design Analysis; Escape Systems; Injuries; Prevention; Human Tolerances

19980048996 Royal Air Force Inst. of Aviation Medicine, Accident Investigation, Farnborough, UK
Human Tolerance to Abrupt Acceleration
Cugley, Jennifer, Royal Air Force Inst. of Aviation Medicine, UK; Injury Prevention in Aircraft Crashes: Investigative Techniques and Applications; Feb. 1998; 8p; In English; Also announced as 19980048994; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Short duration accelerations resulting in injury or death can be inflicted not only on the occupants of vehicles involved in crashes, but also on pedestrians, sportsmen, persons falling from a height, and those exposed to explosions and bomb blast. The injury may be received when a person in motion comes into collision with a solid object or when an object or missile strikes a stationary person. Irrespective of the circumstances surrounding the accident, injury occurs when a person is exposed to forces of some magnitude for a brief period of time, and the degree of injury is related to the magnitude and duration of the applied forces. Hence, the study of accidental injury can be summarized as what we hit, how we hit it, how long we hit it for, how many times we hit it and which part of the body is subjected to the insult. For effective injury reduction programs to be introduced, an appreciation must be gained of the way in which accidents cause injuries, the nature of the forces contributing to the injuries and the characteristics of the type of accident under investigation.
Derived from text
Human Tolerances; Acceleration; Collisions; Injuries; Accident Investigation

19980048997 Biodynamic Research Corp., San Antonio, TX USA

Principles of Crash Survivability

Raddin, James H., Jr., Biodynamic Research Corp., USA; Feb. 1998; 8p; In English; Also announced as 19980048994; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

A comprehensive review of the history of impact protection is clearly beyond the scope of the review. The interested reader is referred to the bibliography for the chapter on Biodynamics: Transitory acceleration in DeHart's Fundamentals of Aerospace Medicine. Suffice is to say here that the endeavor or protect occupants in aircraft crashes began with the pioneers of aviation and continues to the present day. It has met with considerable success but remains limited by the remarkable violence that can be wrought when fast moving objects meet fixed ones. The human body has a meager ability to cope with such violence without assistance and practical methods of assistance can only go so far. The basic line os attack on the problem have generally been to provide a container to surround the occupant, provide a seat and restraint to hold him there, limit the accelerations of the container to tolerable levels, provide personal protective equipment such as helmets, and control for post-crash factors such as fire or water landing. Ejection seats, capsules or modules were something of a special case, since they were intended to allow the occupant to avoid the crash altogether. However, they posed their own set of risks such as the ejection accelerations, windblast, altitude exposure, parachute opening shock, parachute landing, and a host of others. They made a real contribution in many cases, but they didn't make the problem of impact injury go away.

Derived from text

Aircraft Accidents; Constraints; Protection; Ejection Seats; Helmets; Human Body; Crashes; Survival

19980048998 Biodynamic Research Corp., San Antonio, TX USA

The Physical Basis of Impact Injury and its Prevention

Raddin, James H., Jr., Biodynamic Research Corp., USA; Feb. 1998; 6p; In English; Also announced as 19980048994; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Effective prevention of injury in aircraft crashes and the investigation into injury occurrence in those crashes requires a knowledge of how impact injury occurs and how protective techniques work. This review will examine the physical underpinnings of the art of impact protection as applied to vehicular impacts. The same principles apply to terrestrial vehicles, aircraft, and spacecraft in a wide range of impacts and other sudden accelerations. Because they happen so rapidly, they are sometimes difficult to understand in terms of our slower moving daily experience. Some of the understandings may even be counter-intuitive as a result of the need to observe the event from various frames of reference. The review must therefore begin with some basic physics and apply those principles to the collision event. Approaches to describing crash motions and crash severity will be outlined before describing how to analyze occupant motions in a crash. The physics of injury will be briefly reviewed and applied in defining injury mechanisms and injury criteria. Finally, general approaches to crash protection will be addressed along with some perspectives on how to analyze and assess the effectiveness of crash protection. Example cases will be presented with the oral presentation to illustrate the application of the principles reviewed in the paper.

Derived from text

Aircraft Accidents; Impact; Injuries; Prevention; Collisions

19980048999 Biodynamic Research Corp., San Antonio, TX USA

Applications of Physical Analysis and Crash Survivability

Banks, Robert D., Biodynamic Research Corp., USA; Feb. 1998; 4p; In English; Also announced as 19980048994; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

An aircraft accident is always an emotional event that triggers a flurry of activity, particularly if fatalities are involved. Rescuers, damage control crews, search and rescue teams, MEDEVAC teams, and support staff each play a well rehearsed role in activities surrounding the event. Every accident is unique, with its own set of circumstances, surroundings, mysteries and dangers. Initial confusion is always present. But amidst the wreckage, log of events, communication tapes, eye witness accounts, mission briefing, technical manuals, personal interviews and pathology lie important clues that, properly organized and understood, will indicate the cause and the consequences of the accident. The questions confronting an accident investigation board can vary, but usually involve two issues. The first centers on the cause of the accident. Explaining the cause is fundamental to future prevention of similar accidents. The task of making 'sense' from 'nonsense' can be awesome. An investigating team is usually confronted with a confused abundance of physical and human evidence, and an organized approach to information collection and analysis is needed to succeed.

Derived from text

Accident Investigation; Aircraft Accidents; Rescue Operations; Emotional Factors; Damage; Prevention

19980049000 Armed Forces Inst. of Pathology, Washington, DC USA

Aviation Pathology

Cogswell, Steven C., Armed Forces Inst. of Pathology, USA; Feb. 1998; 10p; In English; Also announced as 19980048994; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Aircraft crashes are generally predictable in type and frequency. Different types of aircraft have different types of crashes. Similarly, occupant injuries follow generally predictable patterns, and themselves often consist of patterned abrasions and contusions reflecting portions of the aircraft structure. The role of the medical investigator and/or pathologist includes documentation and interpretation of these injuries to determine how the injuries occurred so that they may be minimized or prevented. The pathologist's documentation and interpretation of injuries, together with manifestations of natural disease processes, provides the core of the Human Factors data for analysis. As few pathologists are familiar with aircraft crash injuries, their interpretation of the injury patterns may be incorrect, which may significantly compromise the investigation.

Derived from text

Aircraft Accidents; Crash Injuries; Pathology; Human Factors Engineering; Aerospace Medicine; Crashes; Injuries

19980049001 Armed Forces Inst. of Pathology, Washington, DC USA

Aviation Pathology Notes

Cogswell, Steven C., Armed Forces Inst. of Pathology, USA; Feb. 1998; 12p; In English; Also announced as 19980048994; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Topics discussed include the following: Aircraft Mishap Investigation; Survivability Analysis; Armed Forces Military Examiner; Injury Analysis; Control Injuries, and Toxicology.

Author

Aerospace Medicine; Aircraft Accidents; Injuries; Pathology; Toxicology; Survival

19980049694

Pulmonary capillary blood volume during lower body negative pressure - Effect of gender

Gotshall, Robert W., Colorado State Univ., Fort Collins, USA; Davrath, Linda R., Colorado State Univ., Fort Collins; Aviation, Space, and Environmental Medicine; Mar. 1998; ISSN 0095-6562; Volume 69, no. 3, pp. 277-281; In English; Copyright; Avail: Aeroplus Dispatch

We examine the changes in pulmonary capillary blood volume (Vc) in men and women during lower body negative pressure (LBNP). Additionally, the components of lung diffusion capacity were measured and evaluated for the effect of gender and LBNP. There were six men and six women who underwent a staged LBNP protocol to -40 mm Hg. The diffusion of the lung for carbon monoxide (DLCO) was determined at two levels of inspired oxygen (21 percent and 60 percent). DLCO was separated into the diffusion capacity of the membrane (DLM) and the diffusion capacity of blood. During supine rest, DLCO values for men were larger than for women. DLCO decreased equally with each stage of LBNP for men and women. Vc during supine rest was greater for men than for women. Vc also declined with each stage of LBNP, and the decline was similar for men and women. DLM did not change with LBNP. The decrease in DLCO with LBNP is due to the reductions in thoracic blood volume in both men and women. These thoracic blood volume changes do not explain the previously reported reduced tolerances to LBNP for women because the reductions in thoracic blood volume were similar for men and women.

Author (AIAA)

Pulmonary Functions; Blood Volume; Capillary Flow; Lower Body Negative Pressure; Sex Factor; Carbon Monoxide

19980049695

The effects of moderately elevated carbon dioxide levels on human physiology and performance: A joint NASA-ESA-DARA study - Overview

Frey, M. A. B., NASA, USA; Sulzman, Frank M., NASA, USA; Oser, Heinz, ESA, France; Ruyters, Gunter, DARA, Germany; Aviation, Space, and Environmental Medicine; Mar. 1998; ISSN 0095-6562; Volume 69, no. 3, pp. 282-284; In English; Copyright; Avail: Aeroplus Dispatch

In constructing the International Space Station (ISS), one of the many tradeoffs involves the setting of limits for ambient carbon dioxide levels. Because most of the extant literature on the effects of chronic exposure to CO2 involves levels higher than those considered for the ISS, or does not address the most relevant variables, NASA, ESA, and DARA sponsored a deep diving

chamber experiment involving the exposure of four subjects to CO2 levels of 0.7 and 1.2 percent for 24 days each. General experiment design considerations are discussed.
AIAA
Human Performance; Gravitational Physiology; NASA Space Programs; European Space Programs; Carbon Dioxide Concentration; International Space Station

19980049697
Effects of sustained low-level elevations of carbon dioxide on cerebral blood flow and autoregulation of the intracerebral arteries in humans. I
Sliwka, U., Aachen Technical Univ., Germany; Simon, S. G., Aachen Technical Univ., Germany; Schmidt, P., Aachen Technical Univ., Germany; Noth, J., Aachen Technical Univ., Germany; Krasney, John A., New York, State Univ., Buffalo; Aviation, Space, and Environmental Medicine; Mar. 1998; ISSN 0095-6562; Volume 69, no. 3, pp. 299-306; In English; Copyright; Avail: Aeroplus Dispatch

Cerebral blood flow velocity (CBFv) was measured by insonating the middle cerebral arteries of four subjects using a 2 MHz transcranial Doppler. Ambient CO2 was elevated to 0.7 percent for 23 d in the first study and to 1.2 percent for 23 d in the same subjects in the second study. by nonparametric testing CBFv was elevated significantly by +35 percent above preexposure levels during the first 1-3 d at both exposure levels, after which CBFv progressively readjusted to preexposure levels. Despite similar CBFv responses, headache was only reported during the initial phase of exposure to 1.2 percent CO2. Vascular reactivity to CO2 assessed by rebreathing showed a similar pattern with the CBFv increases early in the exposures being greater than those elicited later. An increase in metabolic rate of the visual cortex was evoked by having the subjects open and close their eyes during a visual stimulus. Evoked CBFv responses measured in the posterior cerebral artery were also elevated in the first 1-3 days of both studies returning to preexposure levels as hypercapnia continued. Cerebral vascular autoregulation assessed by raising head pressure during 10 deg head-down tilt both during the low-level exposures and during rebreathing was unaltered. There were no changes. in the retinal microcirculation during serial fundoscopy studies. Cerebral vascular autoregulation appears preserved during chronic exposure to these low levels of ambient CO2.
Author (AIAA)
International Space Station; Carbon Dioxide Concentration; Brain Circulation; Blood Flow; Arteries; Human Performance

19980049698
Carotid artery dissection presenting as a painless Horner's syndrome in a pilot - Fit to fly?
Venketasubramanian, N., Tan Tock Seng Hospital, Singapore; Hui, Francis, Tan Tock Seng Hospital, Singapore; Singh, Jarnail, Civil Aviation Authority of Singapore; Lim, Meng-Kin, Civil Aviation Authority of Singapore; Aviation, Space, and Environmental Medicine; Mar. 1998; ISSN 0095-6562; Volume 69, no. 3, pp. 307-310; In English; Copyright; Avail: Aeroplus Dispatch

We describe a case of a middle-aged Caucasian pilot who presented to us with a painless left Horner's syndrome due to a focal dissection of the infrapetrous portion of the ipsilateral internal carotid artery. He did not suffer symptoms of cerebral ischemia at the time of onset, or during the following two yr. The Horner's syndrome persisted unchanged throughout follow-up. Serial magnetic resonance angiograms showed some regression of the focal stenosis at 12 months, with no further change over the next 10 months. The literature suggests that the risk of stroke after onset of dissection is usually in the first month, and the risk of recurrence of dissection is about one percent per year after the first year. Our patient was prescribed aspirin 300 mg/d, and certified to fly as or with a copilot commencing one year after onset of his symptoms.
Author (AIAA)
Aircraft Pilots; Arteries; Dissection; Ischemia; Cerebral Ventricles; Physiological Tests

19980049977
Interplanetary travel and permanent injury to normal heart
Rowe, William J., USA; Acta Astronautica; May 1997; ISSN 0094-5765; Volume 40,, no. 10, pp. 719-722; In English; Copyright; Avail: Aeroplus Dispatch

It is hypothesized that the atrophy of skeletal muscle and bone, leading to a Mg-ion deficiency, will lead to the development of permanent myocardial injury by crewmen on prolonged spaceflights despite the absence of coronary problems or radiation hazards beyond Earth orbit. Toxic free radicals can develop, complicating ischemia and potential high radiation.
AIAA
Interplanetary Flight; Injuries; Myocardium; Spacecrews; Aerospace Medicine

19980050692

Effects of elevated carbon dioxide environment on calcium metabolism in humans. I

Drummer, Christian, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Friedel, Veronika, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Boerger, Angela, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Stoermer, Ingo, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Wolter, Stephan, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Wolfram, Gernot, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Heer, Martina, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Zittermann, Armin, Bonn, Univ., Germany; Aviation, Space, and Environmental Medicine; Mar. 1998; ISSN 0095-6562; Volume 69, no. 3, pp. 291-298; In English; Copyright; Avail: Aeroplus Dispatch

Chronic respiratory acidosis induced by an elevated CO2 environment should provoke hypercalciuria with related total body and subsequent bone calcium losses. We examined this hypothesis in four healthy male volunteers, who were exposed during a 25 d period to an 0.7 percent CO2 environment within a deep diving isolation chamber. Three months later the same subjects were reexamined during a second campaign being exposed to a 1.2 percent CO2 atmosphere. The subjects received a constant calcium intake (1.4 g/d) and vitamin D supplement during both campaigns. Calcium balance (oral calcium intake minus urinary and fecal calcium output) was evaluated. Serum calcium concentrations and biomarkers of bone metabolism were measured, in order to evaluate bone turnover. Additionally, the response to an acute oral calcium load was examined as a sensitive measure of changes in calcium metabolism. Both urinary calcium excretion and fecal calcium losses were significantly reduced in the higher (1.2 percent) CO2 atmosphere. Serum calcium concentrations and biomarkers of bone formation were significantly lower in the higher CO2 campaign. Furthermore, bone resorption was slightly increased in the 1.2 percent experiment. Elevated CO2 atmosphere may dose-dependently preserve body calcium without a parallel improvement of bone substance.

Author (AIAA)

International Space Station; Human Performance; Calcium Metabolism; Carbon Dioxide Concentration; NASA Space Programs; European Space Programs

19980050693

1998 abstracts of AsMA scientific sessions

Aviation, Space, and Environmental Medicine; Mar. 1998; ISSN 0095-6562; Volume 69, no. 3, pp. 199-266; In English; Copyright; Avail: Aeroplus Dispatch

Peer-reviewed abstracts are presented from papers given at the 1998 Annual Scientific Meeting of the Aerospace Medical Association. The presentations of the original papers were variously of slide, poster, or panel session type.

AIAA

Aerospace Medicine; Abstracts; Medical Science; Papers

19980051265

A parallelism between human body temperature and performance independent of the endogenous circadian pacemaker

Monk, Timothy H., Pittsburgh, Univ., USA; Carrier, Julie, Pittsburgh, Univ., USA; Journal of Biological Rhythms; Apr. 1998; ISSN 0748-7304; Volume 13, no. 2, pp. 113-122; In English

Contract(s)/Grant(s): NAS9-18404; NAS9-19407; Copyright; Avail: Aeroplus Dispatch

A battery of performance tests involving manual dexterity serial search and verbal reasoning was given about seven times per day to two healthy young male subjects involved in separate forced desynchrony studies, each involving several months of temporal isolation. In these studies, the period lengths (denoted T) of the imposed day lengths (sleep/wake and light/dark cycles) were 25.8 and 26.0 h for the two subjects. For each subject, the endogenous circadian pacemaker (ECP) failed to entrain to a period of T and instead free-ran at a period length denoted tau (24.2 and 24.5 h). by educing performance rhythms (and rectal temperature rhythms) separately at tau and at T (after three complete beating cycles for the first subject and two complete beating cycles for the second subject), the hypothesis could be tested as to whether performance and temperature were parallel, both when educed at tau (indicating ECP influence) and when educed at T (indicating sleep/wake cycle influences). The hypothesis was consistently confirmed at tau and mostly confirmed at T. For most variables, when educed at T, both performance speed and body temperature showed an inverted V-shaped function, with a peak about 9 to 12 h after waking.

Author (AIAA)

Human Body; Body Temperature; Circadian Rhythms; Sleep; Work-Rest Cycle

19980051375 Army Research Inst. of Environmental Medicine, Natick, MA USA

Thermoregulation, Chapter 12

Wenger, C. B., Army Research Inst. of Environmental Medicine, USA; Oct. 1997; 31p; In English

Report No.(s): AD-A330791; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Lying at the boundary between the body and the thermal environment, the skin is strategically placed for an important role in thermoregulation, and serves both as a source of thermal information and as an effector organ for controlling heat loss from the body. Living tissue is directly injured if it is heated to temperatures higher than about 45 C , the level at which heating the skin causes pain, or if it is cooled so that ice crystals form in the cells. Because of its exposed location the skin is particularly vulnerable to injury by extremes of temperature in the immediate environment; and, in addition to its thermoregulatory responses, local vasodilator responses are elicited when tissue temperature rises toward 40 deg C or falls toward 10 deg C, which help to protect the skin against extremes of temperature.
DTIC
Temperature Control; Thermoregulation; Skin (Anatomy); Thermodynamic Properties

19980052545
Circadian parameters as individual characteristics
Aschoff, Juergen, Max-Planck-Inst. fuer Verhaltenphysiologie, Germany; Journal of Biological Rhythms; Apr. 1998; ISSN 0748-7304; Volume 13, no. 2, pp. 123-131; In English; Copyright; Avail: Aeroplus Dispatch

Human circadian rhythms that are free running in temporal isolation can show an extreme variability of the sleep-wake cycle without the subject being aware of it. This is due mainly to a systematic adjustment of certain circadian time structures to the varying length of the 'day': the perception of long time intervals in the range of 1 h and the intervals between meals have a strong positive correlation with the duration of wake time alpha, in contrast to the amount of hourly locomotor activity that is negatively correlated with alpha. So far, the dependence of locomotor activity, of the '1-h' intervals, and of the intermeal intervals on alpha is well documented for the data sets of single subjects. The present article demonstrates that the correlations found intraindividually also apply if data from several subjects are compared. If plotted as a function of the mean individual or, the individual means of '1-h' intervals and of the intermeal intervals show the same positive correlation and the means of locomotor activity show the same negative correlation with alpha as known from single individuals. It is to be concluded that each individual has its characteristic place on the regression lines that describe the dependence of the three circadian parameters on the duration of wake time.
Author (AIAA)
Human Performance; Circadian Rhythms; Sleep; Work-Rest Cycle; Diurnal Variations; Physiological Tests

19980052988
Plasma protective effect on red blood cells exposed to mechanical stress
Kameneva, Marina V., Univ. of Pittsburgh Sch. of Medicine, USA; Antaki, James F.; Yeleswarapu, Krishna K.; Watach, Mary J.; Griffith, Bartley P.; Borovetz, Harvey S.; ASAIO Journal; Sep-Oct, 1997; ISSN 1058-2916; Volume 43, no. 5, pp. M571-M575; In English; Copyright; Avail: Issuing Activity

The effect of partial and total replacement of plasma on susceptibility of human and bovine red blood cells (RBC) to mechanical stress in vitro is investigated. Hemolysis was measured after the exposure of RBCs suspended in different media to similar mechanical stress. Results suggest that a decrease in the concentration of plasma proteins due to hemodilution may elevate blood damage during extracorporeal circulation and hemodialysis.
EI
Plasmas (Physics); Blood; Stresses; Hemodynamics; Dialysis; Hemoglobin

19980055716
A test plan for the investigation of human thermoregulation in a microgravity environment
Boregowda, S. C., Old Dominion Univ., USA; Tiwari, S. N., Old Dominion Univ., USA; Jan. 1998; In English
Contract(s)/Grant(s): NCC1-254
Report No.(s): AIAA Paper 98-0460; Copyright; Avail: Aeroplus Dispatch

This study constitutes a proposal to investigate human thermoregulation during cognitive tasks in a microgravity environment based on numerical simulations. The simulations are performed using a transient, 3D human thermal model that is being utilized as a 'computational environmental chamber'. This model includes the effects of tissue conduction, convection by blood flow, vascular heat exchange, tissue metabolism, heat transfer due to respiration, and clothing. The model is validated with the experimental data, and an extensive parametric study is conducted. The effects of varying environmental and activity conditions, such as air temperature, relative humidity, metabolism, and clothing on human thermal responses, such as core and skin temperatures, latent skin heat loss, and blood vessel radii, are examined. The study is expected to provide a deeper insight to understand the nature

of peripheral vascular diseases such as Raynaud's syndrome and diabetic neuropathy. These diseases are characterized by impaired blood flow and heat transfer to the peripheral parts of the body.
Author (AIAA)
Microgravity; Human Body; Thermoregulation; Cognition; Digital Simulation

19980056041
Evaluation of effective thermal conductivity in human peripheral tissue regions
Boregowda, S. C., Old Dominion Univ., USA; Tiwari, S. N., Old Dominion Univ., USA; Morris, J. D., Yale Univ., USA; Jan. 1998; In English
Contract(s)/Grant(s): NAG1-363; NCC1-254
Report No.(s): AIAA Paper 98-0840; Copyright; Avail: Aeroplus Dispatch

Several theoretical and experimental investigators have recognized that one of the elements of control available to the human body in the maintenance of a homeothermic state is its ability to vary the resistance of its subcutaneous regions to the transfer of heat. The model presented here includes the effects of tissue conduction, convection by blood flow, vascular heat exchange, and tissue metabolism. These effects are considered simultaneously so that some quantitative insight into the interactions among these effects can be obtained, and their relative importance under various conditions can be assessed. The emphasis in this study is on the elucidation of the important parametric groups governing the various modes of heat transfer. The effective thermal conductivity of the nonisothermal subcutaneous tissue region is determined under various flow conditions. Also, the effect of arterial-venous heat exchange and perfusion rate on variation of the effective thermal conductivity is demonstrated.
Author (AIAA)
Tissues (Biology); Human Body; Thermal Conductivity; Heat Transfer; Body Temperature; Blood Flow

19980058092
Visual influence on the magnitude of somatogravic illusion evoked on advanced spatial disorientation demonstrator
Tokumaru, Osamu, National Defense Medical College, Japan; Kaida, Kenichi, National Defense Medical College, Japan; Ashida, Hiroshi, National Defense Medical College, Japan; Mizumoto, Chieko, National Defense Medical College, Japan; Tatsuno, Jiro, National Defense Medical College, Japan; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 111-116; In English; Copyright; Avail: Aeroplus Dispatch

The somatogravic illusion (SGI) is a kind of spatial disorientation caused by a linear sustained acceleration. Pilots believe that visual cues, such as a visible horizon or texture flow, reduce this illusion. This study was performed to evaluate the influence of visual stimuli on the SGI using the Advanced Spatial Disorientation Demonstrator (ASDD). There were eight healthy males who were exposed to a 0.58 g x-axis linear acceleration on the ASDD, where the direction of the resultant gravitoinertial force was equivalent to 30-deg pitch-up. One of the following visual stimuli was presented during each acceleration: BLANK (no visual cues); HORIZON (a visible horizon without motion); and TEXTURE (vertical lines moving toward the subject evoking vection). The subjective magnitude of the SGI in ordinal scale was observed; and in interval scale, the deviation of the moving point kept at the subjective horizon was observed. The differences among visual stimuli were analyzed. The subjective magnitude of the SGI and the deviation of the moving point were significantly smaller in HORIZON than in BLANK and TEXTURE. No difference was demonstrated between BLANK and TEXTURE. The linear vection produced by the TEXTURE stimulus did not affect the SGI. The presence of a visible horizon reduced the magnitude of the SGI; on the other hand, the presence of a vection stimulus did not influence the magnitude of the SGI.
Author (AIAA)
Space Orientation; Disorientation; Evoked Response (Psychophysiology); Illusions

19980058094
Oculomotor response to linear acceleration as induced by counter-rotation in supine subjects
Cheung, Bob, Civil Inst. of Environmental Medicine, Canada; Money, Ken, Civil Inst. of Environmental Medicine, Canada; Eizenman, Moshe, Toronto, Univ., Canada; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 121-128; In English; Copyright; Avail: Aeroplus Dispatch

Horizontal nystagmus occurs in response to sinusoidal linear accelerations directed along an upright subject's Y (interaural) axis, and is proposed to be mediated by an utricular otolith mechanism. The otolith organs, composed of the utricles and saccules, provide a unique set of signals for any linear acceleration in 3D space. A supine subject under alternate changing directions of linear acceleration as induced by counter-rotation will receive alternate stimulation along the Y as well as the Z (dorsoventral) axis. We hypothesized that alternate horizontal and vertical nystagmus would be elicited as a result of the changing direction of linear acceleration. A group of eight subjects in the supine position were exposed to counterrotation at 0.16, 0.25, and 0.33 Hz.

Vertical and horizontal eye movements were recorded simultaneously using the El-Mar eye and head tracking system. Horizontal nystagmus was observed in all supine subjects. The direction of the slow phase of nystagmus changed with directional changes in linear acceleration. Reversals in the direction of eye movements lagged behind the reversals in the direction of the acceleration. We propose that the nystagmus induced in the supine subject was provoked by linear acceleration and largely an otolith-mediated reflex. The lack of vertical response could be due to the relative paucity of vestibular afferents information along the dorsoventral axis.
Author (AIAA)
Counter Rotation; Supine Position; Physiological Responses; Oculomotor Nerves; High Gravity Environments

19980058095
Activation of coagulation in decompression illness
Boussuges, A., Hopital Salvator, France; Succo, E., Hopital Salvator, France; Juhan-Vague, I., Hopital Salvator, France; Sainty, J. M., Hopital Salvator, France; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 129-132; In English; Copyright; Avail: Aeroplus Dispatch

In animal studies, many authors have observed coagulation activation in decompression illness (DCI). These hemostasis modifications have been attributed to circulating bubbles. We have studied molecular hemostasis markers in 25 consecutive divers, victims of DCI admitted to our hyperbaric center, and in 15 control divers. There was no significant difference in parameters studied in the patients and the control group (platelet, fibrinogen, antithrombin III, Thrombin Antithrombin III complexes, and D-Dimers). An activation of coagulation was noted in three divers with neurologic troubles. However, such signs of coagulation activation were not correlated with the risk of sequeals. No control or study patient with an osteoarticular or vestibular accident presented signs of coagulation activation. Thus, there does not seem to be a correlation between the severity of the accident and the level of coagulation activation.
Author (AIAA)
Decompression Sickness; Coagulation; Hyperbaric Chambers; Bubbles

19980058096
The effect of microgravity on testicular androgen secretion
Strollo, Felice, Italian National Research Centers on Aging, Italy; Riondino, Giuseppe, Italian National Research Centers on Aging, Italy; Harris, Bernard, NASA Johnson Space Center, USA; Strollo, Giovanna, Italian National Research Centers on Aging, Italy; Casarosa, Elena, Italian National Research Centers on Aging, Italy; Mangrosa, Novella, Italian National Research Centers on Aging, Italy; Ferretti, Cinzia, Pisa, Univ., Italy; Luisi, Michele, Pisa, Univ., Italy; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 133-136; In English; Copyright; Avail: Aeroplus Dispatch

Pituitary gonadotrophins (mainly LH) and testicular androgens, like testosterone (T), should decrease inflight in male astronauts. We therefore hypothesized that lowered testicular androgen levels might occur in men during spaceflight, due to stress-dependent lowered LH concentrations. In order to test this hypothesis, on different days pre-, in- and postflight, we assayed wake-time salivary and urinary T in four astronauts, as well as wake-time plasma levels of adrenocorticotropin (ACTH), cortisol (CS), LH, T and its peripherally active metabolite 3-alpha-diol glucuronide (3ADG). In order to compare clinical to subjective data, all seven male crewmembers anonymously answered a daily questionnaire from pre- to postflight asking them to self-rate sexual drive and potency, muscle strength and mood. Salivary, urinary and plasma T, as well as 3ADG, decreased during flight, while LH unexpectedly increased inflight. A parallel decrease in sexual drive was observed. A dramatic recovery of salivary T was found on R+1. This was the first time that spaceflight was demonstrated to cause temporary, still dramatic hypoandrogenism which was not due to blunted pituitary gonadotrophin secretion. The cause for hypoandrogenism is unknown but it may depend on fluid shift affecting testicular function or androgen distribution in various body compartments.
Author (AIAA)
Microgravity; Manned Space Flight; Testes; Physiological Responses; Space Flight Stress; Hormones

19980058097
Body temperature and thermoregulation during submaximal exercise after 115-day spaceflight
Fortney, Suzane, NASA Johnson Space Center, USA; Mikhaylov, Valeriy, Space Biomedical Research Inst., Russia; Lee, Stuart M. C., Krug Life Sciences, Inc., USA; Kobzev, Yevgheny, Gagarin Cosmonaut Training Center, Russia; Gonzalez, Richard R., U.S. Army, Research Inst. of Environmental Medicine, USA; Greenleaf, John E., NASA Ames Research Center, USA; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 137-141; In English; Copyright; Avail: Aeroplus Dispatch

Altered thermoregulation has been reported following spaceflight simulations (bed rest and water immersion) but has never been examined after actual spaceflight. We tested the null hypothesis that body temperatures and heat loss responses during exercise would be similar before and after spaceflight. Two male crewmembers of the 115-d Mir 18 mission performed supine submaximal cycle exercise once at 145-146 d preflight and once at 5 d postflight (R + 5). After flight, neither crewmember could complete the exercise protocol, stopping after 28-29 min. The core temperature at test termination was similar pre- and postflight despite shorter postflight test duration. The slopes of the skin blood flow, and the sweating rate, were both reduced postflight without appreciable change in the core temperature thresholds for sweating or skin blood flow. In this preliminary report for two crewmembers, the sensitivity of the heat loss responses were reduced after long-duration spaceflight, resulting in a faster rate of rise in core temperature.
Author (AIAA)
Human Body; Body Temperature; Thermoregulation; Physical Exercise; Manned Space Flight; Long Duration Space Flight

19980058098
Risk of cancer mortality among the Longitudinal Study of Astronaut Health (LSAH) participants
Hamm, Peggy B., Krug Life Sciences, Inc., USA; Billica, Roger D., NASA Johnson Space Center, USA; Johnson, Gaylen S., NASA Johnson Space Center, USA; Wear, Mary L., NASA Johnson Space Center, USA; Pool, Sam L., NASA Johnson Space Center, USA; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 142-144; In English; Copyright; Avail: Aeroplus Dispatch

The potential for occupational radiation exposures in the U.S. Space Program makes cancer risk a major health concern. The NASA Medical Operations Branch and KRUG Life Sciences Epidemiology Section at the Johnson Space Center (JSC) investigated the rate of cancer mortality among the astronauts and the comparison participants of the LSAH. Cause of death data from death certificates were reviewed for cancer mortality. These data were compared with cancer mortality data for the general population residing in the Texas Gulf Coast area. The astronauts had a higher age-specific risk of cancer mortality than the comparison group, but the difference did not reach statistical significance. Both the astronauts and the comparison group had lower age-specific rates than the general population.
Author (AIAA)
Astronaut Performance; Cancer; Mortality; Physiological Tests

19980058100
Effect of 100 percent oxygen on EKG changes and serum myoglobin in fighter pilots
Comens, Phillip, 131st Tactical Hospital, USA; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 149-153; In English; Copyright; Avail: Aeroplus Dispatch

The author previously reported in-flight EKG changes, Pa2, and blood chemistries in F-4 pilots during surface attack training (SAT) and aerial combat maneuvers (ACM) while breathing ambient air. Myoglobin levels were also measured to determine if rhabdomyolysis occurred during positive +Gz force expenditure. Instead of rising, serum myoglobins dropped sharply during 45 min missions. EKGs revealed marked ischemic and arrhythmia changes. This study further evaluates these changes. There were 22 EKG in-flight recordings made on 20 aircrew members breathing 100 percent oxygen during SAT and ACM and compared with previously reported results with pilots using ambient air. In six of those pilots using 100 percent oxygen, serum myoglobin, ACTH, and cortisol levels were determined before and after each mission and also compared with previously reported results obtained on ambient air. of the six aircrew in the blood study, three flew similar missions the following day on ambient air as a control, with a significant decrease in serum myoglobin after each mission. While sinus arrhythmia and tachycardias persisted on 100 percent oxygen, ischemic changes were absent. ACTH and cortisol levels increased similarly in both studies consistent with a stress response. Serum myoglobins remained unchanged on 100 percent oxygen, unlike the marked decrease noted on ambient air.
Author (AIAA)
Aircraft Pilots; Serums; Oxygen; Myoglobin; Electrocardiography

19980058101
Venous thromboembolism associated with air travel - A report of 33 patients
Mercer, Alicia, Hawaii, Univ., Honolulu, USA; Brown, Joel D., Hawaii, Univ., Honolulu; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 154-157; In English; Copyright; Avail: Aeroplus Dispatch

Air travel, may be a risk factor for venous thromboembolism, but the risk is poorly quantified. We reviewed 134 records of patients hospitalized with venous thromboembolism for comments regarding recent travel. Patients who had traveled within 31 d prior to venous thromboembolism were defined as recent travelers. of 134 patient records, 49 percent had documented inquiries

regarding travel and 50 percent were recent air travelers. Data regarding demographics, mode of travel, day of onset of symptoms in relation to travel, and other risk factors for venous thromboembolism were abstracted from the records of the recent travelers. There were 36 percent travelers who had no other predisposition for venous thromboembolism. All had traveled nonstop by aircraft for four or more hours; none was identified as a crewmember. The median day of onset of venous thromboembolism was on travel day four (range: day 1-31). There were 24 percent patients who had onset during air travel or on the day of arrival, and 82 percent had onset by travel day 15. Air travel for four or more hours within the preceding 31 d was the most common risk factor for venous thromboembolism in our study patients and was present in 50 percent. This incidence is much higher than previously described, perhaps due to limiting the study population to those in which travel was documented.
Author (AIAA)
Air Navigation; Veins; Thrombosis; Civil Aviation; Flight Crews

19980058102
Primary idiopathic optic neuritis in U.S. Air Force aviators
Ivan, Douglas J., Aerospace Consultation Service, USA; Tredici, Thomas J., Aerospace Consultation Service, USA; Burroughs, John R., USAF, USA; Pasquale, August, USAF, USA; Hickman, James R., Jr., USAF, USA; Cuervo, Herminio, USAF, USA; Gooch, John, USAF, USA; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 158-165; In English; Copyright; Avail: Aeroplus Dispatch

The records of 31 male aviators seen at the Ophthalmology Branch of the USAF Aeromedical Consultation Service for a diagnosis of primary idiopathic optic neuritis (PION) were reviewed. Each subject received comprehensive ophthalmologic and neurologic examinations. The long-term follow-up data were collected through repeat examinations and by survey. Despite 39 percent of aviators being grounded due to complications of their PION or multiple sclerosis (MS), many aviators diagnosed with PION may be safely returned to flying duties. However, any aviator diagnosed with PION has a risk of recurrence or a potential to develop systemic MS and must be carefully reevaluated and followed to ensure they remain a viable asset and do not compromise flight safety or mission completion.
Author (AIAA)
Neuritis; Aircraft Pilots; Visual Acuity

19980058103
Central effects of the H1-antihistamine, cetirizine
Nicholson, Anthony N., RAF, School of Aviation Medicine, UK; Turner, Claire, Defense Evaluation Research Agency, UK; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 166-171; In English; Copyright; Avail: Aeroplus Dispatch

Effects of the H1-antihistamine, cetirizine, were studied on daytime alertness and performance to establish whether the drug would be suitable for use by air personnel. The investigation was carried out in six healthy volunteers, and the effects of the drug (5, 10, and 15 mg) were studied on sleep latency, subjective sleepiness, digit symbol substitution, tracking and vigilance from 0.5 h to 7.5 h after ingestion. The study was placebo-controlled and double-blind, with a six-way cross-over design. Promethazine (10 mg) was used as an active control to establish the sensitivity of the experimental procedures. Promethazine (10 mg) decreased the mean level of vigilance over the day, increased objective and subjective sleepiness from 1.5 to 5.5 h, and impaired tracking 5.5 h after ingestion. Cetirizine (10 and 15 mg) led to shortened sleep latencies over the day, and at 7.5 h sleep latencies were shorter with 10 mg cetirizine than with placebo. Subjective sleepiness with cetirizine was increased compared with placebo after 5 mg at 1.5 h, 10 mg at 7.5 h, and 15 mg at 5.5 h and when meaned over the day. Tracking was impaired with 5 and 15 mg cetirizine 0.5 h after ingestion. Dose-response effects of cetirizine are not clear, but it is evident that cetirizine is not free of central activity over the therapeutic range; use by air personnel is not recommended.
Author (AIAA)
Antihistaminics; Sleep; Physiological Tests; Drugs; Physiological Responses

19980058104
Immunosuppression during spaceflight deconditioning
Levine, D. S., NASA Ames Research Center, USA; Greenleaf, J. E., NASA Ames Research Center, USA; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 172-177; In English; Copyright; Avail: Aeroplus Dispatch

Spaceflight results in immunosuppression which is likely due mainly to neurohumoral factors released in response to intermittent stress effects during flight. However, no major nonphysiological health problems have been reported during or following spaceflight, but diseases resulting from immunosuppression could occur on long-duration missions and would include bacterial,

fungal, and viral infections in addition to increased incidence of neoplasia and autoimmunity. Pharmacokinetics and pharmacodynamics appear to be altered during spaceflight and, as a consequence, alternative drug administration and dosing procedures will need to be developed. Moderate exercise training enhances immune function, but in-flight exercise may affect immunological parameters and immunity in ways not yet ascertained. Hyperosmolality may enhance some immune parameters, and attenuate others especially when associated with dehydration and exercise. Reducing in-flight stress may attenuate flight-induced immunosuppression, but pharmacological interventions may be essential to prevent undesirable immune responses which may occur on long-duration missions to Mars.
Author (AIAA)
Manned Space Flight; Immune Systems; Deconditioning; Physical Exercise; Microgravity

19980058177

Analysis of heart rate variability and its application

Yan, Xiaoxia, Inst. of Space Medico-Engineering, China; Zhang, Fusheng, Inst. of Space Medico-Engineering, China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 318-322; In English; Copyright; Avail: Aeroplus Dispatch

Heart rate variability (HRV) has considerable potential in assessing the role of autonomic nervous system fluctuations in healthy individuals and patients. This paper reviews the analytical methods of HRV and their application. HRV is a useful parameter for predicting cardiac risk after acute myocardial infarction and is an early warning sign of diabetic neuropathology in clinical medicine. In space medical studies, HRV analysis has been used to assess changes in autonomic regulation after weightlessness or simulated weightlessness, to evaluate tolerance in various stress tests, to study the regulatory mechanisms of the cardiovascular system, and to assess the effect of countermeasures against weightlessness.
Author (AIAA)
Heart Rate; Autonomic Nervous System; Variability; Bioastronautics; Clinical Medicine

19980058179

Effects of low concentration carbon monoxide on human physiological function

Yu, Bingliang, Inst. of Space Medico-Engineering, China; Zhang, Hengtai, Inst. of Space Medico-Engineering, China; Mou, Xiaofei, Inst. of Space Medico-Engineering, China; Yu, Fang, Inst. of Space Medico-Engineering, China; Zhong, Hao, Inst. of Space Medico-Engineering, China; He, Zhengjie, Inst. of Space Medico-Engineering, China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 328-332; In Chinese; Copyright; Avail: Aeroplus Dispatch

Human volunteers were exposed to various low concentrations of carbon monoxide (CO) in a closed cabin. The results showed that 35 mg/cu m of CO caused slight subjective symptoms, a reduction in visual contrast, operating efficiency, and ECG T-wave. At 80 and 115 mg/cu m the above changes were more severe, and a rise in hearing threshold level was observed. This demonstrated that an inhibitory effect on the CNS and heart were caused by low concentrations of CO. According to the absorption curves for humans exposed to CO, it is suggested that the sensory effect level and vision effect level for CO are 7 percent COHb, and the hearing effect level is 9 percent COHb.
Author (AIAA)
Carbon Monoxide Poisoning; Physiological Responses; Human Reactions; Toxicity; Visual Acuity; Hearing

19980058181

EGG and nausea under vestibular stimulus

Tian, Guanqiang, Chinese Air Force, China; Yu, Yaorong, Chinese Air Force, China; Liu, Zhiqiang, Chinese Air Force, China; Bai, Gang, Chinese Air Force, China; Hu, Suwei, Chinese Air Force, China; Gu, Ying, Chinese Air Force, China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 337-339; In Chinese; Copyright; Avail: Aeroplus Dispatch

Eighty-one pilots were exposed to vestibular stimulus with Coriolis acceleration. They were divided into two groups: the first group consisted of 38 pilots with nausea symptoms; the second group consisted of 43 pilots without any nausea symptoms. The dominant frequency instability coefficient (DFIC), dominant power instability coefficient (DPIC), tachygastria, bradygastria, and normal slow wave (NSW) components of the electrogastrogram (EGG) were analyzed. The results showed that the bradygastria and the NSW components of the EGG were related to the nausea symptoms of the pilots under Coriolis stimulation.
Author (AIAA)
Electrophysiology; Vestibular Tests; Nausea; Gastrointestinal System; Coriolis Effect; Motion Sickness; Aircraft Pilots

19980058182

Human tolerance to landing impact (+Gz) in sitting position

Cheng, Zilong, Inst. of Space Medico-Engineering, China; Han, Yanfang, Inst. of Space Medico-Engineering, China; Zeng, Wenyi, Inst. of Space Medico-Engineering, China; Wang, Yulan, Inst. of Space Medico-Engineering, China; Fan, Jinglian, Inst. of Space Medico-Engineering, China; Jiang, Juncheng, Inst. of Space Medico-Engineering, China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 340-343; In Chinese; Copyright; Avail: Aeroplus Dispatch

This study showed that selected macaca mulatta can be used as substitutes for humans in studying landing impact tolerance. Based on the data of the experiments, the revisional coefficient from macaca mulatta to humans was calculated, and curves of human tolerance to landing impact in the sitting position are given. Tolerance limits for different injury levels such as safe, slight injury, medium injury, and serious injury are also given in this paper. The results might be useful for setting standards of human tolerance to landing impact in the sitting position.
Author (AIAA)

Human Tolerances; Sitting Position; Landing Loads; Impact Tolerances

19980058183

Approximate entropy analysis of changes in heart rate dynamics associated with aerobic training

Zhang, Zhiyuan, 4th Military Medical Univ., China; Zhang, Lifan, 4th Military Medical Univ., China; Wang, Shouyan, 4th Military Medical Univ., China; Zheng, Jun, 4th Military Medical Univ., China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 344-348; In Chinese; Copyright; Avail: Aeroplus Dispatch

To elucidate the effects of aerobic training on heart rate dynamics, the heart rate variability (HRV) of eight students before and after a six-month aerobic training and the HRV of six athletes were analyzed with conventional time and frequency domain methods as well as with approximate entropy (ApEn). The results showed that after six months of aerobic training, heart rate ApEn significantly decreased (P less than 0.01, P less than 0.05) during both supine control and -6.67 kPa/30 min lower body negative pressure (LBNP). The heart rate ApEn of the athletes during supine control and early stage of LBNP testing was significantly lower (P less than 0.01, P less than 0.05) than that of the students before training. It was found that the values of ApEn were negatively correlated with the duration of LBNP in the student group (P less than 0.01). Howerer, both the time and frequency domain analyses were unable to detect the aforementioned changes. The results suggest that aerobic training can decrease the complexity of heart rate dynamics, and the synchronization in heart rate control during LBNP is probably a sustained process.
Author (AIAA)

Entropy; Heart Rate; Exercise Physiology; Physical Exercise; Lower Body Negative Pressure; Hemodynamic Responses

19980058184

Sphygmographic parameters in fighter and transport pilots

Gai, Yuqing, Inst. of Space Medico-Engineering, China; Tian, Guangqing, Inst. of Space Medico-Engineering, China; Yu, Yaorong, Inst. of Space Medico-Engineering, China; Zhao, Yuanhuai, Inst. of Space Medico-Engineering, China; Liang, Bo, Inst. of Space Medico-Engineering, China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 349-352; In Chinese; Copyright; Avail: Aeroplus Dispatch

To evaluate and discover hidden cardiovascular trouble in pilots, the cardiovascular function of 129 active male pilots was examined with a new sphygmographic method. Thirteen (10.3 percent) of the pilots were found to have abnormal cardiovascular function. The average arterial blood pressure and medium artery modulus of the fighter pilots aged from 30 to 34 years were inferior to those aged from 25 to 29, obviously; however, this was not the case in transport pilots. This indicates that frequent examination of cardiovascular function with this convenient special method is necessary for the improvement of the medical quality monitoring of pilots.
Author (AIAA)

Sphygmography; Fighter Aircraft; Transport Aircraft; Aircraft Pilots; Flight Fitness; Cardiovascular System

19980058188

Changes of microcirculation in nasal mucosa during -15-deg head-down tilt

Shen, Xianyun, Inst. of Space Medico-Engineering, China; Zhang, Xinying, Inst. of Space Medico-Engineering, China; Chen, Jianhe, Inst. of Space Medico-Engineering, China; Meng, Jingrui, Inst. of Space Medico-Engineering, China; Xiang, Qiulu, Inst. of Space Medico-Engineering, China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 367-369; In Chinese; Copyright; Avail: Aeroplus Dispatch

Changes of microcirculation in nasal mucosa in 19 young men during 2.5-h head-down -15-deg tilt (HDT) were observed with a laser Doppler flowmeter. The results showed that the change of microcirculation in nasal mucosa was significant; blood

volume, concentration, and flow velocity increased, and a distinct periodical wave of microvessels appeared during HDT. The results suggest that the change of microcirculation in nasal mucosa caused by fluid shift from the lower to the upper body is one of the important factors causing a stuffy nose and breathing with some difficulty.
Author (AIAA)
Mucus; Blood Circulation; Nose (Anatomy); Head Down Tilt; Weightlessness Simulation; Bioastronautics

19980058363
Managing operational fatigue
Rosekind, Mark, NASA Ames Research Center, USA; Neri, David, NASA Ames Research Center, USA; Dinges, David, Pennsylvania, Univ., Philadelphia; Aerospace International; Jan. 1998; ISSN 0305-0831; Volume 25, no. 1, pp. 28-33. Abridged; In English; Copyright; Avail: Aeroplus Dispatch

The problem of fatigue in the aviation industry is examined in the context of the safety of aviation operations. The discussion focuses on human sleep requirements, Circadian rhythms, fatigue contribution to accidents, and the use of scientific data in operational policies. The need for integrated and comprehensive programs that utilize the available scientific research and a multicomponent approach to managing alertness and enhancing the performance capability on the job is emphasized.
AIAA
Aircraft Accidents; Fatigue (Biology); Sleep; Aircraft Pilots; Alertness; Circadian Rhythms

19980063062
Wake-sleep cycles *Les cycles veille-sommeil*
Billiard, Michel, Montpellier I, Univ., France; Nouvelle Revue d'Aeronautique et d'Astronautique; Dec. 1997; ISSN 1247-5793, no. 6, pp. 35-39; In French; Copyright; Avail: Aeroplus Dispatch

Symptoms associated with jet lag are examined. Jet lag is found to be associated with two main factors: external desynchronization and internal dissociation. Possible treatments are reviewed, including hypnosis, melatonin, and phototherapy.
AIAA
Work-Rest Cycle; Jet Lag

19980064321
Long-term consequences of irradiation on the concentration of macro- and microelements in human blood serum during clean-up of the Chernobyl accident *Otdalennye posledstviya dejstviya oblucheniya pri likvidatsii posledstvij Chernobyl'skoj katastrofy na kontsentratsiyu makro- i mikroehlementov v syvorotke krovi cheloveka*
Protasova, O. V., RAN, Inst. Khimicheskoj Fiziki, Russia; Konradov, A. A., RAN, Inst. Khimicheskoj Fiziki, Russia; Maksimova, I. A., RAN, Otdelenie Fiziologii, Russia; Klimenko, L. L., RAN, Otdelenie Fiziologii, Russia; Turna, A. A., RAN, Otdelenie Fiziologii, Russia; Rossijskaya Akademiya Nauk, Izvestiya, Seriya Biologicheskaya; Oct. 1997; ISSN 0002-3329, no. 5, pp. 592-595; In Russian; Copyright; Avail: Aeroplus Dispatch

The content of Cu, Fe, Zn, Mg, P, and S in the blood serum and its ultrafiltrate was studied by inductively coupled argon plasma atomic emission spectrometry in the clean-up crews of the accident at the Chernobyl Nuclear Power Station who worked at the accident site in 1986-1987. Changes in the mineral equilibrium of the blood serum was expressed in elevated concentrations of the ultrafiltered Cu and S, increased Mg content in the serum, and decreased content of ultrafiltered Zn. The Fe concentration in the serum and ultrafiltrate did not differ from the control indices, thus suggesting balanced Fe transport, accumulation, and mobilization in the long term.
Author (AIAA)
Human Performance; Blood Plasma; Nuclear Radiation; Nuclear Reactors; Radiation Dosage; Radiation Sickness

19980064641
VeriFax - Biometric instruments measuring neuromuscular disorders/performance impairments
Morgenthaler, George W., BioServe Space Technologies, USA; Shrairman, Ruth, VeriFax Corp., USA; Landau, Alexander, VeriFax Corp., USA; 1998, pp. 736-742; In English; Copyright; Avail: Aeroplus Dispatch

VeriFax began operations with the aim of developing a biometric tool for the verification of signatures from a distance. In the course of developing this VeriFax Autograph technology, two other related applications for the technologies under development at VeriFax became apparent. The first application was in the use of biometric measurements as clinical monitoring tools for physicians investigating neuromuscular diseases (embodied in VeriFax's Neuroskill technology). The second application was to evaluate persons with critical skills (e.g., airline pilots, bus drivers) for physical and mental performance impairments caused by stress, physiological disorders, alcohol, drug abuse, etc. (represented by VeriFax's Impairoscope prototype instrument). This last

application raised the possibility of using a space-qualified Impairoscope variant to evaluate astronaut performance with respect to the impacts of stress, fatigue, excessive workload, build-up of toxic chemicals within the space habitat, etc. The three applications of VeriFax's patented technology are accomplished by application-specific modifications of the customized VeriFax software. Strong commercial market potentials exist for all three VeriFax technology applications, and market progress is presented here in detail.
Author (AIAA)
Neuromuscular Transmission; Medical Science

19980066808
An in-flight investigation of the efficacy of dextroamphetamine for sustaining helicopter pilot performance
Caldwell, John A., Jr., U.S. Army, Aeromedical Research Lab., USA; Caldwell, J. Lynn, U.S. Army, Aeromedical Research Lab., USA; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1073-1080; In English; Copyright; Avail: Aeroplus Dispatch

A promising countermeasure for fatigue in sustained aviation operations is stimulant administration. However, well-controlled, aviation-relevant studies of the efficacy of medications such as Dexedrine are virtually nonexistent. In this investigation, flight performance, mood, and alertness were evaluated in 10 UH-60 pilots during sleep deprivation periods under Dexedrine or placebo. Relative to placebo, Dexedrine improved flight performance during straight-and-levels, climbs, descents, right turns, and a left-descending turn, with tendencies toward better performance during the left turns and the instrument landing system approach. Dexedrine markedly reduced subjective feelings of fatigue, confusion, and depression while increasing feelings of vigor. Central nervous system arousal was enhanced by Dexedrine relative to placebo. No significant side effects occurred, although Dexedrine was associated with mild asymptomatic increases in heart rate and BP. Thus, Dexedrine appears effective for the short-term sustainment of aviator performance during sustained operations. However, future work should investigate the efficacy of stimulants for longer-term use (more than 40 h of continuous wakefulness).
Author (AIAA)
Helicopter Control; Pilot Performance; Fatigue (Biology); In-Flight Monitoring; Stimulants; Sleep Deprivation

19980066812
Cardiovascular effects of a sustained -Gz force in the horizontal position
Cardus, David, Baylor College of Medicine, USA; McTaggart, Wesley G., Baylor College of Medicine, USA; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1099-1103; In English
Contract(s)/Grant(s): NAGW-1961; Copyright; Avail: Aeroplus Dispatch

We study the effect of a sustained -Gz force applied in the horizontal position on the cardiovascular system and the distribution of body fluids of four men who were submitted to two protocols. In Protocol A the subjects remained supine, whereas in Protocol B the subjects were submitted to a small -Gz force (0.38 G) for a relatively prolonged period while remaining supine. The -Gz force was generated by a short arm centrifuge. The cardiovascular and fluid distribution responses were sampled approximately every 2 min during the whole duration of the experiment (205 min). The variables recorded were thoracic impedance (Tz), stroke volume (SV), heart rate (HR), first derivative of the thoracic impedance change, and systolic (SBP) and diastolic (DBP) arterial BPs. Changes in these variables within each protocol and across protocols were analyzed statistically by group comparisons. This showed that changing from the standing to the supine position causes an increase in SV and a decrease in HR and SBP and DBP. Adding a -Gz force produces the same qualitative effects but causes a greater increase in SV and a greater decrease in systolic and diastolic BPs, even though the -Gz force was only a fraction of 1 G. Changing position from vertical to horizontal position and the application of a -G force produce similar cardiovascular and body fluid effects but these effects are amplified by -Gz.
Author (AIAA)
Cardiovascular System; Body Fluids; Systolic Pressure; Supine Position; Gravitational Effects; Diastolic Pressure

19980066814
Sympatho-vagal responses in humans to thermoneutral head-out water immersion
Miwa, C., Nagoya Univ., Japan; Sugiyama, Y., Nagoya Univ., Japan; Mano, T., Nagoya Univ., Japan; Iwase, S., Nagoya Univ., Japan; Matsukawa, T., Nagoya Univ., Japan; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1109-1114; In English; Copyright; Avail: Aeroplus Dispatch

To clarify the role of autonomic nervous functions in cardiovascular adaptation to microgravity, heart rate variability (HRV) and blood pressure variability (BPV) were evaluated during thermoneutral head-out water immersion (HOI) of eight healthy young subjects 23 to 31 yr of age. The very low-frequency (VLF; 0.00-0.04 Hz) component of BPV tended to increase during HOI, whereas the low-frequency (LF; 0.040.15 Hz) component of BPV and the ratio of LF power to high-frequency (HF;

0.15-0.40 Hz) component (LF/HF ratio) of HRV decreased. The HF component of HRV increased in all the subjects during immersion up to the shoulder. Concomitantly, we found a decrease in heart rate and increases in stroke volume and cardiac output with no significant changes in BP and respiration rate during HOI. These results suggest that both vasomotor and cardiac sympathetic activities are suppressed and that the parasympathetic (vagal) activity is enhanced during HOI.
Author (AIAA)
Water Immersion; Physiological Responses; Human Reactions; Sympathetic Nervous System; Head (Anatomy); Microgravity

19980066816

High altitude effects on human taste intensity and hedonics

Singh, Shashi Bala, Defence Inst. of Physiology and Allied Science, India; Sharma, Alka, Defence Inst. of Physiology and Allied Science, India; Yadav, D. K., Defence Inst. of Physiology and Allied Science, India; Verma, S. S., Defence Inst. of Physiology and Allied Science, India; Srivastava, D. N., Defence Inst. of Physiology and Allied Science, India; Sharma, K. N., Defence Inst. of Physiology and Allied Science, India; Selvamurthy, W., Defence Inst. of Physiology and Allied Science, India; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1123-1128; In English; Copyright; Avail: Aeroplus Dispatch

The study was conducted on human volunteers taken to 3500 m altitude for a period of 3 wk. Subjects rated four compounds representing sweet, salty, sour and bitter taste, and the hedonic matrix in terms of taste threshold, taste intensity, and taste hedonicity were recorded using category scale. Blood sugar levels were estimated weekly. An increase in the taste thresholds for glucose and sodium chloride was shown while quinine sulphate and citric acid thresholds recorded a decrease. The taste intensity ratings showed a linear relationship with increasing logarithmic molar concentrations of each solution, as compared with taste hedonicity which showed an inverted 'U' type function. The blood picture did not reveal any change in the blood sugar level. All the parameters recorded at high altitude (HA) showed a tendency to return to basal values after reinduction to sea level. The study suggests that HA hypoxic stress brings about changes in the hedonic responses, primarily an increased palatibility for sweetness; we speculate that the mechanism may be anorexia-linked nutritional stress.
Author (AIAA)
High Altitude Environments; Human Performance; Taste; Glucose; Sodium Chlorides; Sea Level

19980066817

The influence of hyperbaric oxygenation on leukocyte viability and surface protein expression

McIntyre, Ken M., USAF, Davis Hyperbaric Lab., Brooks AFB; Texas, Univ., Austin, USA; Dixon, Patricia S., USAF, Davis Hyperbaric Lab., Brooks AFB; Texas, Univ., Austin; Krock, Larry P., USAF, Davis Hyperbaric Lab., Brooks AFB; Texas, Univ., Austin; Piepmeier, Edward H., USAF, Davis Hyperbaric Lab., Brooks AFB; Texas, Univ., Austin; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1129-1133; In English; Copyright; Avail: Aeroplus Dispatch

Hyperbaric oxygenation was studied as a potential inducer of cell growth and differentiation in promyelocytic leukemic HL60 cells. We studied changes in HL60 cells exposed to hyperbaric oxygen, oxygen, or CO2 for 72 h. The proliferation rate and viability of cells in the hyperbaric oxygenation groups were significantly lower (p below 0.05) than for the controls. While CD13 and CD38 were expressed less following hyperbaric treatment, CD11 b, CD14, and CD16 showed an increase following hyperbaric treatment, and CD10, CD15, and HLA-DR showed no change. These results support previous studies which demonstrate the role of oxygen tension in the regulation of cell cycle and protein expression.
Author (AIAA)
Oxygenation; Hyperbaric Chambers; Proteins; Leukocytes; Cells (Biology); Viability

19980066819

Case report - Obstructive sleep apnea an air safety risk

Panton, S., National Univ. Hospital, Denmark; Norup, P. W., National Univ. Hospital, Denmark; Videbaek, R., National Univ. Hospital, Denmark; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1139-1143; In English; Copyright; Avail: Aeroplus Dispatch

Aviation safety reports indicate that many incidents are related to fatigue. Obstructive sleep apnea (OSA) is characterized by irregular snoring with repeated apnea episodes during sleep and excessive daytime sleepiness. Deprived of sleep, patients suffer from daytime sleepiness and involuntary sleep attacks. The prevalence of OSA among adult men is more than one percent, 0.5 percent in women. Predisposed are men aged 40-65 yr. Many patients, including pilots, are unaware of their sleeping disturbance and the symptoms are not easily recognized. Therefore, this condition may not be discovered during a regular health examination. However, this condition can be effectively treated. In our opinion, pilots suffering from OSA do not necessarily have to lose their

certificate. Diagnosis and treatment can be conducted, followed by regular checkups. We suggest that questions about sleep be included in pilots' health examinations.
Author (AIAA)
Aircraft Pilots; Flight Safety; Sleep Deprivation; Health

19980066821
East meets West - A comparison of Eastern Block/western aeromedical practices
Lyons, Terence J., USAF, Germany; Neel, Richard L., USAF, Germany; Simpson, Carl G., USAF, Germany; Moore, Verba A., USAF, Germany; Van Syoc, Daniel, USAF, Germany; Knowles, James R., USAF, Germany; Salamanca, Victor P., USAF, Germany; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1150-1153; In English; Copyright; Avail: Aeroplus Dispatch

Under the auspices of the European Command (EUCOM) Military-to-Military Exchange Program, the authors participated in 13 trips to visit aeromedical facilities of nine Eastern European nations (Albania, Belarus, Bulgaria, Czech Republic, Hungary, Lithuania, Poland, Romania, and Slovakia). In addition, eight of these Eastern European nations visited USAF aeromedical facilities. This article highlights the similarities and differences noted between the USAF and Eastern Europe in the practice of aerospace medicine. Flight surgeons from both Eastern Europe and the USAF address issues such as physiologic stresses of flight (acceleration, hypoxia, etc.) and lifestyle stresses (rest, diet, alcohol, cigarettes, etc.). Eastern European flight surgeons do not regularly fly. The Eastern European approach to medical standards and screening for aviation applicants is much stricter and more comprehensive than ours. Several of the nations visited had active research programs at their central aeromedical institute emphasizing aircrew selection and retention standards. With the exception of the Czech Republic, Eastern European nations did not routinely grant waivers for chronic medical conditions such as hypertension in aircrew. Soviet-built aircraft had many unique features such as an outside-in attitude indicator and an autorecovery system.
Author (AIAA)
Aerospace Medicine; Europe; Military Technology; Flight Surgeons; Stress (Physiology)

19980067907
Information about venous gas emboli improves prediction of hypobaric decompression sickness
Conkin, Johnny, Universities Space Research Association, USA; Powell, Michael R., NASA Johnson Space Center, USA; Foster, Philip P., NASA Johnson Space Center, USA; Waligora, James M., NASA Johnson Space Center, USA; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 8-16; In English; Copyright; Avail: Aeroplus Dispatch

Information about venous gas emboli (VGE) detected in the pulmonary artery, such as the occurrence of VGE, Grade of VGE, the time when VGE first appear, and the time course of the grade or occurrence of VGE, can be used to better assess the probability of decompression sickness (P(DCS)) in any hypobaric decompression. We hypothesized that these data would improve the estimate of P(DCS) since objective measurements of the decompression stress are available for the individual. A binary correlation and survival analysis approach were used on information from 1322 hypobaric chamber exposures to establish the relationships between VGE and DCS. Based on the correlation analysis, the absence of VGE is highly correlated with the absence of a DCS symptom, as is evident from a negative predictive value of 0.98. However, the presence of VGE in the pulmonary artery is not highly correlated with a subsequent DCS symptom, as is evident from a positive predictive value of 0.39 for Grades III and IV VGE. The correlation results suggest the presence of VGE in the pulmonary artery is a necessary, but not sufficient, condition for DCS.
Author (AIAA)
Aeroembolism; Decompression Sickness; Pulmonary Circulation

19980067908
The convective afterdrop component during hypothermic exercise decreases with delayed exercise onset
Giesbrecht, Gordon G., Manitoba, Univ., Canada; Bristow, Gerald K., Manitoba, Univ., Canada; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 17-22; In English; Copyright; Avail: Aeroplus Dispatch

Following cold water immersion, the postcooling decrease in esophageal temperature (Tes) (i.e., afterdrop) is three times greater during exercise than during shivering, presumably due to increased muscular blood flow and convective core-to-periphery heat loss with exercise. We felt that if exercise were to commence once the afterdrop period during shivering is complete, the threat of a further decrease in Tes (i.e., a second afterdrop) during the subsequent exercise would be minimized because much of the convective capacity for core cooling would already be dissipated. Methods: Six subjects were each cooled three times in 8 C water, until Tes decreased to 35.3 +/- 0.7 C, and rewarmed by either shivering alone, exercise, or exercise commencing once a shivering

afterdrop period was complete. It is likely that during the shivering-exercise protocol, continued blood flow to shivering muscles contributes to the initial afterdrop, and thus diminishes the convective capacity (or heat sink) available for further cooling during subsequent exercise.
Author (AIAA)
Hypothermia; Physical Exercise; Water Immersion; Exercise Physiology; Body Temperature

19980067909
Plasma colloid osmotic pressure increases in humans during simulated microgravity
Hsieh, Shi-Tong T., NASA Ames Research Center, USA; Ballard, Richard E., NASA Ames Research Center, USA; Murthy, Gita, NASA Ames Research Center, USA; Hargens, Alan R., NASA Ames Research Center, USA; Convertino, Victor A., USAF, Clinical Sciences Div., USA; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 23-26; In English; Copyright; Avail: Aeroplus Dispatch

On exposure to microgravity, astronauts lose up to 12 percent of their plasma volume, which may contribute to postflight orthostatic intolerance. It is hypothesized that whole-body dehydration during prolonged microgravity, simulated by 6-deg head-down tilt (HDT), may increase plasma colloid osmotic pressure (COP). Seven healthy male subjects (30-55 yr of age) were placed in 6-deg HDT for 16 d. Plasma COP was measured from blood samples drawn immediately before HDT, on day 14 of HDT, and 1 h following bed rest termination using a 20 micro-L colloid osmometer. Plasma volume was determined before HDT, on day 16 of HDT, and 1 h following bed rest termination using a modified Evans blue dye technique. Plasma COP on day 14 of bed rest (29.9 +/- 0.7 mm Hg) was higher (p = 0.001) than pre-HDT value (23.1 +/- 0.8 mm Hg), coinciding with a decrease of plasma volume. At 1 h of upright recovery following HDT, plasma volume stayed below baseline and plasma COP remained elevated as compared with the pre-HDT value. Our results indicate that reduced plasma volume and significantly elevated plasma COP probably reflect an overall loss of extracellular fluids during simulated microgravity.
Author (AIAA)
Osmosis; Weightlessness Simulation; Microgravity; Colloids; Blood Pressure

19980067910
Control of isometric force in hypergravity
Bock, Otmar, German Sports Univ., Germany; Cheung, Bob S. K., Civil Inst. of Environmental Medicine, Canada; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 27-31; In English; Copyright; Avail: Aeroplus Dispatch

Previous work suggests that proprioceptive signals are degraded in hypergravity (hyper-G). We, therefore, expected that production of finely graded force is disturbed as well. Subjects produced isometric force with their thumb and index finger upon verbal instruction, before, during, and after exposure to +1.5 and +3 Gz. Produced force was orthogonal to the direction of gravity. In hyper-G, responses to a given target value were significantly higher than in normal gravity, while the modulation of produced force with target force did not change. The results in +1.5 and +3 Gz were quantitatively similar, and a positive aftereffect was found. Subjects underestimate by a constant amount the force they produce in hyper-G. Our results are reminiscent of similar findings with pointing and grasping movements in hyper-G.
Author (AIAA)
High Gravity Environments; Proprioception; Force; Gravitational Physiology

19980067911
Cardiovascular changes during and after different LBNP levels in men
Laszlo, Zoltan, Graz, Univ., Austria; Roessler, Andreas, Graz, Univ., Austria; Hinghofer-Szalkay, Helmut G., Graz, Univ., Austria; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 32-39; In English; Copyright; Avail: Aeroplus Dispatch

This study quantifies hemodynamic and thoracic impedance (TI) changes with four levels of lower body negative pressure (LBNP) from -15 to -65 mm Hg in seven healthy men in supine position 20 min before (pre-LBNP), 30 min during, and 20 min after suction (post-LBNP), as well as without suction (LBNP-0, rest control). It was found that different levels of lower body subatmospheric pressure produced quantitatively different time-course and dose-response patterns and remained nonhypotensive up to -65 mm Hg suction. Further, heart rate was depressed after LBNP, while arterial BP and TI-computed total peripheral resistance exceeded prestimulus levels, indicating an altered cardiovascular state after 30 min of simulated orthostasis.
Author (AIAA)
Cardiovascular System; Lower Body Negative Pressure; Supine Position; Hemodynamic Responses

19980067912

The effects of linear acceleration on distortion product otoacoustic emissions in human ears

Johnson, Robert E., Tripler Army Medical Center, USA; Allen, John R., USAF, Armstrong Lab., USA; Schultz, Theresa, USAF, Armstrong Lab., USA; Liening, Douglas A., U.S. Army, Walter Reed Army Medical Center, USA; Bell, Ann F., U.S. Army, Walter Reed Army Medical Center, USA; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 40-44; In English; Copyright; Avail: Aeroplus Dispatch

It is hypothesized that in-ear acceleration at high levels has no effect on the human cochlea, as demonstrated by a comparison of pre- and post-exposure measurements. Twenty-two healthy volunteers underwent exposure to up to 9 G in a military aviation training centrifuge. Prior to exposure they were screened for cochleovestibular disorders and underwent tympanometry, audiometry, and distortion product otoacoustic emissions testing (DPOAE). Immediately after exposure, they underwent serial testing of each of these parameters until they returned to baseline. There was no significant change in tympanometry in any subject. Audiometry revealed a temporary threshold shift of 30 db at 6 kHz in one ear of a single subject. This was accompanied by a complete loss of DPOAE at the same frequency. DPOAE did not return to baseline at 2 wk even though the audiogram had reverted to baseline by 8 d. This study demonstrates that accelerative stress may cause transient injury to the cochlea. The mechanism of injury due to acceleration is probably ischemia, although a purely mechanical effect on the outer hair cells cannot be precluded. These data also reinforce a growing body of evidence that demonstrates the greater sensitivity of DPOAE over psychoacoustic testing in detecting early or subclinical cochlear damage.
Author (AIAA)

Acceleration Stresses (Physiology); Otology; Cochlea; Audiometry; Eardrums; Acoustic Emission

19980067913

Point prevalence of barotitis in children and adults after flight, and effect of autoinflation

Stangerup, Sven-Eric, Gentofte Univ. Hospital, Denmark; Tjernstrom, Orjan, Gentofte Univ. Hospital, Denmark; Klokker, Mads, Gentofte Univ. Hospital, Denmark; Harcourt, Jonathan, Gentofte Univ. Hospital, Denmark; Stockholm, Jens, Gentofte Univ. Hospital, Denmark; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 45-49; In English; Copyright; Avail: Aeroplus Dispatch

This study estimates the point prevalence of barotrauma in children and adults after flight, and tests the effect of an autoinflation device (Otovent), in improving negative middle ear pressure after flight. Questionnaires and Otovent were distributed to all air passengers in eight incoming flights. The questionnaires inquired about nasal allergy, nasal congestion, previous and actual ear pain, use of decongestants, and experience of inflating the Otovent set during descent. After flight, the passengers were offered an ear examination including otoscopy and tympanometry both before and after a Valsalva maneuver, as well as after Otovent inflation. Otoscopic signs of barotitis were found in 10 percent of the adults and in 22 percent of the children. Negative middle ear pressure of more than 10 hPa after landing was found in 20 percent of the adults and in 40 percent of the children. The Valsalva maneuver normalized the pressure in 46 percent of the adults and in 33 percent of the children. of the adults, 73 percent, and of the children, 69 percent with an unsuccessful Valsalva maneuver could improve or normalize the middle ear pressure by inflating the Otovent set. In conclusion, we recommend autoinflation using the Otovent set to air passengers with problems clearing the ears during flight.
Author (AIAA)

Children; Barotrauma; Inflating; Middle Ear Pressure; Prophylaxis; Flight Stress (Biology)

19980067914

Magnetic resonance imaging of the paranasal sinuses in divers

Yanagawa, Youichi, National Defense Medical College, Japan; Okada, Yoshiaki, National Defense Medical College, Japan; Ishida, Kouji, Maizuru Hospital, Japan; Fukuda, Hisayoshi, Maizuru Hospital, Japan; Hirata, Fumihiko, Maizuru Hospital, Japan; Fujita, Kazuyuki, Maizuru Hospital, Japan; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 50-52; In English; Copyright; Avail: Aeroplus Dispatch

CT and magnetic resonance imaging (MRI) frequently reveal asymptomatic paranasal sinus mucosal hypertrophy in the general population. It is hypothesized that divers can suffer symptomatic paranasal sinus mucosal injury secondary to barotrauma. We examined 20 professional divers by MRI and compared them to 20 normal controls. Paranasal sinus mucosal hypertrophy was defined as mucosal thickening of 3 mm or greater. Nine divers had paranasal sinus mucosal hypertrophy vs four controls ($p = 0.09$). There was no significant relationship between paranasal sinus hypertrophy and age, diving history, alcohol consumption, or smoking. It is concluded that the divers had a tendency toward paranasal sinus mucosal hypertrophy.
Author (AIAA)

Paranasal Sinuses; Diving (Underwater); Mucus; Physiological Effects; Barotrauma

19980067915

Effects of exercise training mode on the cardiovascular responses to lower body negative pressure in males

Ioudina, Marina, Iowa State Univ., Ames, USA; Franke, Warren, Iowa State Univ., Ames; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 53-57; In English; Copyright; Avail: Aeroplus Dispatch

It is hypothesized that endurance-trained runners differ from endurance-trained swimmers in their cardiovascular responses to lower body negative pressure (LBNP). Male intercollegiate cross country runners, sprinters, and swimmers underwent exposures to 10, -20 and -40 mm Hg LBNP. Forearm blood flow, heart rate and blood pressure were measured throughout. Maximal oxygen consumption was determined separately via combined arm-and-leg cycle ergometry. It was found that the cardiovascular responses to LBNP up to 40 mm Hg do not differ in chronically exercising males training with different modalities.

Author (AIAA)

Lower Body Negative Pressure; Exercise Physiology; Physical Exercise; Hemodynamic Responses; Males; Orthostatic Tolerance

19980067916

Partial renal resistance to arginine vasopressin as an adaptation to high altitude living

Ramirez, German, South Florida, Univ., USA; Pineda, David, South Florida, Univ., USA; Bittle, Polly A., South Florida, Univ., USA; Rabb, Hamid, South Florida, Univ., USA; Rosen, Raquel, South Florida, Univ., USA; Vesley, David, South Florida, Univ., USA; Sasaki, Sei, South Florida, Univ., USA; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 58-65; In English; Copyright; Avail: Aeroplus Dispatch

Ten men from the Southern Colombian Andes (2600 m) in Pasto, Colombia, were compared to age-matched men from sea level (SL), Tampa, FL, in the U.S., with respect to their total body water (TBW), ability to handle a water load, and response to exogenous arginine vasopressin (AVP). Measurements included circulating AVP, atrial natriuretic peptides, and urinary excretion of the AVP sensitive water channel, aquaporin-2 (AQP2). The high-altitude (HA) subjects had significantly lower TBW, AQP2 excretion, and vessel dilator circulating levels at baseline compared to SL subjects. With water loading there was a rapid increase in urine volume at 30 min with a decline thereafter in HA subjects, while SL subjects had a gradual increment peaking at 120 min. The data demonstrate the following adaptations to HA: decrease in TBW, better ability to handle a water load despite high levels of AVP, a significant decrease in the circulation of vessel dilator, and diminished excretion of AQP2 water channel. These findings indicate an insensitivity of the collecting duct of HA subjects to the actions AVP. However, exogenous administration of AVP caused a marked excretion of AQP2.

Author (AIAA)

Renal Function; Altitude Acclimatization; Antidiuretics; High Altitude Environments; Hormone Metabolisms

19980069543

Man and altitude in aeronautics *L'homme et l'altitude en aeronautique*

Marotte, Henri, Centre d'Essais en Vol, France; Nouvelle Revue d'Aeronautique et d'Astronautique; Sep. 1997; ISSN 1247-5793, no. 4, pp. 28-35; In French; Copyright; Avail: Aeroplus Dispatch

With increasing altitude, the partial pressure of oxygen in inspired air diminishes. This diminishment is the origin of the state of hypoxia or of acute hypoxia, characterized by central nervous system disturbances. Above 6000 m, the 'critical zone', is the zone of very acute hypoxia, characterized by the risk of a brief loss of consciousness. In particular, it is the risk incurred in the case of a breakdown in the oxygen system or during decompression accidents in the cabin at high altitude. Cabin decompression brings about perturbations in gas exchange and in breathing mechanics. These phenomena are discussed in this paper.

AIAA

Aeronautics; High Altitude; Hypoxia; Unconsciousness; Decompression Sickness; Central Nervous System

19980069544

Pilots' G-tolerance

Balldin, Ulf I., National Defence Research Establishment, Sweden; Nouvelle Revue d'Aeronautique et d'Astronautique; Sep. 1997; ISSN 1247-5793, no. 4, pp. 36-39; In English; Copyright; Avail: Aeroplus Dispatch

The high accelerations to which fighter aircraft pilots are subjected cause a pooling of blood and a substantial increase of blood pressure in the lower parts of the body. This may induce visual loss and reduce pilot performance. It may also generate the risk of sudden G-induced loss of consciousness during flight maneuvers. Different techniques have been developed to increase the G-protection of the pilots. These techniques may enhance the G-tolerance and prolong the G-endurance.

Author (AIAA)

Acceleration Tolerance; Fighter Aircraft; Aircraft Pilots; Physiological Responses

19980069698 Texas A&M Univ., Dept. of Mechanical Engineering, College Station, TX USA

Cement Line Interphase Effects on the Dynamic Mechanical Behavior of Haversian Cortical Bone Tissue ***Final Report, 1 May 1995 - 30 Apr. 1997***

Hogan, Harry A., Texas A&M Univ., USA; Oct. 17, 1997; 21p; In English

Contract(s)/Grant(s): F49620-95-I-0335

Report No.(s): AD-A331158; AFOSR-TR-97-0545; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research is part of the recent AFOSR initiative in Biomimetics, which has the broad overall goal or seeking to elucidate and understand the salient characteristics of naturally occurring biological composite materials, with an aim toward mimicking these features in devising improved man-made composite materials. The biological composite of interest in this effort is bone tissue, or more specifically Haversian cortical bone tissue. A major underlying task in this project is to develop a more deterministic understanding of the relationships between microstructural details and macroscopic mechanical behavior. The specific objectives of the project are: to conduct extensive dynamic mechanical tests on cortical bone specimens from a variety of sources to determine the dynamic elastic moduli and material damping; to quantitatively characterize the microstructural features of all bone specimens tested: To correlate mechanical behavior and microstructure through statistical analysis as well as theoretical modeling studies. Recent efforts have focused upon developing methods for extending dynamic mechanical testing to include 3-point bending in addition to torsional loading. Effort has also been directed at developing more detailed characterization of material microstructure in two particular areas. One of these areas is bone tissue composition, or more specifically, determining calcium content, phosphorous content, and collagen content.

DTIC

Bones; Dynamic Tests; Mechanical Properties; Cements; Calcium; Bending

19980069847

Salivary melatonin as a circadian phase marker - Validation and comparison to plasma melatonin

Voultsios, Athena, Adelaide, Univ., Australia; Kennaway, David J., Adelaide, Univ., Australia; Dawson, Drew, South Australia, Univ., Australia; Journal of Biological Rhythms; Oct. 1997; ISSN 0748-7304; Volume 12, no. 5, pp. 457-466; In English; Copyright; Avail: Aeroplus Dispatch

The aim of this study was to develop and validate a salivary melatonin radioimmunoassay and to compare results obtained against a plasma assay for determining the onset of melatonin secretion. The assay developed was sensitive (4.3 pM) and required only 200 micro-l of sample. A rhythm in melatonin was detected in saliva, peaking at approximately 120 pM or 30 percent of the plasma levels. Using an objective criterion for determining the onset of secretion, the time of onset was shown to exhibit low intraindividual variability. The time of onset determined using saliva was significantly correlated with the plasma onset. The onsets determined were 22:30 h +/- 22 min for the saliva and 21:50 h +/- 16 min for plasma for 17 subjects. Similarly, the acrophases of the saliva and plasma melatonin rhythms were significantly correlated. Neither posture alone nor changes in posture affected the calculation of the onset of melatonin secretion using the saliva approach. Very high saliva flow rates induced by citric acid resulted in lower melatonin concentrations compared to the gentle chewing on parafin film. These results firmly establish the use of salivary melatonin measurements for phase typing of the melatonin rhythm in humans.

Author (AIAA)

Circadian Rhythms; Blood Plasma; Radioimmunoassay; Saliva

19980069848

Complex effects of melatonin on human circadian rhythms in constant dim light

Middleton, Benita, Surrey, Univ., UK; Arendt, Josephine, Surrey, Univ., UK; Stone, Barbara M., Defence Research Agency, Centre for Human Sciences, UK; Journal of Biological Rhythms; Oct. 1997; ISSN 0748-7304; Volume 12, no. 5, pp. 467-477; In English; Copyright; Avail: Aeroplus Dispatch

The authors investigated the effects of daily melatonin administration on sighted individuals kept in continuous very dim light. A total of 10 normal, healthy males were maintained in two separate groups in partial temporal isolation under constant dim light (below 8 lux) with attenuated sound and ambient temperature variations but with knowledge of clock time for two periods of 30 days. In these circumstances, the majority of individuals free run with a mean period of 24.3 h. In a double-blind, randomized crossover design, subjects received 5 mg melatonin at 20:00 h on Days 1 to 15 (Melatonin 1st) followed by placebo on Days 16 to 30 (Placebo 2nd) or vice versa (Placebo 1st, Melatonin 2nd) during Leg 1 with treatment reversed in Leg 2. The variables measured were melatonin, rectal temperature, activity, and sleep. Nine of the 10 subjects free ran with Placebo 1st, whereas melatonin 1st stabilized the sleep-wake cycle to 24 h in eight of 10 individuals. Two individuals showed irregular sleep with this treatment. In some subjects, there was a shortening of the period of the temperature rhythm without synchronization. Melatonin 2nd induced phase advances (5 of 9 subjects), phase delays (2 of 9 subjects), and stabilization (2 of 9 subjects) of the sleep-wake cycle with

subsequent synchronization to 24 h in the majority of individuals (7 of 9). The results obtained indicate that melatonin was able to phase shift sleep and core temperature but was unable to synchronize core temperature consistently. In the majority of subjects, the sleep-wake cycle could be synchronized.
Author (AIAA)
Human Performance; Circadian Rhythms; Illumination; Physiological Responses; Sleep

19980069850
Magnesium salts in physiology and pathology - Possible medical applications ***Soli magniya v fiziologii i patologii - Vozmozhnosti ikh primeneniya v meditsine***
Spasov, A. A., Volgogradskaya Meditsinskaya Akademiya, Russia; Orobinskaya, T. A., Volgogradskaya Meditsinskaya Akademiya, Russia; Smirnova, L. A., Volgogradskaya Meditsinskaya Akademiya, Russia; Uspekhi Fiziologicheskikh Nauk; Jun. 1997; ISSN 0301-1798; Volume 28, no. 2, pp. 79-93; In Russian; Copyright; Avail: Aeroplus Dispatch

Data in the literature on the biological activity of magnesium ions and their physiological and pathophysiological effects are reviewed. The effects of magnesium deficiency or excessive amounts of magnesium in the body and the mechanisms regulating the magnesium content are discussed. Data are presented on the use of preparations containing magnesium ions in pathologies of the kidneys, liver, gastrointestinal tract, in diabetes mellitus, arrhythmias, hypertension, ischemia, miocardial infarction, and other conditions.
AIAA
Magnesium Compounds; Salts; Physiology; Human Pathology; Aerospace Medicine

19980069851
A comparative analysis of the existing UV radiation standards ***SRavnitel'nyj analiz sushchestvuyushchikh normativov vozdejstviya ul'trafioletovoj radiatsii***
Strzhizhovskij, A. D., Gosudarstvennyj Nauchnyj Tsentr RF-Inst. Mediko-Biologicheskikh Problem, Russia; Uspekhi Fiziologicheskikh Nauk; Jun. 1997; ISSN 0301-1798; Volume 28, no. 2, pp. 94-106; In Russian; Copyright; Avail: Aeroplus Dispatch

The maximum allowable UV radiation limits in the workplace established by the existing standards in the U.S.A., Netherlands, and Russia are analyzed in quantitative terms. A comparison of the results against the currently available data on the spectral and energy parameters of the biological effect of UV radiation highlights some essential differences and contradictions in the existing approaches to the UV radiation exposure standards.
AIAA
Ultraviolet Radiation; Radiation Hazards; Radiation Dosage; Biological Effects

19980070009
Effect of vision on reduced gravity posture
Zimmerman, Julianne, Maryland, Univ., College Park, USA; Akin, David L., Maryland, Univ., College Park; Jul. 1997; In English Contract(s)/Grant(s): NAGW-2245
Report No.(s): SAE Paper 972406; Copyright; Avail: Aeroplus Dispatch

Eight experienced neutral buoyancy test divers were instructed to maintain quiet relaxed posture while 'standing' in instrumented Space Shuttle middeck (IVA) type foot restraints in the Space Systems Laboratory (SSL) Neutral Buoyancy Research Facility (NB) and onboard the NASA KC-135 reduced gravity aircraft (PF). Foot restraint reaction loads and subject joint angles were recorded during blind and sighted conditions. Visual cues played a significant role in subject anxiety onboard the KC; however, while subject joint angles and reaction loads differed between NB and PF conditions, no differences were found between sighted and blind conditions in either simulation environment for reaction loads or joint angles. This very surprising result indicates that there are not only anecdotal but concrete differences between reduced gravity and terrestrial posture mechanisms.
Author (AIAA)
Vision; Microgravity; Posture; Buoyancy; Parabolic Flight

19980070768
Biodynamic modeling of human neck response during vertical impact
Perry, Chris E., USAF, Armstrong Lab., USA; Rizer, Annette, Systems Research Labs., Inc., USA; Smith, Jeanne, Systems Research Labs., Inc., USA; Anderson, Beth, Systems Research Labs., Inc., USA; SAFE Journal; Aug. 1997; ISSN 0191-6319; Volume 27, no. 3, pp. 183-191; In English; Copyright; Avail: Aeroplus Dispatch

A study is conducted of the feasibility of using the Articulated Total Body (ATB) model to estimate the dynamic accelerations experienced by the head during a positive z-axis impact acceleration akin to that of the catapult phase of ejection. If accurate in

estimating head accelerations, the ATB could also be used to estimate loads experienced at the occipital condyles during the dynamic impact event. The present tests were conducted with volunteer subjects using a parametric helmet that allowed changes in its inertial properties to simulate those of various head-mounted systems. The current configuration of the three-segment model was found to predict the z-axis linear head acceleration.
AIAA
Human Body; Neck (Anatomy); Biodynamics; Biological Models (Mathematics); Impact Acceleration; Head-Up Displays

19980070770
The effects of various anti-G suit pressures and positive pressure breathing on lung volumes
Tripp, Lloyd D., Jr., Systems Research Labs., Inc., USA; SAFE Journal; Aug. 1997; ISSN 0191-6319; Volume 27, no. 3, pp. 196-206; In English; Copyright; Avail: Aeroplus Dispatch

Anti-G suits have historically been evaluated using G-tolerance and G-endurance as the primary benchmarks of effectiveness. One area which has been overlooked is the effect of G-suit inflation on lung volumes. Lung inflation to about 75 percent of normal capacity is key to producing the optimum intrathoracic pressure for performing the anti-G straining maneuver. This study evaluated three separate G-suit designs: the Advanced Protection System (APS), the Advanced Technology Anti-G Suit (ATAGS), and the standard CSU-13B/P anti-G suit. In addition, this study looked at the effect positive pressure breathing had on maintaining lung volumes during G-suit inflation to 27.6, 41.4, and 55.2 kPa at 1 G. Results from these tests showed that while the full pressure suit design of the APS suit had the smallest effect on inspiration, a comparison of classic G-suit (trousers) showed the ATAGS to be superior in design compared to the CSU-13B/P. At a suit pressure of 55.2 kPa, forced inspiratory vital capacity (FIVC) percent change from baseline values for the APS, ATAGS, and CSU-13B/P were 80, 93, and 60 percent respectively. When Positive Pressure Breathing (PPB) was added, FIVC values were 102, 66, and 46 percent. Pulmonary function testing for determining the effect of G-suit inflation on lung volumes may be very useful in designing and evaluating the next generation of anti-G suits.
Author (AIAA)
Antigravity; Pressure Breathing; Lungs; Pulmonary Functions; Acceleration Tolerance

19980070811
Potential pathological effects of repeated +Gz exposures on brain
Sun, Xi-Qing, Fourth Military Medical Univ., China; Zhang, Li-Fan, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; 1997, pp. 33-38; In English; Copyright; Avail: Aeroplus Dispatch

It has been demonstrated that during +Gz exposure cerebral blood flow is significantly reduced, resulting in brain ischemia. Such conditions could be repeated several times during combat maneuvers. We know little about pathophysiological effects of repeated +Gz exposures on the brain. The present study was undertaken to investigate whether repeated +10 Gz (3 min each) exposures produce brain tissue damage, and whether this is reversible. Awake rats were restrained and placed on animal centrifuge. Control rats were exposed to +1 Gz and an experimental group was exposed to +10 Gz three times each, for 3 min at 30 min intervals. The changes in morphology of cortex were examined immediately, at 1, 6, and 24 h after three +Gz exposures. Light microscopic observations showed that a few neurons in the parietal cortex after repeated +Gz exposures demonstrated ischemic cell changes which returned to normal 24 h after three +Gz exposures. Electron microscope observations showed that, after three +Gz exposures, swollen mitochondria with cristae blurred were observed in a few pyramidal cells. A few pyramidal cells showed degenerative changes with decreased endoplasmic reticulum and ribase nuclear protein and increased lysosomes.
Author (AIAA)
Brain Circulation; Blood Flow; High Gravity Environments; Ischemia; Aircraft Pilots; Physiological Acceleration

19980070812
The effects of heat stress on UH-60 helicopter pilots
Reardon, Matthew J., U.S. Army, Aeromedical Research Lab., USA; Katz, Lawrence C., U.S. Army, Aeromedical Research Lab., USA; Fraser, Beth, U.S. Army, Aeromedical Research Lab., USA; 1997, pp. 39-45; In English; Copyright; Avail: Aeroplus Dispatch

A repeated measures study with 14 aviators flying simulated UH-60 helicopter mission profiles was recently performed to evaluate the effects of standard (MOPPO) and encumbered (MOPP4) aviator ensembles in cool (70 F) and hot (100 F) conditions. Average crew endurance was reduced from the fully completed mission time of 309 minutes in the standard-cool condition to 107 minutes in the encumbered hot condition. This was due to rapid increases in core temperature, progressive physical discomfort and psychological stress, and adversely affected mood. Calculated total body heat storage for the encumbered-hot condition was 1445 W compared to 627 W for the standard-hot condition. Heavy sweat rates while in the encumbered-hot condition led to significantly greater amounts of dehydration over shorter periods of time. The results of this evaluation suggest that encumbered protec-

tive aviator flight uniforms should be designed to be lightweight and porous, to allow efficient evaporation of sweat. Microclimate cooling should be considered for preventing excessive core temperature elevation when aviators wear occlusive protective ensembles in hot weather conditions.
Author (AIAA)
Aircraft Pilots; High Temperature Environments; Stress (Physiology); Body Temperature; Dehydration; Protective Clothing

19980070825
The effect of helmet inertial properties on male and female head response +Gz impact accelerations
Perry, Chris E., USAF, Armstrong Lab., USA; 1997, pp. 189-195; In English; Copyright; Avail: Aeroplus Dispatch

As women become increasingly integrated into USAF combat missions, there is a potential to see an increase in the number of emergency ejections with females. Current risk assessment methods are based on primarily male data; the need exists to investigate the injury potential of female crewmembers during cockpit ejection. These injuries can be extremely debilitating and even fatal. Additional concern is focused on the effect the catapult phase of ejection will have on aircrew while wearing some form of a helmet-mounted system (HMS). The potential for neck injury may increase due to the increase in dynamic forces generated in the cervical spine as a result of the change in helmet inertial properties including weight, center-of-gravity, and moment-of-inertia. Since women are generally smaller and shorter with different neck strength than males, there may be differences in their degree of susceptibility to neck injury; females have less neck flexor and extensor strength when compared to males. Therefore, the dynamic loads induced in the neck of females with HMS may put them at greater risk during the catapult phase of ejection.
Author (AIAA)
Impact Acceleration; Helmet Mounted Displays; Ejection Injuries; Flight Crews; Center of Gravity; Moments of Inertia

19980070842
Evaluation of GEBOD as a predictor of human body data - Performed using high resolution human body topography
Whitestone, Jennifer J., USAF, Armstrong Lab., USA; Hudson, Jeffrey A., Sytronics, Inc., USA; 1997, pp. 362-372; In English; Copyright; Avail: Aeroplus Dispatch

Modeling efforts in Armstrong Laboratory are supported by a number of human body data collection programs including horizontal and vertical sled testing, anthropometric studies, reach capability mapping, and strength studies. GEBOD (GEnerator of BOdy Data), a preprocessor for human models including the Articulated Total Body (ATB), generates human body data sets. Seventy subjects (35 men and 35 women) meeting USAF entrance requirements, were measured extensively with traditional anthropometric tools (calipers and tape measures) in a combined effort with the Navy and Armstrong Laboratory to measure whole body mass properties for ejection seats. These measurements are compared to GEBOD predicted measures. Additionally, high resolution 3D surface data of 53 of these subjects was recorded. These image data are compared to the GEBOD-generated output ellipsoidal representations of the subjects. Evaluation of GEBOD as a predictor of human body models is documented. While some of the traditional anthropometric measures showed strong prediction ability by GEBOD, most of them were biased with either consistently high or low estimates and/or were characterized by distributions greatly skewed to the y = x perfect predictor function.
Author (AIAA)
Human Body; Anthropometry; Ejection Seats; Body Weight; Size (Dimensions); Prediction Analysis Techniques

19980070849
Extended exposure capability after rapid decompression at 60,000 feet and above
Self, Brian P., USAF, Armstrong Lab., USA; Pilmanis, Andrew A., USAF, Armstrong Lab., USA; Diesel, Donald, USAF, Armstrong Lab., USA; Sears, William J., Aerospace Associates, Inc., USA; 1997, pp. 431-436; In English; Copyright; Avail: Aeroplus Dispatch

There are several offensive and defensive benefits for fighter aircraft to fly at altitudes of 60,000 ft and above. The kinematic range of air-to-air missiles is much greater in high-to-low shots, and high flying aircraft are less likely to be detected by surface threats. Fighter aircraft technology has increased to allow flight above 60,000 ft; similar advances in life support equipment must now be made. The physiologic limitations of hypoxia and decompression sickness at 60,000 ft and above have debilitating consequences. At these altitudes, pressure breathing at the required 70 mmHg cannot be sustained beyond a 'get-me-down' scenario. The Sustained High Altitude Respiratory Protection and Enhanced Design G-Ensemble is being developed to enable the pilot to remain at 60,000 ft and above and complete the mission after an unexpected rapid decompression. The system, which will be compatible with current anti-G suits, will consist of a fully enclosed pressure helmet with neck seal, pressure sleeves added to the vest,

and gloves. The helmet design incorporates a pressure breathing mask to provide +Gz protection and an unpressurized crown area to prevent helmet rise.
Author (AIAA)
Fighter Aircraft; Aircraft Pilots; Decompression Sickness; High Altitude Breathing; Physiological Responses

19980070851
Will canopy-embedded mild detonating cord affect aircrew visual performance?
Gannon, Aaron J., USAF, Crew System Ergonomics Information Analysis Center, USA; Gentner, Frank C., USAF, Crew System Ergonomics Information Analysis Center, USA; Schopper, Aaron W., USAF, Crew System Ergonomics Information Analysis Center, USA; Urzi, Russell E., USAF, Wright Lab., USA; 1997, pp. 442-451; In English; Copyright; Avail: Aeroplus Dispatch

Mild Detonating Cord (MDC) in the next generation transparency has provided the opportunity for improvements to aircrew ejection separation times. Embedded as quarter-inch thick lines outlining the ejection zone, the MDC explosive fractures the boundaries of this zone in halves that open upward and outward as the ejection seat penetrates the canopy. MDC eliminates the need to jettison the canopy prior to ejection, preserving the critical escape time requisite for aircrew survival. Unfortunately, aircrew visual performance may suffer as a consequence of installing MDC. MDC is a canopy visual obstruction that may interfere with target detection and tracking. Consequently, it is prudent to identify and characterize the potential negative visual performance consequences of installing MDC, then minimize them prior to canopy production. This paper presents the most relevant results suggesting possible visual performance effects associated with canopy-embedded MDC. Visual processes (e.g., accommodation) may interact with MDC characteristics (e.g., placement, contrast) and environmental conditions (e.g., low illumination, homogeneous visual field) to create varied visual performance consequences. MDC may become visually prominent, trapping aircrew visual attention, thereby interfering with target detection, perception, and tracking.
Author (AIAA)
Flight Crews; Visual Acuity; Canopies; Detonation; Visual Stimuli; Pilot Performance

19980071254
Aerospace Medical Association, Annual Scientific Meeting, 68th, Chicago, IL, May 11-15, 1997, Program and Abstracts
1997; In English; Copyright; Avail: Aeroplus Dispatch

The objective of the annual scientific meeting of the Aerospace Medical Association is to provide a forum for the exchange of information, knowledge, and advances in the clinical, operational, and research efforts in aviation, space, and environmental medicine and their allied sciences. This volume contains the program and abstracts for the 68th annual meeting.
AIAA
Conferences; Aerospace Medicine

19980071838
Effects of normobaric hypoxic confinement on visual and motor performance
Gustafsson, Christina, National Defence Research Establishment, Sweden; Gennser, Mikael, National Defence Research Establishment, Sweden; Ornhagen, Hans, National Defence Research Establishment, Sweden; Derefeldt, Gunilla, National Defence Research Establishment, Sweden; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 985-992; In English; Copyright; Avail: Aeroplus Dispatch

The use of reduced oxygen levels has been suggested for fire prevention in closed spaces, such as submarines. However, if humans are to work and live in environments with reduced oxygen levels, the effect of hypoxia on human performance must be further assessed. In three 11-to-14-day confinements, a total of 22 subjects were exposed to different levels of normobaric hypoxia for up to 10 days, with intervening periods of normoxia. In each experiment eight subjects were divided into two teams, working in six hr shifts around the clock. Subjects performed tests of spatial orientation, visual reaction time, parallel processing and motor skills. Performance tests and questionnaires were administered once or twice in every 24-h period. All of the subjects appeared to tolerate the acute reduction in oxygen partial pressure well. In many of the tests performance improved with time as a result of learning, despite reductions in the oxygen level. No reduction in performance or decrease in rate of learning was observed at any of the oxygen levels tested. Oxygen levels down to 14 kPa appear not to impair visual and motor performance during rest.
Author (AIAA)
Hypoxia; Human Performance; Fire Prevention

19980071839
Cognitive performance during short acclimation to severe hypoxia
Leifflen, Daniel, Service de Sante des Armees, Centre de Recherches, France; Poquin, Didier, Service de Sante des Armees,

Centre de Recherches, France; Savourey, Gustave, Service de Sante des Armees, Centre de Recherches, France; Barraud, Pierre-Alain, Service de Sante des Armees, Centre de Recherches, France; Raphel, Christian, Service de Sante des Armees, Centre de Recherches, France; Bittel, Jacques, Service de Sante des Armees, Centre de Recherches, France; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 993-997; In English; Copyright; Avail: Aeroplus Dispatch

Exposure to high altitudes requires acclimation to prevent the negative effects of severe hypoxia. Short acclimation with intermittent exposure to severe hypoxia in a hypobaric chamber triggers efficient physiological preadaptation mechanisms. However, we have little knowledge about the cognitive repercussions of such an acclimation protocol. Four mountaineers were tested daily in the course of a short acclimation protocol (five days). After their SaO2 (arterial oxyhemoglobin saturation) were recorded, they carried out a choice reaction time task (Manikin test) twice every day; first at ground level (250 m, control sessions), second at the highest altitude of the day (D1 = 5000 m, D2 = 5500 m, D3 = 6000 m, D4 = 6500 m, D5 = 7000 m). High altitude SaO2 level decreased during the first 3 d, then stabilized around 72-73 percent. Despite a slight and transient increase at the highest altitude relative to the ground level in D4, the error rate remained low throughout the protocol. Further, response time to the Manikin task did not show significant changes among the days during the acute stage of hypoxia relative to ground level up to 7000 m. It seems that a short acclimation protocol based on intermittent exposure to simulated high altitudes triggered adaptive processes without major impairment in a choice reaction time task during the acute stages of severe hypoxia.

Author (AIAA)

Hypoxia; Altitude Acclimatization; Mental Performance; Human Performance

19980071840

Anti-emetic drug effects on pilot performance - Granisetron vs. ondansetron

Benline, Terry A., Systems Research Labs., USA; French, Jonathan, USAF, Armstrong Lab., USA; Poole, Eric, USAF, Armstrong Lab., USA; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 998-1005; In English; Copyright; Avail: Aeroplus Dispatch

We evaluate the effects of two antiemetic drugs, granisetron (1 mg tablets/2 mg oral dose) and ondansetron (8 mg tablets/8 mg oral dose) on flying and mission performance in an F-16 research simulator. The experiment, involving nine pilots, was of placebo-controlled, double-blind, crossover design. Each pilot flew three defensive counterair missions. Data on nine measures of flying performance were collected via the simulator data recorder. In addition, ratings on mission and flying performance were recorded by simulator instructor pilots. Data were also collected on symptoms and side effects, mood, and vigilance. This study, in the context of a simulated tactical air-to-air combat mission, produced no significant differences between the effects of the target drugs and placebo on any of the nine objective flying performance measures, including a composite measure of landing performance. There were no differences in evaluator ratings of routine mission flying or air combat performance. Pilots could not distinguish active drug from placebo and there were no differences on any of the mood scales. These results confirm our earlier findings that the drugs of interest are well tolerated and produce no cognitive, psychomotor or subjective state changes. There was no evidence of performance degradation due to either granisetron or ondansetron in a complex military environments.

Author (AIAA)

Pilot Performance; Antiemetics and Antinauseants; Aerospace Medicine

19980071841

Injury among female and male Army parachutists

Amoroso, Paul J., U.S. Army, Research Inst. for Environmental Medicine, USA; Bell, Nicole S., Social Sectors Development Strategies, Inc., USA; Jones, Bruce H., U.S. Army, Center for Health Promotion and Preventive Medicine, USA; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 1006-1011; In English; Copyright; Avail: Aeroplus Dispatch

While military parachuting injuries have been well studied, the relationship between gender and risk of injury has not. Injuries among women may be different due to anatomic and physiologic differences, or due to exposure to different jump conditions. Training methods and equipment developed for men may not be as effective in preventing injuries among women. This descriptive retrospective study used 10 yr of parachute injury data reported to the U.S. Army Safety Center, and exposure data obtained from the Defense Manpower Data Center. Women appear to jump under less hazardous conditions (jump more often than men in daylight and in static-line, nontactical environments), yet appear to be at greater risk of serious injury, particularly lower extremity fractures. Injured male parachutists are more likely to experience upper extremity injury. Women's injuries are more likely to be the result of an improper parachute landing fall or parachute malfunction, while men are more likely to be injured due to ground

hazards. There are some provocative gender differences in patterns of injury. Further research is indicated starting with a comprehensive, prospective study, controlling for physical fitness and exposure differences, as well as for potential reporting bias.
Author (AIAA)
Parachuting Injury; Sex Factor; Aerospace Medicine

19980071842

Aircraft type and diagnosed back disorders in U.S. Navy pilots and aircrew

Simon-Arndt, C. M., U.S. Navy, Naval Health Research Center, USA; Yuan, H., U.S. Navy, Naval Health Research Center, USA; Hourani, L. L., U.S. Navy, Naval Health Research Center, USA; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 1012-1018; In English; Copyright; Avail: Aeroplus Dispatch

Back disorders have long been recognized as a serious problem within the military aviation community and a possible threat to mission accomplishment. The purpose of the present study was to determine the extent to which the type of aircraft flown is associated with diagnosed back problems, and to examine differences in the prevalence of back disorders between pilots and aircrew. A case-control study was conducted in which U.S. Navy pilots and aircrew members with a diagnosed back disorder on their most recent physical exam between 1991 and 1993 were compared with pilots and aircrew without such diagnoses. Data were obtained from the automated physical examination records maintained by the Naval Operational Medicine Institute for all Naval aviation personnel. Results showed that aircrew members have a higher risk of diagnosed back problems than pilots for both helicopters and fixed-wing aircraft. The study revealed that flight engineers have a higher risk of diagnosed back problems than other aircrew members. Among pilots, no association was found between type of aircraft and diagnosed back problems.
Author (AIAA)
Back Injuries; Aircraft Pilots; Flight Crews; Military Aircraft; Aerospace Medicine

19980071843

Effects of Topical Skin Protectant on heat exchange in humans

Gabaree, Catherine L. V., U.S. Army, Research Inst. of Environmental Medicine, USA; Mair, Brent S., U.S. Army, Research Inst. of Environmental Medicine, USA; Kolka, Margaret A., U.S. Army, Research Inst. of Environmental Medicine, USA; Stephenson, Lou A., U.S. Army, Research Inst. of Environmental Medicine, USA; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 1019-1024; In English; Copyright; Avail: Aeroplus Dispatch

The application of a Topical Skin Protectant (TSP) under chemical protective clothing may impair heat exchange and/or decrease tolerance time during exercise. The extent to which TSP might act as a barrier to heat transfer was unknown. Since TSP may be permeable to water vapor, we hypothesized that there would be no significant differences between treatments on variables effecting heat exchange. There were 10 subjects who walked (3.5 mph, 3 percent grade) until volitional exhaustion in an environmental chamber in two conditions: no TSP application (CON) and TSP application (TSP). TSP was applied to 21 percent of body surface area on six specific areas. Esophageal temperature, skin temperature (eight sites), heart rate, and pre- and postexperimental weights were measured. Mean skin temperature, mean body temperature, changes in esophageal temperature/min of exercise, evaporative heat loss, and sweating rate were calculated. There was no effect of TSP on esophageal temperature, mean skin temperature, heart rate, tolerance time, sweating rate and evaporative heat loss. At the change in TES/min of exercise-averaged TSP rate obtained, the difference between treatments for 4 h would be 0.48 C. There were no adverse local or systemic reactions to TSP application.
Author (AIAA)
Exercise Physiology; Heat Transfer; Skin Temperature (Biology)

19980071844

Neurological manifestation of arterial gas embolism following standard altitude chamber flight - A case report

Rios-Tejada, Francisco, Centro de Instruccion de Medicina Aeroespacial, Spain; Azofra-Garcia, Jose, Centro de Instruccion de Medicina Aeroespacial, Spain; Valle-Garrido, Jose, Centro de Instruccion de Medicina Aeroespacial, Spain; Pujante Escudero, Angel, Centro de Instruccion de Medicina Aeroespacial, Spain; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 1025-1028; In English; Copyright; Avail: Aeroplus Dispatch

In the course of a decompression at flight level 28,000 ft in an altitude chamber flight, a 45-yr-old cabin air traffic controller developed sudden numbness in his left upper and lower extremities and, soon after, complete paralysis in the left side, dysarthria and left facial palsy. A presumptive diagnosis of arterial gas embolism (AGE) was made and hyperbaric oxygen therapy (HBO) was given after airevac of the patient to the closest compression facility. Complete resolution of the symptoms was obtained after treatment Table VI-A (extended), with three consecutive HBO treatments (90 min of oxygen). AGE is a rare event in the course

of regular altitude chamber flight and diagnosis should be done in the context of the barometric pressure changes and an acute cerebral vascular injury. Risk factors and follow-up diagnostic procedures are discussed.
Author (AIAA)
Aeroembolism; Arteries; Aerospace Medicine; Decompression Sickness; Case Histories; Neurology

19980071845
Long-term follow-up of aviators after functional endoscopic sinus surgery for sinus barotrauma
Parsons, David S., Missouri, Univ., Columbia, USA; Chambers, David W., Missouri, Univ., Columbia; Boyd, Edgar M., USAF, Wilford Hall Medical Center, USA; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 1029-1034; In English; Copyright; Avail: Aeroplus Dispatch

Prior to endonasal endoscopic advances for the treatment of sinus disease, surgical results for aviators with recurrent sinus barotrauma (RSB) were inconsistent. Between 1988 and 1992, 54 aviators, who were permanently or temporarily grounded, underwent functional endoscopic sinus (FES) surgery in an attempt to return them to active flying status. Follow-up in the immediate postoperative period revealed that 98 percent of these aviators returned to active flight duty. A questionnaire was mailed to each of these aviators to compare their preoperative and long-term postoperative symptoms and determine their current flying status. Longterm follow-up time ranged from 20 to 72 months, with average of 48 months. of the aviators who responded to the survey, 92 percent have continued their flying duties and do not report difficulties with RSB. We conclude that FES surgery is effective in the short- and long-term management RSB in aviators.
Author (AIAA)
Aircraft Pilots; Sinuses; Barotrauma; Endoscopes; Surgery

19980071846
Case report - Unilateral mydriasis from topical Opcon-A and soft contact lens
Williams, Timothy L., Southern Illinois Univ., USA; Williams, Andrea J., Southern Illinois Univ., USA; Enzenauer, Robert W., Southern Illinois Univ., USA; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 1035-1037; In English; Copyright; Avail: Aeroplus Dispatch

The use of topical ocular antihistamine/decongestant combinations to treat symptoms associated with allergic conjunctivitis is widespread, effective, and generally without adverse effects. Recently, these medications have become available without a prescription, possibly leading patients to the erroneous assumption that they are void of side effects. Likewise, patients may use these drugs for many ocular therapies for which they are unintended, possibly resulting in ocular complications. One significant adverse effect of these antihistamine/decongestant combinations when used inappropriately is pupillary dilation with associated blurry vision. Continued emphasis of the possible deleterious side effects by the clinician is recommended to circumvent these problems.
Author (AIAA)
Contact Lenses; Conjunctivitis; Antihistaminics

19980071847
Renal and hormonal responses to exercise in man at 46 and 37 atmospheres absolute pressure
Claybaugh, John R., Tripler Army Medical Center, USA; Freund, Beau J., U.S. Army, Research Inst. of Environmental Medicine, USA; Luther, G., GKSS-Forschungszentrum Geesthacht GmbH, Germany; Mueller, K., DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Bennett, P. B., Duke Univ. Medical Center, USA; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 1038-1045; In English; Copyright; Avail: Aeroplus Dispatch

Exercise increases plasma arginine-vasopressin (Pavp), plasma atrial natriuretic peptide (Panp), plasma renin activity (PRA), and plasma aldosterone (Paldo) in an intensity-dependent manner. With acute exercise, urine osmolality (Uosm) is often decreased despite increased Pavp. The hyperbaric environment lowers Pavp and Uosm, and increases urine flow. If work produced similar renal effects at hyperbaria, greater than normal dehydration could result from larger free water losses. Hormonal and renal responses were assessed during exercise at 80 percent of maximum heart rate at 46 atmospheres absolute in three males, and during maximum exercise at 37 atm abs in four males. This maximum exercise was performed at the highest pressure thus far reported and revealed no loss in peak power output. Maximum O2 consumption and heart rate were only slightly reduced, 9.5 percent and 7 percent respectively, despite a 41 percent reduction in maximum minute ventilation. Basal levels and the changes resulting from maximum exercise in PRA and Paldo were unaffected by pressure, but basal and exercise-stimulated levels of Panp and Pavp were reduced compared with 1.5 atm abs control values. Contrary to the hypothesis, Uosm was increased by about 200 mosm/kg by both exercise protocols during hyperbaric exposure and free water was conserved.
Author (AIAA)
Exercise Physiology; Pressure Effects; Kidneys; Hormones; Hyperbaric Chambers; High Pressure

19980071849

High refractive errors and the accident/incident rate in Canadian medical Category 1 pilots

Wallace, J. M., Canadian Civil Aviation Medicine Division, Canada; Liddy, B., Canadian Civil Aviation Medicine Division, Canada; Charbonneau, H., Canadian Civil Aviation Medicine Division, Canada; Balfour, D., Canadian Civil Aviation Medicine Division, Canada; Wielgosz, A., Canadian Civil Aviation Medicine Division, Canada; Aviation, Space, and Environmental Medicine; Nov. 1997; ISSN 0095-6562; Volume 68,, no. 11, pp. 1050, 1051; In English; Copyright; Avail: Aeroplus Dispatch

Since 1982, the Canadian Civil Aviation Medicine Division (CAMD) has medically certified to Category 1 standard commercial and airline transport pilots whose visual correction was in excess of +/- 3.5 diopters (D). A review between the years 1982 and 1991 of the 253 pilots who had been medically certified, although they were outside the standard, was conducted. We determined if there was any difference in the accident/incident rate in this group as compared with the Canadian general aviation population standardized to a rate per 100,000 flying hours. The 253 pilots were divided into two groups with Group A having a refractive error outside the range +/- 5.7 D and Group B having a refractive error range of +/- 3.5 to +/- 5.6 D. The Group A rate was within the expected range of accidents and incidents per 100,000 flying hours. The accident/incident rate in Group B was significantly lower than the expected average. CAMD's policy on granting 'flexibility' to applicants with moderate to high refractive errors has not affected adversely the accident or incident rate and therefore has not compromised aviation safety.

Author (AIAA)

Aircraft Pilots; Visual Acuity; Aircraft Accidents

19980072308

Medicine in manned space flight ***Geneeskunde in de bemande ruimtevaart***

Oei, S. I., Netherlands; Ruimtevaart; Aug. 1997; ISSN 1382-2446; Volume 46, no. 4, pp. 9-14; In Dutch; Copyright; Avail: Aeroplus Dispatch

The effects of space flight, and weightlessness in particular, on human physiology are examined. Effects on the cardiovascular system, the blood and immune systems, the skeletal system, and the neurological system are examined. The neurological system is discussed with particular attention given to the vestibulo-ocular reflex and the space adaptation syndrome.

AIAA

Manned Space Flight; Aerospace Medicine; Weightlessness

19980072516

Homeostatic versus circadian effects of melatonin on core body temperature in humans

Cagnacci, Angelo, Modena, Univ., Italy; Volpe, Annibale, Modena, Univ., Italy; Krauechi, Kurt, Psychiatric Univ. Clinic, Switzerland; Wirz-Justice, Anna, Psychiatric Univ. Clinic, Switzerland; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 509-517; In English; Copyright; Avail: Aeroplus Dispatch

In humans, the circadian rhythm of melatonin is strictly associated with that of CBT, the nocturnal decline of CBT being inversely related to the rise of melatonin. Whereas there is inconsistent evidence for the suggestion that the decline of CBT may prompt the release of melatonin, conversely, stringent data indicate that melatonin decreases CBT. Administration of melatonin during the day, when it is not normally secreted, decreases CBT by about 0.3 to 0.4 C, and suppression of melatonin at night enhances CBT by about the same magnitude. Accordingly, the nocturnal rise of melatonin contributes to the circadian amplitude of CBT. It is known that melatonin enhances heat loss, but a reduction of heat production cannot be excluded. Besides actions on peripheral vessels aimed to favor heat loss, it is likely that the effect of melatonin to reduce CBT is exerted mainly in the hypothalamus, where thermoregulatory centers are located. Recent observations have shown that the acute thermoregulatory effects induced by melatonin and bright light are independent of their circadian phase-shifting effects.

Author (AIAA)

Circadian Rhythms; Body Temperature; Human Body; Homeostasis; Temperature Control; Diurnal Variations

19980072519

Photic regulation of melatonin in humans - Ocular and neural signal transduction

Brainard, George C., Jefferson Medical College, USA; Rollag, Mark D., Uniformed Services Univ. of Health Sciences, USA; Hanifin, John P., Jefferson Medical College, USA; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 537-546; In English

Contract(s)/Grant(s): NAGW-1196; Copyright; Avail: Aeroplus Dispatch

The elements for physical/biological stimulus processing that regulate photic influences on melatonin secretion include the physics of the light source, gaze behavior relative to the light source, and the transduction of light energy through the pupil and ocular media. Elements for sensory/neural signal processing become involved as photons are absorbed by retinal photopigments

and neural signals are generated in the retinohypothalamic tract. Aspects of this physiology include the ability of the circadian system to integrate photic stimuli spatially and temporally as well as the wavelength sensitivity of the operative photoreceptors. Acute, light-induced suppression of melatonin is proving to be a powerful tool for clarifying how these elements of ocular and neural physiology influence the interaction between light and the secretion of melatonin from the human pineal gland.
Author (AIAA)
Human Body; Circadian Rhythms; Neurology; Visual Control; Biocontrol Systems; Light (Visible Radiation)

19980072521

Resetting the melatonin rhythm with light in humans

Shanahan, Theresa L., Brigham and Women's Hospital, USA; Zeitzer, Jamie M., Brigham and Women's Hospital, USA; Czeisler, Charles A., Brigham and Women's Hospital, USA; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 556-567; In English; Copyright; Avail: Aeroplus Dispatch

Investigations to date have firmly established that the melatonin rhythm can be reentrained following an inversion of the light-dark (LD) cycle. Exposure to bright light and darkness given over a series of days can rapidly induce large-magnitude phase shifts of the melatonin rhythm. Even single pulses of bright light can shift the timing of the melatonin rhythm. Recent data have demonstrated that lower light intensities than originally believed are capable of resetting the melatonin rhythm and that stimulation of photopically sensitive photoreceptors (i.e., cones) is sufficient to reset the endogenous circadian melatonin rhythm. In addition to phase resetting, exposure to light of critical timing, strength, and duration can attenuate the amplitude of the endogenous circadian rhythm of melatonin. Measurement of melatonin throughout resetting trials provides a dynamic view of the resetting response of the human circadian pacemaker to light. Future studies of the melatonin rhythm in humans may further characterize the resetting response of the human circadian timing system to light.
Author (AIAA)
Light (Visible Radiation); Human Body; Circadian Rhythms

19980072522

Acute and delayed effects of exercise on human melatonin secretion

Buxton, Orfeu, Chicago, Univ., USA; Hirschfeld, Ulrich, Chicago, Univ., USA; Van Cauter, Eve, Northwestern Univ., USA; L'Hermite-Baleriaux, Mireille, Bruxelles, Univ. Libre, Belgium; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 568-574; In English
Contract(s)/Grant(s): F49620-94-0203; F49620-96-1-0252; Copyright; Avail: Aeroplus Dispatch

Accumulating evidence suggests that exercise may have both rapid and delayed effects on human melatonin secretion. The presence and nature of both acute and delayed effects appear to be dependent on the timing of exercise. The presence of a detectable acute effect also depends on the duration, intensity, and type of exercise. Late evening exercise during the rising phase of melatonin secretion may blunt melatonin levels. High-intensity exercise during the nighttime period, when melatonin levels already are elevated, consistently results in a further (nearly 50 percent) elevation of melatonin levels. In support of the concept that a shift of the melatonin onset on the day after nighttime exercise represents a shift of intrinsic circadian timing is the observation that similar phase shifts (in both direction and magnitude) may be observed simultaneously for the onset of the circadian elevation of thyrotropin secretion. The observation of exercise-induced phase shifts of the onset of melatonin secretion is, therefore, interpreted as evidence that, in humans as in rodents, increased physical activity during the habitual rest period is capable of altering circadian clock function.
Author (AIAA)
Exercise Physiology; Human Body; Diurnal Variations; Nocturnal Variations

19980072525

Melatonin as a chronobiotic - Treatment of circadian desynchrony in night workers and the blind

Sack, Robert L., Oregon Health Sciences Univ., Portland, USA; Lewy, Alfred J., Oregon Health Sciences Univ., Portland; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 595-603; In English; Copyright; Avail: Aeroplus Dispatch

Although the causes are different, totally blind people (without light perception) and night shift workers have in common recurrent bouts of insomnia and wake-time sleepiness that occur when their preferred (or mandated) sleep and wake times are out of synchrony with their endogenous circadian rhythms. In this article, the patterns of circadian desynchrony in these two populations are briefly reviewed with special emphasis on longitudinal studies in individual subjects that used the timing of melatonin secretion as a circadian marker. In totally blind people, the most commonly observed pattern is a free-running rhythm with a stable non-24-h circadian period (24.2-24.5 h), although some subjectively blind people are normally entrained, perhaps by residually

intact retinoypothalamic photic pathways. Experiments at the cellular and behavioral levels have shown that melatonin can produce time-dependent circadian phase shifts. With this in mind, melatonin has been administered to blind people in an attempt to entrain abnormal circadian rhythms, and substantial phase shifts have been accomplished; however, it remains to be demonstrated unequivocally that normal long-term entrainment can be produced. In untreated night shift workers, the degree and direction of phase shifting in response to an inverted sleepwake schedule appears to be quite variable.
Author (AIAA)
Circadian Rhythms; Blindness; Night; Human Body; Work

19980072526
Efficacy of melatonin treatment in jet lag, shift work, and blindness
Arendt, Josephine, Surrey, Univ., UK; Skene, Debra J., Surrey, Univ., UK; Middleton, Benita, Surrey, Univ., UK; Lockley, Steven W., Surrey, Univ., UK; Deacon, Stephen, Surrey, Univ., UK; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 604-617; In English; Copyright; Avail: Aeroplus Dispatch

Melatonin is able to phase shift strongly endogenous rhythms, such as core temperature and its own endogenous rhythm, together with the sleep-wake cycle. Its ability to synchronize free-running rhythms has not been fully investigated in humans. There is evidence for synchronization of the sleep-wake cycle, but the available data suggest that it is less effective with regard to endogenous melatonin and core temperature rhythms. When suitably timed, most studies indicate that fast release preparations are able to hasten adaptation to phase shift in both field and simulation studies of jet lag and shift work. Both subjective and objective measures support this statement. However, not all studies have been successful. Careful evaluation of the effects on work-related performance is required. When used to alleviate the non-24-h sleep-wake disorder in blind subjects, again most studies report a successful outcome using behavioral measures, albeit in a small number of individuals. The present data suggest, however, that although sleep-wake can be stabilized to 24 h, entrainment of other rhythms is exceptionally rare.
Author (AIAA)
Jet Lag; Work; Blindness

19980072527
Commentary - Evidence for melatonin as a circadian phase-shifting agent
Czeisler, Charles A., Brigham and Women's Hospital, USA; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 618-623; In English; Copyright; Avail: Aeroplus Dispatch

Of all the health claims that have been attributed to melatonin during the recent craze of 'melatonin madness' (Reppert and Weaver, 1995), the claim that melatonin pills can ease jet lag by resetting the circadian clock is often reported as a proven fact. Yet, evidence for that mechanism of action is clouded by the claim that melatonin is a hypnotic (Roth and Richardson, 1997) since any effective sleep-inducing agent might be expected to improve the symptoms of jet lag. Unfortunately, the use of inconsistent terminology has further complicated comparisons of results across labs. This commentary reconciles these differences in language to highlight areas of both consensus and controversy.
Author (AIAA)
Circadian Rhythms; Phase Shift; Reviewing

19980072528
Melatonin and the circadian regulation of sleep initiation, consolidation, structure, and the sleep EEG
Dijk, Derk-Jan, Brigham and Women's Hospital, USA; Cajochen, Christian, Brigham and Women's Hospital, USA; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 627-635; In English; Copyright; Avail: Aeroplus Dispatch

Administration of melatonin during the day increases daytime sleep propensity as indexed by both the latency to sleep onset and sleep consolidation. The EEG during daytime sleep after melatonin administration exhibits characteristics reminiscent of the nocturnal sleep EEG, that is, increased sleep spindle activity and reduced slow-wave sleep and slow-wave activity, as detected by quantitative EEG analysis. Administration of higher doses of melatonin (5 mg or more) prior to nocturnal sleep results in an increase in rapid eye movement (REM) sleep. These data demonstrate that melatonin exerts effects on the main characteristics of human sleep, that is, latency to sleep onset, sleep consolidation, slow waves, sleep spindles, and REM sleep. There is a need for further studies using physiological doses and delivery systems that generate physiological plasma melatonin profiles to firmly establish the role of the endogenous circadian rhythm of melatonin in the circadian regulation of sleep.
Author (AIAA)
Circadian Rhythms; Sleep; Electroencephalography

19980072529

The acute soporific action of daytime melatonin administration - Effects on the EEG during wakefulness and subjective alertness

Cajochen, Christian, Psychiatric Univ. Clinic, Switzerland; Krauechi, Kurt, Psychiatric Univ. Clinic, Switzerland; Wirz-Justice, Anna, Psychiatric Univ. Clinic, Switzerland; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 636-643; In English; Copyright; Avail: Aeroplus Dispatch

Melatonin has been reported to have soporific effects; following daytime administration, it induces sleepiness and reduces sleep onset latency. However, subjective sleepiness is masked by a variety of stimuli and behaviors; thus, it is important to be able to delineate objective psychophysiological sequelae of melatonin administration. Alertness decrements during wakefulness are correlated with augmented theta/alpha power in the waking electroencephalogram (EEG). This has been validated in a constant routine protocol. In a variety of experiments with melatonin administration (5 mg), it is shown that the EEG changes can be measured immediately, before any subjective soporific effects are recognized. These increases in theta/alpha power occur when melatonin is administered during the day (1300 or 1800 h) but are less visible when near the endogenous melatonin rise in the evening (2040 h). Importantly, both subjective and objective measures of sleepiness are suppressed when subjects change posture from supine to standing.

Author (AIAA)

Sleep; Electroencephalography; Alertness; Wakefulness; Daytime

19980072530

Efficacy of melatonin as a sleep-promoting agent

Zhdanova, Irina V., MIT, USA; Wurtman, Richard J., MIT, USA; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 644-650; In English; Copyright; Avail: Aeroplus Dispatch

This article considers the dose dependence of melatonin effects on sleep, interindividual variability, and age-related differences in circulating melatonin levels produced in response to a given dose of the hormone. Possible side effects of melatonin treatment, and the use of an animal model to serve as a guide in the development of therapeutic applications, are also considered.

Author (AIAA)

Sleep; Age Factor

19980072531

Efficacy of melatonin as a hypnotic agent

Mendelson, Wallace B., Chicago, Univ., USA; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 651-656; In English; Copyright; Avail: Aeroplus Dispatch

The seemingly contradictory literature on the use of melatonin in insomnia is best understood by considering issues of time of administration (day or night), dose range (physiological or pharmacological), subject selection (normals or insomniacs), choice of dependent variable (self-report or EEG), and comprehensiveness of the reported variables (sleep onset or sleep maintenance). Available data on nighttime administration to normals and insomniacs are reviewed. It is concluded that there is not yet a convincing body of evidence, using generally accepted measures, that melatonin administration improves sleep in insomniacs with noncircadian sleep disturbance.

Author (AIAA)

Sleep; Insomnia

19980072532

Melatonin - Role in gating nocturnal rise in sleep propensity

Lavie, Peretz, Technion - Israel Inst. of Technology, Haifa, Israel; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 657-665; In English; Copyright; Avail: Aeroplus Dispatch

The present article reviews the evidence that melatonin possesses sleep-inducing effects and that it gates the increase in nocturnal sleepiness. It is shown that, without exception, all the studies that have investigated daytime administrations of melatonin reported increased sleepiness, even at doses that do not increase plasma levels of melatonin beyond its physiological levels. by contrast, nighttime increase in sleepiness was achieved only after administration of high doses. Based on these findings and on the precise coupling between the endogenous nocturnal increase in melatonin secretion and the opening of the sleep gate, it is suggested that melatonin participates in the regulation of the sleep-wake cycle by inhibiting the central nervous system wakefulness generating system. This inhibition allows a smooth transition from wakefulness to sleep. Clinical findings on decreased levels

of nocturnal melatonin in chronic insomniacs, and on the efficacy of exogenous melatonin in improving sleep in melatonin-deficient insomniacs, are congruent with this hypothesis.
Author (AIAA)
Sleep; Nocturnal Variations; Night

19980073088 Aichi Inst. of Tech., Toyota, Japan
Relationship of Body-Composition Types Physical Fitness Performance for College Men
Ohara, Shirou, Aichi Inst. of Tech., Japan; Bulletin of Aichi Institute of Technology; Mar. 1997; Volume 32, N0. 9, pp. 33-40; In Japanese; Also announced as 19980073087; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The purpose of this study was twofold: (1) to classify the body composition of healthy college men into certain types by combining percent body fat, and lean body mass per unit of height; and (2) to clarify the characteristics of physical fitness performance in each group. The subjects were 1067 healthy college men (average age: 18.3 +/- 0.6 years). Data collected on body forms and physical fitness performance of subjects in 1991-1996. Body density was calculated by the Suzuki-Nagamine skinfold thickness method for Japanese, and also %Fat by the Brozek formula. In order to check significant differences of mean values for each type, this study employed the t-test, and a statistically significant level of 0.05.
Author
Physical Fitness; Males; Human Body; Body Composition (Biology)

19980073089 Aichi Inst. of Tech., Toyota, Japan
An Approach to Auxology by Wavelet: Discussion in the Historical Detail and the Theoretical Background of Mathematical Function Before Proposing Wavelet
Fujii, Katsunori, Aichi Inst. of Tech., Japan; Bulletin of Aichi Institute of Technology; Mar. 1997; Volume 32, No. 9, pp. 41-50; In Japanese; Also announced as 19980073087; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Human growth is the phenomena in which an individual changes with time, the beginning of this process can be attributed to embryology. Recently, the significance of auxology has grown. Auxology is the phenomena in which the individual changes with time from birth to adult, and to elucidate the phenomena, is to investigate the universal principle. Therefore, studies which fit the mathematical function to the growth process are popularly known historically as the methodology to derive the universal principle in auxology. This paper investigates the historical significance and the theoretical background of fitting the mathematical function to the growth phenomena to derive the universal principle in auxology. The wavelet is proposed as a process which more effectively fits the mathematical function to the growth phenomena.
CASI
Wavelet Analysis; Growth; Mathematical Models; Functions (Mathematics)

53
BEHAVIORAL SCIENCES

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

19980050742
Visual behaviors for real-time control of a binocular active vision system
Batista, J., Univ. of Coimbra, Portugal; Peixoto, P.; Araujo, H.; Control Engineering Practice; October, 1997; ISSN 0967-0661; Volume 5, no. 10, pp. 1451-1461; In English; Copyright; Avail: Issuing Activity

An active vision system has to enable the implementation of reactive visual processes and of elementary visual behaviors in real time. Therefore the control architecture is extremely important. This paper discusses a number of issues related to the implementation of a real-time control architecture, and describes an architecture being used with camera heads. Even though in most applications a fully calibrated system is not required, a methodology for calibrating the camera head is also described, taking advantage of its degrees of freedom. Several visual processes are implemented, computing relevant measures for the control process. At higher levels the architecture is modelled as a state transition system. Finally, the paper shows how this architecture can be used to implement a pursuit behavior using optical flow.
Author (EI)
Binocular Vision; Real Time Operation; Visual Control; Computer Techniques; Degrees of Freedom; Optical Flow (Image Analysis)

19980050991

Initial captain training - A systems approach

Beaumont, Graham, Qantas Airways, Ltd., Australia; Aviation training: Learners, instruction and organization; 1997, pp. 216-235; In English; Copyright; Avail: Aeroplus Dispatch

A systems approach to initial captain training (ICT) that aims to increase the success rate of ICT by establishing a trainee-centered system that is responsive to differing needs of the trainee is presented. The trainee will be challenged, coached, and guided from co-pilot checkout, and potential to succeed will be carefully monitored. The proposed system will also reinforce the concept of a training culture. This systems approach is also designed to minimize the waste, both human and material, that can result from failure. As a result, organizations will be able to resort to 'just in time' ICT and meet crewing and budgetary targets.

AIAA

Pilot Training; Training Analysis; Training Evaluation

19980050993

Evaluation and the instructor

Anca, Joey M., Jr., Philippine Airlines, Philippines; Aviation training: Learners, instruction and organization; 1997, pp. 142-154; In English; Copyright; Avail: Aeroplus Dispatch

A Philippine Airlines (PAL) Flight Training Survey Questionnaire (composed of 20 questions on learning, instruction, and administration) that was given to flight crew members is described. The average means for the 'deep', 'achieving', and 'deep-achieving' approaches to training are illustrated. It is concluded that there is a need for systematic evaluation of ground instruction, and that instructors should be selected for their teaching competencies as well as their technical abilities.

AIAA

Instructors; Training Evaluation; Pilot Training; Flight Training

19980050994

Reducing attrition rates of cadet pilots

McNabb, Paul, Air Niugini, Papua New Guinea; Sellars, Ken, Air Niugini, Papua New Guinea; Aviation training: Learners, instruction and organization; 1997, pp. 111-120; In English; Copyright; Avail: Aeroplus Dispatch

A common problem for the airlines of Asia and the Pacific is the combination of pressure for localization and the attrition rate encountered in national cadet pilot training. Air Niugini has introduced an innovatory program which appears to be solving the problem. The 12-month program uses the knowledge of the Head Start educational programs of the 1960s, and their current research into pilots' learning as the bases for systematic personal development of the cadet pilots. Head Start, which began in the U.S. in the mid 1960s, was designed to prepare pre-school children to attend school. As the name suggests, the young children were given opportunities to develop socially and intellectually, through specially designed programs, so that when they entered school they had a 'head start', they were prepared for their future. Translated to the airline, this meant the preparation of newly selected cadet pilots so that on their entry into actual ab initio training, they would have had a period of 'working' in the airline in various departments and also would have had the opportunity to work at rectifying any weaknesses identified through the selection process. Importantly, the Head Start candidates would have been in direct contact with the organizational culture of the airline.

Author (AIAA)

Pilot Training; Training Analysis; Training Evaluation; Students; Flight Training

19980050996

Pilot characteristics

Hunter, David R., FAA, USA; Aviation training: Learners, instruction and organization; 1997, pp. 41-53; In English; Copyright; Avail: Aeroplus Dispatch

A large-scale FAA survey of pilots to obtain data to be used in support of research on aeronautical decision making and on designing training that meets pilots' needs is described. Tables are presented on recent and total flight experience, educational level attained, involvement in hazardous events, and attendance at FAA safety seminars.

AIAA

Aircraft Pilots; Pilot Training; Training Analysis; Training Evaluation

19980051618

Training and developing the aircrew manager

Farquharson, Terry L., Cathay Pacific Airways, Hong Kong; Aviation training: Learners, instruction and organization; 1997, pp. 286-299; In English; Copyright; Avail: Aeroplus Dispatch

This chapter examines reasons why aircrews have difficulty with the transition to the management role. The role the organization plays in this process is discussed. Proposals are made for a system of selection, training, and development which will benefit both the individual aircrew manager and the organization.
Author (AIAA)
Flight Crews; Training Analysis; Airline Operations

19980051625
Predicting and enhancing flightdeck performance
Roscoe, Stanley N., Illinois, Univ., Urbana, USA; Aviation training: Learners, instruction and organization; 1997, pp. 195-208; In English; Copyright; Avail: Aeroplus Dispatch

Beyond raw intelligence and motor skills, pilot performance depends largely on situational awareness, the overarching ability to attend concurrently to multiple sources of information, evaluate alternatives, establish priorities, and work on whatever has the highest momentary urgency. Crew duties add a social dimension to individual performance that is addressed by training in crew resource management. The PC-based WOMBAT test was designed to measure the situational awareness and attention-management ability of individual crew members under stress. The new DuoWOMBAT addresses the abilities of flight crews to manage their collective resources under similar conditions.
Author (AIAA)
Human Performance; Performance Prediction; Flight Crews

19980051630
Joint training and 'the real stuff'
Naef, Werner, Swissair, Switzerland; Aviation training: Learners, instruction and organization; 1997, pp. 128-141; In English; Copyright; Avail: Aeroplus Dispatch

The cooperation and synergy construction that result when a team of people with great potential are brought together for joint aviation training are discussed. It is found that: specialization in various areas of a company is increasing; polarizing, centrifugal, and other forces result from the creation of profit centers or cooperation in general; and cost pressures are increasingly gaining momentum. It is argued that the danger is great that these factors, particularly the pressure to reduce costs across the board, are pressurizing strategic investment and comprehensive solutions over the long term. A company's primary duties, in the present case product design in flight operations, must be reflected in aspects of training.
AIAA
Pilot Training; Training Analysis; Training Evaluation; Flight Crews; Flight Training

19980051633
The flight crew member's responsibility and role in aviation training
Gebers, Brett, South African Airways, South Africa; Aviation training: Learners, instruction and organization; 1997, pp. 97-110; In English; Copyright; Avail: Aeroplus Dispatch

Flight crews have usually been left to their own devices in terms of how to study and learn while attending ground school and simulator courses. With airlines becoming more cost conscious, flight crew and airline training departments will have to ensure that the desired learning is achieved in what is almost inevitably going to result in less and less time in the simulator and classroom. This places a heavy burden on the flight crew member to make the best use of the facilities and time available. This chapter offers some practical guidelines as to how crew members falling primarily into the following categories can achieve the best from the training courses they attend: initial type qualification (conversion) onto first airliner; initial command; type rating qualification (conversion) for captain, first officer and flight engineer; recurrent training at predetermined intervals; and requalification training following illness or layoffs.
Author (AIAA)
Flight Crews; Flight Training; Training Analysis; Training Evaluation

19980051634
Learning for new technologies
Moore, Phillip J., Newcastle, Univ., Australia; Telfer, Ross A., Newcastle, Univ., Australia; Aviation training: Learners, instruction and organization; 1997, pp. 87-96; In English; Copyright; Avail: Aeroplus Dispatch

One of the inevitabilities for pilots in commercial aviation in the 1990s and beyond is that they will need to become competent in the efficient and effective use of a range of ever increasingly complex technologies. In the case of automation of systems, the machinery is allocated functions that would otherwise be assigned to humans. New technologies have emerged, for example, in

training with computer-based training and flight motion simulators, on the flight deck (the glass cockpit), and in the very way in which flights are managed, as with the use of datalink. Indeed, it could be argued that for the majority of pilots undergoing conversion training, grappling with 'new' technologies plays a substantial role in both line operations and training. The level of difficulty is commensurate with the novelty of the technology. In this chapter we address the complexities of these issues and provide a glimpse of how experienced pilots tackle the problems of learning about and using new technologies.
Author (AIAA)
Pilot Training; Training Analysis; Training Evaluation; Aircraft Pilots; Flight Training

19980051636
Individual differences and CRM training
Schiewe, Albrecht, Lufthansa German Airlines, Germany; Moore, Phillip J., Newcastle, Univ., Australia; Aviation training: Learners, instruction and organization; 1997, pp. 67-77; In English; Copyright; Avail: Aeroplus Dispatch

An extension of Schiewe's (1995) work on a 3-d crew resource management (CRM) program for 77 pilots is presented. Attention is given to whether or not meaningful groupings of participants can be established from this sample and to what roles factors such as age, position, fleet affiliation, and pretraining attitudes to training may have in defining those groupings. The effects of the program on attitudes towards CRM training, as well as attitudes towards psychological training modifying behavior, are also examined.
AIAA
Pilot Training; Training Analysis; Training Evaluation; Flight Training

19980051637
Expertise and cognitive skills development for ab-initio pilots
Wiggins, Mark W., Newcastle, Univ., Australia; Aviation training: Learners, instruction and organization; 1997, pp. 54-66; In English; Copyright; Avail: Aeroplus Dispatch

A framework within which the development of cognitive training systems can occur is provided. The general characteristics of expertise are defined in terms of behavioral, cognitive, and affective elements to provide the basis for an examination of the general characteristics associated with cognitive expertise. From a training perspective, the extent and nature of the cognitive demands associated with a task can be determined through the application of information acquisition strategies including cognitive task analysis. This serves to clarify the training objectives necessary to develop and implement cognitive training strategies in the ab initio training environment and is therefore likely to increase both training efficiency and pilot safety.
AIAA
Pilot Training; Mental Performance; Training Analysis; Training Evaluation; Intelligence; Aircraft Pilots; Flight Training

19980051639
Age and pilot performance
Tsang, Pamela S., Wright State Univ., USA; Aviation training: Learners, instruction and organization; 1997, pp. 21-40; In English; Copyright; Avail: Aeroplus Dispatch

There are three major approaches to assess pilot performance: subjective evaluation of actual flight performance by the instructor or check pilot, quantitative off-line performance measures (e.g., tracking error, degree of deviation from a simulator flight course, reaction time), and accident rate. The present chapter reviews some of the known age effects on cognitive functions such as perception and decision making that have been identified to be essential to piloting. The relationship between pilot age, experience, perfomance, and accident rate is examined.
Author (AIAA)
Age Factor; Pilot Performance; Aircraft Pilots

19980051642
Aviation training: Learners, instruction and organization
1997; In English; ISBN 0-291-39837-5; Copyright; Avail: Aeroplus Dispatch

The present volume on aviation training discusses the roles of learning, instruction, and the organization in aviation training; age and pilot performance; pilot characteristics; and expertise and cognitive skills development for ab initio pilots. Attention is given to line-orientated flight training (LOFT) for facilitators, predicting and enhancing flightdeck performance, production of crew resource management programs, and a systems approach to initial captain training. Other topics addressed include organiza-

tional issues in human factor training, airline training for new technology, training and developing the aircrew manager, and the management of change in aviation training.
AIAA
Flight Training; Pilot Training; Aircraft Pilots; Training Analysis; Training Evaluation

19980057433
Pilot selection in the Norwegian Air Force - A validation and meta-analysis of the test battery
Martinussn, Monica, Tromso, Univ., Norway; Torjussen, Tore; International Journal of Aviation Psychology; 1998; ISSN 1050-8414; Volume 8,, no. 1, pp. 33-45; In English; Copyright; Avail: Aeroplus Dispatch

The purpose of this study was to evaluate the test battery currently used for pilot selection to the Norwegian Air Force. Selection is currently based on a standard battery of 20 different psychological tests as well as on medical tests and on an interview by a licensed psychologist. First, two-factor analyses were conducted to examine the relation between the tests in the battery. Then, a correlation study was conducted to evaluate the predictive validity of the tests against two criteria of pilot performance collected during the basic training period. Finally, a small-scale meta-analysis of previous validation studies in Norway was conducted. The best predictors of success in training, based on the meta-analysis, were Instrument Comprehension, Mechanical Principles, and Aviation Information (mean correlations 0.29, 0.23, and 0.22, respectively).
Author (AIAA)
Aircraft Pilots; Pilot Selection; Military Aircraft; Psychological Tests; Pilot Training

19980057436
Size-distance variance and eye accommodation - The ways of an investigator
Roscoe, Stanley N., ILLIANA Aviation Sciences, Ltd., USA; International Journal of Aviation Psychology; 1998; ISSN 1050-8414; Volume 8,, no. 1, pp. 75-80; In English; Copyright; Avail: Aeroplus Dispatch

Biased judgments of size and distance are encountered with all types of imaging displays, and the literature on visual perception is replete with violations of the size-distance invariance hypothesis, including the paradoxical moon illusion. to sort out the basic variables that relate these seemingly unrelated events calls for unfettered multifactor experimentation rather than the severe reduction of traditional psychophysical methodology. The high correlation among the focal distance of the eyes, apparent size, and changes in the locus of the retinal blind spot would never have been discovered if all cues to distance other than accommodation had been eliminated, as called for by experimental reductionists.
Author (AIAA)
Display Devices; Distance; Visual Perception; Psychophysiology; Visual Accommodation; Size (Dimensions)

19980058091
Effects of map orientation during learning on airport identification
Mealey, Jeannine B., NASA Ames Research Center, USA; Cohen, Malcolm M., NASA Ames Research Center, USA; Jordan, Kevin, San Jose State Univ., USA; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 104-110; In English; Copyright; Avail: Aeroplus Dispatch

If an observer first learns to recognize an object in a specific orientation, a significant increase in processing time usually occurs when the object is subsequently seen in a different orientation; this phenomenon is called the 'misorientation effect'. The present study examines how quickly and how accurately human observers discriminate between airport maps that are viewed in orientations other than those in which they were initially learned. Participants were trained to discriminate between two navigation maps that were seen in only one orientation; they subsequently were tested with maps and aerial photographs of the same airports that were presented in various orientations. Discriminative responses to maps of airports were most rapid when the maps were seen in the same orientation as that in which they were initially learned. A significant reduction in reaction time occurred with repeated presentations of the misoriented stimuli, and information learned from navigation maps was not sufficient for all observers to recognize aerial photographs of the same airports.
Author (AIAA)
Airports; Aerial Photography; Photomapping; Reaction Time; Pattern Recognition

19980058176
Problems of psychological monitoring in astronaut training
Morgun, V. V., Cosmonauts Training Center, Russia; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 313-317; In English; Copyright; Avail: Aeroplus Dispatch

Monitoring of the goal-oriented psychological changes of a man during professional training is necessary. The level of development of an astronaut's psychological features are checked by means of psychological testing, with the final aim of evaluating each professionally important psychological quality and for general evaluation. The list of psychological features needed for evaluation is determined, and empirically selected weight factors based on wide statistical sampling is introduced. Accumulation of psychological test results can predict an astronaut's ability to solve complicated problems in a flight mission. It can help to correct the training process and reveal weaknesses.
Author (AIAA)
Astronaut Training; Psychological Factors; Psychological Tests

19980058186
Multivariate discriminant analysis for assessing mental workload during dual task operation
Dong, Mingqing, 4th Military Medical Univ., China; Ma, Ruishan, 4th Military Medical Univ., China; Cheng, Hongwei, 4th Military Medical Univ., China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 358-362; In Chinese; Copyright; Avail: Aeroplus Dispatch

In order to investigate the efficiency of multivariate discriminant analysis (MDA) in the assessment of mental workload during dual task operations, various psychophysiological indices and performances were recorded. The dual task consisted of a primary visual tracking task and a secondary Oddball task. The results indicated that tracking error, latency of P3, and IBI of HR correlated well with the mental workload and that MDA succeeded in classifying the levels of mental workload with higher conformation rate than that using a single index. This suggests that MDA is meaningful in the assessment of mental workload under dual-task situations.
Author (AIAA)
Discriminant Analysis (Statistics); Multivariate Statistical Analysis; Workloads (Psychophysiology); Task Complexity; Mental Performance; Visual Tasks

19980060450
Supervisory task analysis - Aircraft maintenance environment
Kraus, David C., Galaxy Scientific Corp., USA; Gramopadhye, Anand K., Clemson Univ., USA; Saboda, Richard, Galaxy Scientific Corp., USA; Chandler, Terrell N., Galaxy Scientific Corp., USA; 1997, pp. 1878-1883; In English; Copyright; Avail: Aeroplus Dispatch

A safe and reliable air transportation system depends on a well-designed and operated maintenance system. The linchpin of the maintenance system is the supervisor who is responsible for the maintenance, repair, and delivery of an airworthy aircraft. A task analysis of the supervisory function was conducted to obtain a better understanding of the requirements of this function. For the purposes of this study, two large certified repair station facilities were selected because they provided a broad spectrum of supervisory personalities, protocols, and operational philosophies. In both facilities, the tasks and activities of lead mechanics and foremen were examined. A hierarchical task description/analysis technique was used, and the result was the recommendation of a leadership skills training curriculum to facilitate the leadership tasks and activities of first- and second-line supervisors within the aircraft maintenance environment.
Author (AIAA)
Aircraft Maintenance; Air Transportation; Maintenance Training

19980060536
Fostering peer relationships
Bhasin, R.; Pulp & Paper; Nov, 1997; ISSN 0033-4081; Volume 71, no. 11, pp. 33; In English; Copyright; Avail: Issuing Activity

The paper describes why good peer relationships are important and suggests ways of fostering relationships with your peers. A manager must identify key peers, be helpful, be dependable, avoid gossiping and keep this reality in perspective.
Author (revised by EI)
Management

19980062816
Crew resources *Resursy ehkipazha*
Risukhin, V., Russia; Grazhdanskaya Aviatsiya; Jul. 1997; ISSN 0017-3606, no. 7, pp. 22-24; In Russian; Copyright; Avail: Aeroplus Dispatch

Recent developments in the area of human factors engineering in Russian commercial aviation are briefly reviewed. These developments are largely based on the experience of the USA and other countries. In particular, attention is given to the introduc-

tion of Crew Resources Management (CRM) concepts, that were adopted in the USA in the late 1970s, and to the SHEL (software, hardware, environment, liveware) model.
AIAA
Human Factors Engineering; Civil Aviation; Software Development Tools; Hardware

19980066809
Validity of using non-pilot subjects to represent pilots in a sustained acceleration environment
Popper, Stephen E., USAF, USA; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1081-1087; In English; Copyright; Avail: Aeroplus Dispatch

A preliminary study determined the similarities between the personality of military pilots (transport and fighter) and centrifuge subjects using the Edwards Personal Preference Schedule. Past similar personality studies have shown differences between fighter and transport pilots, and general population vs male and female general aviators. to use subjects in lieu of pilots in the centrifuge, they must represent the pilot characteristics of interest, for both ethical and scientific reasons. With the increase in measuring performance metrics (e.g., reaction time, tracking tasks, missile evasion) during centrifuge testing, any factor effecting performance must be explored. It is unknown whether personality affects performance. Cluster analysis of 36 pilot and subject personality tests were conducted. The clusters generated by the 36 pilots and subjects did not match the Retzlaff and Gibertini (1987) clusters. Two clusters were preferred over three, and while the values of the personality variables Dominance, Exhibition, and Aggression were similar, the pilot membership did not coincide. Subjects had basically the same cluster characteristics as pilots and did not alter the pilot cluster composition characteristics when clustered together. Females did not appear to differ from the males in the cluster analysis.
Author (AIAA)
Aircraft Pilots; Fighter Aircraft; Personality Tests; Transport Aircraft; Sex Factor; Pilot Performance

19980066810
Stress in Air Force aviators facing the combat environment
Parsa, Brian B., USAF, School of Aerospace Medicine, USA; Kapadia, Asha S., USAF, School of Aerospace Medicine, USA; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1088-1092; In English; Copyright; Avail: Aeroplus Dispatch

This paper evaluates the effect of stress on four squadrons of USAF aviators in tactical high performance aircraft deployed for combat operations compared with U.S.-based aircrew using the Beck Depression Inventory as the evaluating instrument. This is a retrospective cross-sectional study consisting of 42 aviators in deployed squadrons stationed overseas and involved in a contingency mission, and 15 subjects stationed in the U.S. and not exposed to combat conditions. Each subject was administered the test instrument, which was completed in privacy and with complete anonymity. The hypotheses of interest were: the proportion of individuals in the population of fighter aircrew who would report excessive stress is 0, and no significant differences would exist in the proportion of individuals with excessive stress in the various squadrons. Using statistical methodology, these hypotheses were rejected. It is concluded that more studies in each given circumstance are necessary.
Author (AIAA)
Aircraft Pilots; Stress (Biology); Combat; Fighter Aircraft; Pilot Performance

19980066811
Content analysis of the crew communication with external communicants under prolonged isolation
Gushin, Vadim I., Ministry of Health, Inst. for Biomedical Problems; California, Univ., San Francisco, USA; Zaprisa, Nina S., Ministry of Health, Inst. for Biomedical Problems; California, Univ., San Francisco; Kolinitchenko, B., Ministry of Health, Inst. for Biomedical Problems; California, Univ., San Francisco; Efimov, Vladimir A., Ministry of Health, Inst. for Biomedical Problems; California, Univ., San Francisco; Smirnova, Tatiana M., Ministry of Health, Inst. for Biomedical Problems; California, Univ., San Francisco; Vinokhodova, Alla G., Ministry of Health, Inst. for Biomedical Problems; California, Univ., San Francisco; Kanas, Nick, Ministry of Health, Inst. for Biomedical Problems; California, Univ., San Francisco; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1093-1098; In English; Copyright; Avail: Aeroplus Dispatch

The communication between space crews and outside monitoring personnel in Mission Control (MC) gives valuable information about crewmember psychological health. We hypothesized that psychological closing and information filtration will be observed in a confined crew as the mission progresses and will differ by the type of communication (e.g., audio vs computer-generated) with the outside monitors in the simulated MC. In addition, communication patterns will vary with the specific group of people on-duty outside. Audio and computer communications between space simulation crews and MC teams were analyzed dur-

ing two isolation studies lasting 135 and 90 d. A number of temporal, content and quantitative parameters of verbal activity were examined. The total intensity of communication dropped after month 1 of the missions. The commander had the highest intensity of communication. There was evidence for the presence of psychological closing and information filtration in the crews over time, with some variation based on type of communication. Communication patterns differed with different outside teams. The communication between confined groups and outside monitoring personnel is affected by psychological closing and information filtration and by the make-up of the teams that comprise the monitoring groups.
Author (AIAA)
Spacecrews; Isolation; Psychological Effects; Health; Voice Communication; Content

19980066820
How to measure human adaptation in extreme environments - The case of Antarctic wintering-over
Le Scanff, Christine, Caen, Univ., France; Larue, Jacques, Caen, Univ., France; Rosnet, Elisabeth, Reims, Lab. de Psychologie Appliquee, France; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1144-1149; In English; Copyright; Avail: Aeroplus Dispatch

Whether wintering-over causes cognitive and sensory impairment and associated adaptation problems is still a subject of debate. Performance on cognitive and psychomotor tasks might be an indicator of adaptation problems. Ten scientists and six technicians (both groups clinically normal) who wintered-over for a year in the Antarctic. A subset of tasks of the AGARD standardized battery (SB) of Tests for Research with Environmental Stressors was completed eight times during the isolation. to assess adaptation, the adaptability questionnaire (AQ) was completed by the physician before every performance test. SB showed a sensitive period of adaptation at midwinter and at the end of the isolation, but the performance in the different tasks did not deteriorate exactly at the same time. No systematic relationship between AQ notations and SB performances was noted. However, three subjects showed significant positive correlations. Some clinically normal individuals can experience adaptation problems, and SB tasks can be an indicator of these problems when comparisons are done at an individual level.
Author (AIAA)
Human Performance; Cold Weather; Adaptation; Antarctic Regions; Sensory Perception; Psychomotor Performance

19980067918
Longitudinal studies of behavior and performance during a winter at the South Pole
Palinkas, Lawrence A., California, Univ., San Diego, USA; Johnson, Jeffrey C., East Carolina Univ., USA; Boster, James S., Connecticut, Univ., Storrs; Houseal, Matthew, Lubbock, Univ., USA; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 73-77; In English
Contract(s)/Grant(s): NSF DPP-90-96178; NSF BNS-90-11351; Copyright; Avail: Aeroplus Dispatch

It is hypothesized that decrements in performance in isolated and confined (ICE) environments occur in a linear, dose-response manner, occur in stages, or do not occur at all. Eighty-three members of the U.S. Antarctic Program spent an austral winter at the Amundsen-Scott South Pole Station (90 deg S) between 1991 and 1994 and completed the Profile of Moods States (POMS) once a month for an 8-mo period from March through October. Over the entire 8-mo period, there was a decline in depression and vigor, and an increase in fatigue and tension-anxiety. of these four measures, only vigor exhibits a linear pattern. Mean scores for tension-anxiety and fatigue were lower during the first half of the winter than the second half. In comparisons between each quarter and the remaining three quarters, averaged mean tension-anxiety scores and fatigue scores were lower during the second quarter, and higher during the fourth quarter than during the previous three quarters combined. It is concluded that the duration of optimal performance in isolated and extreme environments and the explanation for changes in performance during long duration assignments in such environments both depend on what behavioral measure is used to assess performance.
Author (AIAA)
Winter; Antarctic Regions; Social Isolation; Confinement; Human Behavior; Human Performance

19980069545
Disorientation
Money, Kenneth, Civil Inst. of Environmental Medicine, Canada; Nouvelle Revue d'Aeronautique et d'Astronautique; Sep. 1997; ISSN 1247-5793, no. 4, pp. 40-44; In English; Copyright; Avail: Aeroplus Dispatch

Spatial disorientation is defined, and four specific examples are described. The basic cause of disorientation and the source of knowledge about it are examined. Attention is then given to certain mechanisms whereby accelerations and alcohol can produce disorientation. Finally, some comments are made on instruction for pilots dealing with disorientation.
AIAA
Aircraft Pilots; Disorientation

19980069944

Operational psychological issues for Mars and other exploration missions

Vander Ark, Stephen T., Krug Life Sciences, Inc., USA; Curtis, Kelly D., Krug Life Sciences, Inc., USA; Holland, Albert W., NASA Johnson Space Center, USA; Flynn, Christopher F., NASA Johnson Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972290; Copyright; Avail: Aeroplus Dispatch

Long duration NASA-Mir program missions, and the planned International Space Station missions, have given impetus for NASA to implement an operational program of psychological preparation, monitoring, and support for its crews. For exploration missions measured in years, the importance of psychological issues increases exponentially beyond what is currently done. Psychologists' role should begin during the vehicle design and crew selection phases. Extensive preflight preparation must focus on individual and team adaptation, and leadership. Factors such as lack of resupply options and communication delays will alter inflight monitoring and support capabilities, and require a more self-sufficient crew. Involvement in postflight recovery will also be necessary to ensure appropriate reintegration to the family and job.

Author (AIAA)

Manned Mars Missions; Psychological Factors; Long Duration Space Flight; International Space Station; Spacecrews; Flight Training

19980069967

Development of a power-assisted space suit glove joint

Sorenson, E. A., Maryland, Univ., College Park, USA; Sanner, R. M., Maryland, Univ., College Park; Howard, R. D., Maryland, Univ., College Park; Akin, D. L., Maryland, Univ., College Park; Lingo, B., ILC Dover, Inc., USA; Cadogan, D., ILC Dover, Inc., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972323; Copyright; Avail: Aeroplus Dispatch

The need for improvement of EVA gloves has been identified by NASA and the user community. Particularly important, especially for near-to-long term goals in the space program, is the need to reduce the fatigue associated with manual tasks. The U. of Maryland Space Systems Laboratory, together with ILC Dover, are currently developing an unobtrusive, power-assisted EVA glove that will attempt to provide a suited crewperson with close-to-nude-body hand dexterity. The power-assisted joint is designed to provide sufficient force to offset the resistance of the pressurized glove itself, thus alleviating manual fatigue, but provides no additional strength augmentation. This paper describes the initial prototype power-assist mechanism which has been developed, reviewing the relevant design issues and discussing the initial test results from the prototype.

Author (AIAA)

Space Suits; Gloves; Extravehicular Activity

19980070006

Human adjustment to isolation and confinement

Stuster, Jack, Anacapa Sciences, Inc., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972399; Copyright; Avail: Aeroplus Dispatch

Small groups living and working in isolation and confinement experience unique stressors that have predictable effects on individual adjustment and mission performance. Because the stress is cumulative, long duration missions impose considerable burdens on an individual's capacity to adjust to the conditions and to perform well, both technically and socially. This paper describes research conducted to extrapolate design and procedural guidelines for lunar and planetary expeditions from a review of information concerning analogous conditions, including Antarctic winter-over experiences and previous expeditions and voyages of discovery. It is found that humans can adjust to and perform well under conditions that are far more austere and arduous than those anticipated for future space crews, if proper precautions are made.

Author (AIAA)

Social Isolation; Confinement; Behavior; Human Performance

19980072335

Controller situation awareness in free flight

Endsley, Mica R., Texas Tech Univ., Lubbock, USA; Mogford, Richard H., FAA, William J. Hughes Technical Center, USA; Stein, Earl, FAA, William J. Hughes Technical Center, USA; 1997, pp. 4-8; In English; Copyright; Avail: Aeroplus Dispatch

This study provides an objective evaluation of some of the possible effects of free flight on controllers' ability to maintain an accurate and complete picture of the traffic situation. This picture or mental representation is essential for monitoring and separation functions. The study revealed that, using current technology, some aspects of free flight might adversely influence the situa-

tion awareness and performance of controllers. The results of this study provided information for better defining how free flight should be implemented and for determining needed design and procedural modifications to support the concept.
Author (AIAA)
Free Flight; Air Traffic Controllers (Personnel); Human Performance; Aircraft Control

19980072337
Success and failure at self-separation in simulated free flight
Smith, Kip, Minnesota, Univ., Minneapolis, USA; Briggs, Amy, Minnesota, Univ., Minneapolis; Knecht, William, Minnesota, Univ., Minneapolis; Hancock, Peter, Minnesota, Univ., Minneapolis; 1997, pp. 13-17; In English
Contract(s)/Grant(s): FAA-93-G-048; Copyright; Avail: Aeroplus Dispatch

Pilots in free flight will assume responsibility for self-separation. This paper discusses research that identifies constraints on a pilot's ability to maintain self-separation in free flight. It documents a principled approach to scoring the concurrent verbal reports of pilots engaged in simulated en route traffic scenarios. One such protocol is used to identify a mismatch between the tacit criteria for self-separation invoked by professional airline pilots and the separation criterion currently mandated by the FAA: 5 mi laterally and 1000 ft vertically.
Author (AIAA)
Free Flight; Aircraft Approach Spacing; Flight Simulation; Aircraft Control; Automated En Route ATC; Aircraft Pilots

19980072340
Validation of the explanatory concept for decision support in air-to-air combat
Crick, Jeffrey L., Defence Evaluation and Research Agency, UK; Selcon, Stephen J., Defence Evaluation and Research Agency, UK; Piras, Maddalena, Defence Evaluation and Research Agency, UK; Shanks, Craig, Defence Evaluation and Research Agency, UK; Drewery, Chris, Defence Evaluation and Research Agency, UK; Bunting, Alex, Defence Evaluation and Research Agency, UK; 1997, pp. 28-31; In English; Copyright; Avail: Aeroplus Dispatch

A decision-support aid developed for use by pilots in air-to-air combat was evaluated in a simulated beyond-visual-range combat scenario in which military pilots competed against one another head-to-head. Combat performance was assessed on a range of operationally-valid measures with three different versions of a head-down display showing integrated information derived from data fusion. One version presented graphical, dynamic representations of both ownship's and the enemy's missile performance envelopes (launch success zones); another showed only the launch success zones of the enemy aircraft; and a third, control version showed neither form of graphical representation. Superior attacking performance was demonstrated with the display showing both ownship and enemy launch success zones, while more successful evasive performance was associated with the display showing only enemy launch success zones. Greater levels of situation understanding were associated with the display showing both ownship and enemy launch success zones. The results lend ecological validity to the use of explanatory graphical displays in providing decision support for pilots in air-to-air combat.
Author (AIAA)
Combat; Decision Making; Air Defense; Warfare; Attack Aircraft; Display Devices; Pilot Performance

19980072355
Effects of age and experience on mental workload for computer tasks
Nair, Sankaran N., Miami, Univ., USA; Hoag, Didrik W., Miami, Univ., USA; Leonard, Dwayne C., Miami, Univ., USA; Sharit, Joseph, Miami, Univ., USA; Czaja, Sara J., Miami, Univ., USA; 1997, pp. 139-143; In English
Contract(s)/Grant(s): NIH-AG-11748-05; Copyright; Avail: Aeroplus Dispatch

This study examined the influence of age and experience on mental workload for three computer tasks. Three hundred forty-five subjects, ranging in age from 20 to 75 yr, performed one of three computer tasks over a 3-d period. The tasks included: data entry, data-base inquiry, and accounts balancing. The data indicated significant main effects of days and task and significant task x days and age x days interactions. Overall, ratings of workload decreased with experience on the task, and the participants perceived higher workload for the accounts balancing task as compared to the other two tasks. The effects of experience varied across the three tasks and according to age. Ratings of workload decreased over time for the data-base inquiry and accounts balancing tasks; there was no change for the data entry task. With respect to age, the data indicated that ratings of workload declined with experience for the younger and middle-aged participants but not for the older subjects.
Author (AIAA)
Age Factor; Experience; Workloads (Psychophysiology); Mental Performance; Human-Computer Interface; Tasks

19980072356

The influence of age and experience on the performance of a data entry task

Czaja, Sara J., Miami, Univ., USA; Sharit, Joseph, Miami, Univ., USA; 1997, pp. 144-147; In English

Contract(s)/Grant(s): NIH-AG-11748-05; Copyright; Avail: Aeroplus Dispatch

Findings from research examining age and computer task performance indicate that older people perform less well than younger people on these types of tasks. The present study examined whether age-related performance differences are maintained with task experience. to address this issue 110 subjects, ranging in age from 20 to 75 yr, performed a data entry task over a 3-d period. The task represented a simulation of a real world job. The data indicated significant age differences in work output (amount of data entered). Further, although there were significant improvements in performance with increased task experience across subjects, age group differences were maintained over time. With respect to errors there were no age effects, and there was a significant reduction in errors across the three days. However, the pattern of change varied across age groups. These results are consistent with other studies which suggest that experience does not compensate for age effects for tasks which emphasize speed of processing.

Author (AIAA)

Age Factor; Experience; Tasks; Psychomotor Performance; Human Performance; Human-Computer Interface

19980072357

Assessing performance of AWACS command and control teams

Elliott, Linda R., USAF, Armstrong Lab., USA; Neville, Kelly, USAF, Armstrong Lab., USA; Dalrymple, Mathieu A., Systems Research Lab., USA; 1997, pp. 172-176; In English; Copyright; Avail: Aeroplus Dispatch

Performance constructs are discussed within the context of complex and dynamic command and control (C2) team performance. Airborne Warning and Control System (AWACS) team members function in an information-rich environment, exchanging updates through an array of visual displays and communication channels. In combat, they face challenges of limited resources, ambiguous information, time pressure, and enemy interference. Subsequently, accurate assessment of communication, coordination, and decision making in AWACS teams can be difficult and time-consuming. Theoretical predictions arising from laboratory tasks must ultimately face the test of external validity using criterion measures of performance. This paper describes some of the challenges in developing criterion measures of performance and situation assessment within a dynamic and complex task requiring high expertise and teamwork. Results from two studies are briefly described.

Author (AIAA)

AWACS Aircraft; Command and Control; Teams; Human Performance; Performance Prediction; Prediction Analysis Techniques

19980072358

The effects of decision time and decision-aid accuracy on workload and performance

Entin, Eileen B., Alphatech, Inc., USA; Entin, Elliot E., Alphatech, Inc., USA; 1997, pp. 177-181; In English

Contract(s)/Grant(s): DAA15-92-C-0078; Copyright; Avail: Aeroplus Dispatch

Assessing the impact of providing a decision aid on decision time, workload, and performance is critical for optimizing overall human-system performance. This paper first examines the effects of providing a decision aid on decision time and workload and then looks at the effects of decision time and decision-aid accuracy on performance. Results show that the availability of a decision aid exacts a penalty in decision time but provides a significant decrease in cognitive workload. The availability of a decision aid significantly increases operators' performance, but does not raise it to the performance level that a high accuracy decision aid would achieve. Contrary to expectation, a longer decision time has a negative effect on performance, especially with a low accuracy decision aid. The results indicate the importance of providing operators with training in the use of a decision aid so they develop an accurate mental model of how it works and how to optimize the integration of its judgments with their own.

Author (AIAA)

Workloads (Psychophysiology); Accuracy; Human Performance; Time Dependence; Decision Making; Cognitive Psychology; Target Recognition

19980072359

Decision skills training

Klein, Gary, Klein Associates, Inc., USA; McCloskey, Michael, Klein Associates, Inc., USA; Pliske, Rebecca, Klein Associates, Inc., USA; Schmitt, John; 1997, pp. 182-185; In English

Contract(s)/Grant(s): N00178-95-D-1008; Copyright; Avail: Aeroplus Dispatch

An approach to training decision skills was developed that attempts to train people to learn like experts, rather than to think like experts. Several methods were developed to provide increases in experience, and increases in the amount of learning that could

be derived from experiences. These included a technique for identifying decision requirements, a method for presenting low-level simulations, a method for reflecting on the decision making in training events, a method for mentally simulating plans, and a method for leaders to obtain feedback on the expression of intent. The training was presented to 30 U.S. Marine Corps squad leaders at Camp Pendleton, CA, over a period of 3.5 mo. Initial subjective evaluations are high, indicating good user acceptance.
Author (AIAA)
Decision Making; Training Analysis; Education

19980072364
Broadening the measurement of situation awareness through cognitive engineering methods
Cooke, Nancy J., Mew Mexico State Univ., Las Cruces, USA; Stout, Renee, U.S. Navy, Naval Air Warfare Center, USA; Salas, Eduardo, U.S. Navy, Naval Air Warfare Center, USA; 1997, pp. 215-219; In English
Contract(s)/Grant(s): N61339-97-M-0507; N61339-96-M-0872; Copyright; Avail: Aeroplus Dispatch

Situation awareness (SA) and team SA are popular concepts, yet vaguely defined and inadequately measured. They involve representations of the current situation, performance resulting from those representations, and cognitive structures and processes leading to those representations. Current measures of individual and team SA focus on the assessment of performance or the accuracy of the resulting situation model at the expense of other aspects of SA, such as situation assessment, mental models, and team process behaviors. As a result, these measures fail to capture the richness of the constructs of individual and team SA, critical for applications involving training and team SA. We propose that a cognitive engineering approach to measuring SA which focuses on the elicitation of the cognition underlying SA can extend measurement by overcoming many of the current limits. As an illustration, the measurement of situation models using this approach is presented.
Author (AIAA)
Cognitive Psychology; Psychometrics; Human Factors Engineering

19980072365
Operator specific modeling of identification judgments in a complex dynamic task
Gay, Paul, Georgia Inst. of Technology, Atlanta, USA; Phipps, Donita A., Georgia Inst. of Technology, Atlanta; Bisantz, Ann M., Georgia Inst. of Technology, Atlanta; Walker, Neff, Georgia Inst. of Technology, Atlanta; Kirlik, Alex, Georgia Inst. of Technology, Atlanta; Fisk, Arthur D., Georgia Inst. of Technology, Atlanta; 1997, pp. 225-229; In English
Contract(s)/Grant(s): N61339-95-K-0018; Copyright; Avail: Aeroplus Dispatch

We consider the problem of training operators to make identification judgments from multidimensional, possibly probabilistic, information sources. We used models of the environment and the operator to measure the causes of lack of fit of the operator to the environment. Linear regression was used to model the relationship between cues and identifications. Cues in the environment were regressed on the correct identification to obtain the environmental model. These same cues were regressed on the operators' identity judgments to obtain the operator models. Individual environmental models were necessary in order to properly represent the environment when operator decisions and timing shaped the environment dynamically. High agreement between environmental and operator models were linked to top performance on the task. Implications for training are discussed.
Author (AIAA)
Judgments; Task Complexity; Training Analysis; Operators (Personnel); Mathematical Models; Identifying; Environment Models

19980072366
Reducing situation awareness errors in air traffic control
Jones, Debra G., Texas Tech Univ., Lubbock, USA; 1997, pp. 230-233; In English; Copyright; Avail: Aeroplus Dispatch

Since situation awareness (SA) is vital to the decision process, SA errors can degrade decision making. Many SA errors occur when all the relevant information has been correctly perceived. In these cases, the information's significance is not comprehended, and a representational error occurs. Schema influence this comprehension aspect of SA. This study investigates the impact of information with certain schema-related characteristics on SA: (1) schema bizarre information will impact SA more than schema irrelevant information, and (2) schema unexpected information will impact SA more than the absence of schema expected information. Using a high fidelity ATC simulation, misinformation was provided to the controller and schema-related cues were furnished to indicate the error. The results indicated that schema bizarre cues impacted SA more than schema irrelevant cues, and that no difference existed between the impact of the absence of schema-expected cues and schema-unexpected cues. Additionally, the results emphasize the difficulty incurred when trying to prevent SA errors.
Author (AIAA)
Air Traffic Control; Air Traffic Controllers (Personnel); Human Performance; Control Simulation

19980072367

Aircrew response procedures to inflight mechanical emergencies

Deaton, John E., CHI Systems, Inc., USA; Glenn, Floyd A., III, CHI Systems, Inc., USA; Federman, Philip J., CHI Systems, Inc., USA; Nickerson, G. W., Pennsylvania State Univ., State College; Byington, Carl S., Pennsylvania State Univ., State College; Malone, Robert, Galaxy Scientific, USA; Stout, Renee, U.S. Navy, Naval Air Warfare Center, USA; Oser, Randall, U.S. Navy, Naval Air Warfare Center, USA; Tyler, Robert R., U.S. Navy, Naval Air Warfare Center, USA; 1997, pp. 234-237; In English; Copyright; Avail: Aeroplus Dispatch

The central goal of this investigation was to study crew response procedures to inflight mechanical system emergencies. This study assessed those cognitive activities found to be important when responding to mechanical emergencies and the attention that is devoted to each of these activities. Participants are required to fly a predetermined mission scenario in which mechanical system failures were introduced. Aircrews were asked to identify the procedures that were triggered by each problem condition, and how their attention was allocated to various cognitive activities. The usefulness of a preliminary taxonomic structure that was developed to characterize the cognitive activities of aircrews engaged in a simulated flight scenario will become apparent during actual interface development. These activities will be translated into interface design and functionality requirements to support new sensor/diagnostic technologies currently being developed.

Author (AIAA)

Flight Crews; Emergencies; System Failures; Aircraft Hazards; Aircraft Equipment; Man Machine Systems; Human Reactions

19980072369

Shift changes, updates, and the on-call model in Space Shuttle Mission Control

Patterson, Emily S., Ohio State Univ., Columbus, USA; Woods, David D., Ohio State Univ., Columbus; 1997, pp. 243-247; In English

Contract(s)/Grant(s): NAG9-786; Copyright; Avail: Aeroplus Dispatch

A field study was conducted to investigate what it means to update a supervisory controller on the status of a continuous, anomaly-driven process in a complex, distributed environment. Sixteen shift changes, or handovers, were observed during an anomalous Space Shuttle mission. Handover updates included descriptions of events that had occurred, ongoing activities, results of data analyses, and changes to mission plans. The controllers engaged in intense, interactive briefings that highlighted what the incoming controller needed to review more deeply following the update. Interrogation strategies were employed by the incoming controllers. Implications for organizational investments and the design of tools to support updates are discussed.

Author (AIAA)

Space Shuttle Missions; Ground Based Control; Human Performance; Ground Crews; Scheduling; Information Dissemination

19980072370

Dispositional self-confidence in judgment and framing bias susceptibility in a dynamic decision making environment

Nygren, Thomas E., Ohio State Univ., Columbus, USA; Ransom-Flint, Terry, Ohio State Univ., Columbus; 1997, pp. 249-253; In English; Copyright; Avail: Aeroplus Dispatch

Decision-makers demonstrate framing bias when their decision making behavior is a function of the contextual presentation or framing (positive or negative) of the decision problem. Framing effects in simple, static situations (e.g., gambling) have been well documented, but past research on framing has typically ignored both dynamic environments and the effects of predispositional variables like risk-taking tendency and confidence in judgment. We examined the impact of these influences by exposing participants who measured either very high or low in decision making self-confidence to a high workload environment with either an 'opportunity for gain' or a 'threat of loss' decision frame condition. Participants performed a multi-task, computer-generated flight simulation program (the MAT) for 30 min. Results indicated that participants' actual performance on the MAT subtasks could be affected by the framing manipulation, and also that their decision strategies to optimize task performance were influenced by both by the framing manipulation and their self-confidence level.

Author (AIAA)

Confidence; Judgments; Decision Making; Human Performance; Bias

19980072371

The effect of experience background on remote diagnosis

Xiao, Yan, Maryland, Univ., Baltimore, USA; Mackenzie, Colin F., Maryland, Univ., Baltimore; Spencer, Richard L., Maryland, Univ., Baltimore; 1997, pp. 254-258; In English

Contract(s)/Grant(s): N00014-91-J-1540; NCC2-921; Copyright; Avail: Aeroplus Dispatch

Telecommunication systems have enabled experts to offer consultation to spatially distanced locations. to understand this mode of distributed decision making, a series of experiments were conducted to contrast how experts with different experience background (nurses, surgeons, and anesthesiologists) extract information from audio-video sources. These experiments were designed to simulate remote diagnosis tasks in which experts provide consultation through video linkage. Although all were experienced with the domain and given the same stimulus materials, these three groups of experts differed in their abilities to detect critical cues and offer diagnostic suggestions. It appears that experts were bound by their own regular roles in a resuscitation team. The findings suggest that to provide consultation of dynamic, multidisciplinary team-oriented activities, an assembly of teleconsultants and/or special training is needed to provide effective consultation.
Author (AIAA)
Experience; Decision Making; Diagnosis; Medical Personnel; Telemedicine; Audio Visual Material

19980072376
Effects of scene-linked symbology on flight performance
Shelden, Stephen G., San Jose State Univ., USA; McCann, Robert S., San Jose State Univ., USA; Foyle, David C., NASA Ames Research Center, USA; 1997, pp. 294-298; In English; Copyright; Avail: Aeroplus Dispatch

Previous research has shown that the presence of aircraft HUD symbology indicating altitude improves maintenance of altitude, but at a cost to (ground) path-following ability. We term this the altitude/path performance trade-off. Differential motion between HUD symbology and the world has been posited as leading to attentional tunneling on the symbology at the expense of flight information in the world. In the first of two flight simulation studies, scene-linked symbology was tested to see if the absence of differential motion cues between the symbology and the world would negate attentional tunneling and the resulting performance trade-off. This not only proved to be the case, but relative to a control condition with no explicit altitude display, scene-linked symbology yielded improved altitude and path performance. In the second study, an attempt was made to discern the source of improvement in path performance found with the use of scene-linked symbology. The result suggests that flight task integration and fusion of the symbology with the world permits object-based parallel processing benefits that are evidenced by improved path-following performance.
Author (AIAA)
Symbols; Head-Up Displays; Aircraft Performance; Flight Instruments; Flight Simulation; Man Machine Systems

19980072378
Measuring human detection performance in aircraft visual inspection
Drury, Colin G., New York, State Univ., Buffalo, USA; Spencer, Floyd W., Sandia National Labs., USA; Schurman, Donald L., Idaho National Engineering and Environmental Lab., Idaho Falls; 1997, pp. 304-308; In English; Copyright; Avail: Aeroplus Dispatch

In airworthiness assurance, while there is a long tradition of measuring inspection reliability for machine-aided NDI, the more common visual inspection has received little attention. Yet inspection reliability measurements are needed if we are to set appropriate inspection intervals for airframe components. Visual inspection of aircraft is characterized as using multiple senses (despite its name) and having to inspect for multiple fault types, in contrast to NDI which is used for single specific fault types. The study here used 12 professional inspectors to perform nine visual inspection tasks on a long-service Boeing 737 aircraft. Each inspector worked over two days. Measures were taken of performance, strategy, and individual differences. Only a fraction of the results are presented here, with a major finding that aircraft visual inspection has approximately the same reliability as industrial inspection. Individual differences were found, as well as correlations between certain aspects of performance and individual characteristics such as field independence and peripheral visual acuity. However, there was little correlation between an individual inspector's performance on the different tasks, showing the difficulty of designing selection and placement procedures for such a wide-ranging job.
Author (AIAA)
Inspection; Human Performance; Fault Detection; Aircraft Structures; Reliability Analysis; Visual Tasks

19980072385
Beyond 'hits' and 'misses' - Evaluating performance on typical inspection tasks of regional airline inspectors
Wenner, Caren, New York, State Univ., Buffalo, USA; Wenner, Frederick, New York, State Univ., Buffalo; Drury, Colin, New York, State Univ., Buffalo; Spencer, Floyd, Sandia National Labs., USA; 1997, pp. 579-583; In English; Copyright; Avail: Aeroplus Dispatch

Eleven inspectors from regional airlines participated in a study on inspection performance conducted at the FAA's Airworthiness Assurance NDI Validation Center (AANC) at Sandia Laboratories. These inspectors were asked to perform six inspection

tasks, typical of inspections performed in their airline's maintenance department, on a testbed aircraft using workcards developed by the researchers. Performance on these six tasks varied widely between inspectors. Differences in performance were due to three main factors: differences in the domain knowledge of the inspectors, differences in workcard familiarity, and differences in the way the tasks were approached. The major factor seemed to be the individual's approach to the tasks.
Author (AIAA)
Inspection; Airline Operations; Passenger Aircraft; Commercial Aircraft; Aircraft Maintenance; Human Performance

19980072386
Individual differences in performance accuracy as a function of work load manipulation
Ippel, Martin J., USAF, Armstrong Lab., Brooks AFB, TX; Leiden, Univ., Netherlands; 1997, pp. 584-588; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents a theoretical analysis of how manipulation of workload effects task performance as measured by accuracy scores. The analysis is based on a central assumption of human performance theory: the assumption of limited cognitive resources. It is shown that the addition of an individual difference postulated by this theory makes it possible to derive a class of mathematical models that allows precise predictions of response accuracy as a function of cognitive work load (task parameter) and available resources (subject parameter).
Author (AIAA)
Workloads (Psychophysiology); Human Performance; Accuracy; Performance Prediction

19980072387
Individual differences in visual, motor and cognitive performances - Correlations with a simulated Shuttle landing task
Kennedy, Robert S., Essex Corp., USA; Lane, Norman E., Essex Corp., USA; Turnage, Janet J., Star Mountain, Inc., USA; Harm, Deborah L., NASA Johnson Space Center, USA; 1997, pp. 589-593; In English
Contract(s)/Grant(s): NAS9-19107; Copyright; Avail: Aeroplus Dispatch

Numerous physiological changes which occur during and following space flight are well-documented. Documenting the extent and nature of such potential performance decrements, to the extent that they occur, becomes increasingly important as NASA prepares for longer-duration missions on Space Station and contemplates more complex missions in future exploration of space. We explored the application of a methodology we are developing called surrogate testing. The method requires the linkage of complex real world tasks to more elemental tasks. This report shows, as first steps, predictive validities of such tests for a simulated Shuttle landing and provides a series of surrogate scores which can be used to evaluate stresses and drug effects.
Author (AIAA)
Cognitive Psychology; Pilot Performance; Spacecraft Landing; Landing Simulation; Psychomotor Performance; Visual Tasks

19980072388
Psychological mood profiles of Army, Marine Corps, and Special Operations Forces personnel
Johnson, Richard F., U.S. Army, Research Inst. of Environmental Medicine, USA; Merullo, Donna J., Geo-Centers, Inc., USA; 1997, pp. 594-598; In English; Copyright; Avail: Aeroplus Dispatch

Elite male athletes have been portrayed as possessing positive mental health. On standardized measures of mood, they typically score below average on tension, depression, anger, fatigue, and confusion while they score above average on vigor. This mood pattern has been labeled the 'iceberg profile' because scores on unhealthful moods fall below the adult norm, while scores on the healthy mood, vigor, fall above the norm. The elite athlete's iceberg profile of moods is generally regarded as a result of physical training and competition. In this study, mood profiles of male military personnel were measured. U.S. Army soldiers and U.S. Marines both exhibited a flattened iceberg profile, scoring no higher than average on the positive mood vigor. In contrast, Special Operations Forces, who are noted for adherence to very demanding exercise routines, exhibited the iceberg profile typical of the elite male athlete: they had a higher than normal vigor score and lower than normal tension, depression, anger, fatigue, and confusion scores.
Author (AIAA)
Armed Forces (USA); Moods; Athletes; Psychological Tests; Mental Health

19980072389
Body consciousness and situation awareness in perceptual motor systems
Jackson, Tonya S., North Carolina State Univ., Raleigh, USA; Klein, Katherine W., North Carolina State Univ., Raleigh; 1997, pp. 599-603; In English; Copyright; Avail: Aeroplus Dispatch

The purpose of this study was to explore the relationship between body consciousness, perceptual motor performance, and subjective ratings quality. Twenty-one college students participated. The Criterion Task Set unstable tracking task and the Private Body Conscious Scale were used to explore relationships. Two hypotheses were tested: (1) self-reporting of performance accuracy varies with objective task difficulty and with actual performance quality, and (2) high body conscious individuals will outperform and also give more accurate estimates of their own performance than low body conscious subjects. Results provided support for the self-report accuracy and difficulty level relationship. Marginal support was found for the relationship between body consciousness and self-report accuracy. Additionally, a significant interaction indicated that, at higher difficulty levels, high body conscious subjects performed better than low body conscious subjects. Implications for situation awareness training, usability testing, and performance improvement are discussed.
Author (AIAA)
Consciousness; Psychomotor Performance; Perception; Sensory Feedback

19980072390
Equipment compatibility and performance of men and women during heavy load carriage
Harper, William H., U.S. Army, Research Lab., USA; Knapik, Joseph J., U.S. Army, Research Lab., USA; de Pontbriand, Rene, U.S. Army, Research Lab., USA; 1997, pp. 604-608; In English; Copyright; Avail: Aeroplus Dispatch

This study examined the relative load-carrying ability of men and women. Nineteen male and 15 female soldiers carried loads of 18, 27, and 36 kg during individual voluntary maximal speed 10-km road marches. Measures included march times, pre-/post-march vertical jump and grenade throw, and a post-march questionnaire about equipment compatibility. The major findings were that the average march rates for both male and female soldiers in all load conditions were faster than the rates published in U.S. Army field manuals. This suggests that the test subjects were within the published zone of acceptable performance. Men completed the marches an average of 21 percent faster than the women. Women reported more problems with the shoulder straps, fit of the waist belts, and the fit and stability of the backpack. Data suggest that at least a portion of the gender differences in march rate may be explained by equipment problems reported by the women.
Author (AIAA)
Compatibility; Males; Females; Load Carrying Capacity; Walking

19980072401
Line Operational Evaluation (LOE) air carrier scenario based evaluation
Hamman, William R., United Airlines, USA; Holt, Robert W., George Mason Univ., USA; 1997, pp. 907-911; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents a methodology for developing Line Operational Evaluations (LOEs) which assess crew and individual pilot proficiency in the FAA's Advanced Qualification Program (AQP). Under AQP, Crew Resource Management (CRM) skills are trained and assessed along with technical maneuvers in the issuing of an Airmen type certification. The environment for assessing this technical and CRM proficiency is the LOE which must be designed and implemented under strict adherence to the requirements of AQP. This paper discusses the five major steps in the design process, the issues associated with scenario based measurement of pilot proficiency, and the application of statistical analysis to improve evaluator standardization and the reliability and validity of data.
Author (AIAA)
Methodology; Pilot Training; Training Evaluation; Flight Simulation

19980072403
Application of psychometrics to the calibration of air carrier evaluators
Holt, Robert W., George Mason Univ., USA; Johnson, Peder J., New Mexico, Univ., Albuquerque; Goldsmith, Timothy E., New Mexico, Univ., Albuquerque; 1997, pp. 916-920; In English; Copyright; Avail: Aeroplus Dispatch

The FAA's Advanced Qualification Program (AQP) encourages airlines to implement proficiency-based training programs and requires collection of reliable and valid performance assessment data. We present applications of traditional and innovative psychometric methods to this domain.
Author (AIAA)
Psychometrics; Calibrating; Airline Operations; Flight Simulation; Training Evaluation; Flight Training

19980072410

Unidimensional versus multidimensional workload scales and the effect of number of rating scale categories

Anthony, X Christopher R., Hewlett-Packard Co., USA; Biers, David W., Dayton, Univ., USA; 1997, pp. 1084-1088; In English; Copyright; Avail: Aeroplus Dispatch

The present study investigated why the Subjective Workload Assessment Technique (SWAT) (a multidimensional scale) has been found to be less sensitive than Overall Workload Scale (OW) (a unidimensional scale) in previous research. It was hypothesized that previous results could be attributed to number of points on the rating scale. to that end, four rating scale groups were employed in which the dimensionality (unidimensional vs multidimensional) and number of rating scale points (7 vs. 19) on the overall workload scale were varied. Forty-eight subjects performed a continuous recognition task composed of 12 levels of difficulty and then rated workload under one of four rating scale conditions (OW-7, OW-19, MOD-SWAT-7, MODSWAT- 19). Results indicated that: (1) the preponderance of evidence favored equal sensitivity; (2) previous differences between OW and SWAT could not be due to differences in the number of points on the rating scale; and (3) dimensionality affected overall workload ratings in subtle ways. However, the differences found between the unidimensional (OW) and multidimensional (MOD-SWAT) scales is probably attributed to the nature of the task itself where increases in the difficulty in one dimension were accompanied by decreases in another dimension.

Author (AIAA)

Workloads (Psychophysiology); Categories; Scaling Laws

19980072425

Could mental practice and imagery be techniques for enhancing aviation performance?

Jentsch, Florian, Central Florida, Univ., USA; Bowers, Clint, Central Florida, Univ., USA; Salas, Eduardo, U.S. Navy, Naval Air Warfare Center, USA; 1997, pp. 1172-1175; In English; Copyright; Avail: Aeroplus Dispatch

To test the feasibility of mental practice for aviators, the present study sought to assess the degree to which pilots already use mental practice and imagery. Sixty pilots of varying experience levels were surveyed regarding the frequency, vividness, and content of mental practice they use. The results indicate that pilots use mental practice and imagery quite often and report a degree of vividness of mental imagery that is significantly higher than in the general population. Differences between novices and experts in the use of imagery are also presented. The results are discussed in terms of their implications for aviation training.

Author (AIAA)

Mental Performance; Pilot Performance; Pilot Training

19980072426

Multiple resource contributions to training

Boles, David B., Rensselaer Polytechnic Inst., USA; 1997, pp. 1176-1179; In English; Copyright; Avail: Aeroplus Dispatch

Can training of a task be achieved using a different task drawing on the same mental resources? Subjects performed five successive blocks of trials, with bargraph recognition required in Blocks 1, 4, and 5. Blocks 2 and 3 either involved bargraph recognition, dot cluster recognition, or word number recognition. The majority of the practice effect across blocks was found to be due to practice within a previously identified 'spatial quantitative' perceptual resource, regardless of whether the resource was instantiated in bargraph or dot cluster recognition. These results suggest that (1) training should focus on the target task's perceptual resources, and (2) training can use tasks different from the target task as long as the same resources are used. If these findings generalize, substantial savings in training costs may be achievable by using different, simplified tasks during training.

Author (AIAA)

Training Analysis; Factor Analysis; Mental Performance

19980072427

The effects of observational learning and practice schedule on the acquisition of a complex skill

Goettl, Barry P., USAF, Armstrong Lab., USA; Connolly-Gomez, Cathy, Galaxy Scientific Corp., USA; 1997, pp. 1180-1184; In English; Copyright; Avail: Aeroplus Dispatch

The goal of the present study was to explore the question of whether observational learning provides additional benefits over and above those gained by spacing. Using a desktop flight simulator task, we compared five groups. Massed-perform-observe (MPO) participants performed a block of massed trials while massed-observe-perform (MOP) participants watched. After one hour these two groups switched roles. Spaced-observe (SO) participants were paired among themselves and alternated between the role of observer and performer every two trials. These three groups were compared to massed- and spaced-control conditions. Results indicated that participants receiving massed observation, but not spaced observation, showed better performance compared to the control conditions. The results also indicated that participants in the MPO condition showed better performance

than those in the massed-control condition. These findings have implications for the design of training protocols, and suggest that observational learning may benefit both the observer and the performer.
Author (AIAA)
Learning; Visual Observation; Psychomotor Performance; Training Analysis

19980072428
Effects of mission preparation on crew combat mission training performance
Spiker, V. A., Anacapa Sciences, Inc., USA; Nullmeyer, Robert T., USAF, Armstrong Lab., USA; Tourville, Steven J., Hughes Training, Inc., USA; Silverman, Denise R., Hughes Training, Inc., USA; 1997, pp. 1185-1189; In English; Copyright; Avail: Aeroplus Dispatch

The present study investigated the relationship between mission preparation and mission performance during combat mission training of 11 MC-130P (Combat Shadow) aircrews from USAF Special Operations Forces squadrons. Two observers independently rated crew coordination processes and mission performance based on extensive observations taken both during a planning period and while the crews executed a simulated mission. Statistically, a reliable, strong relationship between preparation and performance was noted, with correlations ranging from 0.60 to 0.78. Exceptional preparation behaviors include utilizing personnel effectively, establishing a firm timeline, aggressively questioning a plan's assumptions, and testing a plan's logic against possible contingencies. The paper concludes with a discussion of the characteristics of effective mission preparation and implications of the research for combat mission training.
Author (AIAA)
Flight Training; Flight Crews; Combat; Mission Planning; Human Performance

19980072429
Collective orientation and team performance
Stout, Renee J., U.S. Navy, Naval Air Warfare Center, USA; Driskell, James E., Florida Maxima Corp., Winter Park; Salas, Eduardo, U.S. Navy, Naval Air Warfare Center, USA; 1997, pp. 1190-1194; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes a program of research designed to address three primary questions regarding collective orientation. First, can we measure it? Second, does collective orientation make a difference in how well teams perform? Third, in what ways does behavior differ in collectively-oriented versus non collectively-oriented teams? Results indicate that collective orientation can be reliably measured. The development and test of a Collective Orientation scale provide good evidence of reliability and convergent and divergent validity. Second, results indicate that the collective orientation construct is meaningful - that is, it predicts team effectiveness on a range of interdependent tasks, including decision making, negotiation, and executing tasks. Finally, current research is being conducted to identify what specific behaviors are related to high and low collective orientation during task interaction. The results of this analysis should pinpoint specific behaviors for training intervention.
Author (AIAA)
Teams; Performance Prediction; Human Performance

19980072430
Emphasis change and verbal elaboration in skill acquisition - A tale of two components
Goettl, Barry P., USAF, Armstrong Lab., USA; Snooks, Shirley F., Galaxy Scientific Corp., USA; Day, Eric, Texas A & M Univ., College Station; Shebilske, Wayne L., Texas A & M Univ., College Station; 1997, pp. 1195-1199; In English; Copyright; Avail: Aeroplus Dispatch

The goal of this study was to examine the relationship between multiple emphasis on components (MEC) and verbal elaboration in the acquisition of a complex skill. Participants were trained using either MEC or emphasis on total score (TOT), with or without verbal elaboration between training modules. Results indicated low-aptitude learners performed better when trained with the MEC protocol than with the TOT protocol, but high-aptitude learners benefited from verbal elaborations. Analysis of the component scores indicated that the combined effects of verbal elaboration and MEC disrupted components representing implicit processing, and enhanced components representing explicit processes. These findings are consistent with other research on verbal elaboration and suggest that care must be taken when combining verbal elaboration with emphasis change instructions. More important, these results suggest ways to effectively combine the two protocols.
Author (AIAA)
Learning; Training Analysis; Verbal Communication

19980072431

Challenges to assessing Distributed Interactive Simulation for training

Mirabella, Angelo, U.S. Army, Research Inst. for the Behavioral and Social Sciences, USA; Moses, Franklin L., U.S. Army, Research Inst. for the Behavioral and Social Sciences, USA; 1997, pp. 1200-1202; In English; Copyright; Avail: Aeroplus Dispatch

This paper explores some of the conditions which pose special challenges to evaluation of Distributed Interactive Simulation (DIS) training. Underlying these conditions is the mushrooming of complexity as training moves from single site to multisite, multiservice DIS. One issue is discrepant perceptions of training value across sites and Services. Another is the need to tailor measurement instruments to accommodate site-specific characteristics. The paper will propose some ways to address these issues, based on results of an assessment of user reactions to the Multi-Service Distributed Training Testbed (MDT2) program of research.
Author (AIAA)

Distributed Interactive Simulation; Training Evaluation

19980072432

Assessing knowledge structures - Don't always call an expert

Rowe, Anna L., USAF, Armstrong Lab., USA; Meyer, Thomas N., MEI Technology Corp., USA; Miller, Todd M., MEI Technology Corp., USA; Steuck, Kurt, MEI Technology Corp., USA; 1997, pp. 1203-1207; In English; Copyright; Avail: Aeroplus Dispatch

This study investigated different approaches for forming a standard knowledge structure for two knowledge structure measures: relatedness ratings and a diagramming task. Three approaches to developing knowledge standards were compared: a standard derived from expert data, a standard based on high-performing students, and a rational standard developed through an analysis of instructional materials. The knowledge standards were compared in their ability to predict performance on a multiple-choice test. The results showed that comparison of students' structures with a standard constructed by aggregating high-performing student structures produced scores that were independently predictive of performance for both measures, whereas the expert standard resulted in independently predictive knowledge scores for only the diagramming task. For both measures, the high-performer standard and the aggregate expert standard were superior to the rational standard. These results offer support for using standards other than the expert-consensus standard typically used when assessing the quality of knowledge structures.
Author (AIAA)

Knowledge; Training Evaluation; Learning Theory

19980072445

Search differences for the presence and absence of features in sustained attention

Schoenfeld, Victoria C., Old Dominion Univ., USA; Scerbo, Mark W., Old Dominion Univ., USA; 1997, pp. 1288-1292; In English; Copyright; Avail: Aeroplus Dispatch

The present study examined the ability of individuals to look for the presence or absence of stimulus features in a vigilance paradigm. Forty participants monitored a computer display comprised of either two or five circles for 40 min. Half of the participants were instructed to respond when a line was present in one of the circles, and the other half responded when the line was absent from one of the circles. Although performance declined throughout the vigil in all conditions, the overall level of performance was dependent upon both display size and type of signal. Specifically, performance was worse when searching for the absence as opposed to the presence of the feature, and this effect was exacerbated with the five-stimulus display. On the other hand, display size had no effect when searching for the presence of the feature. These results are discussed with respect to the feature integration theory and the nature of the critical signal in vigilance.
Author (AIAA)

Pattern Recognition; Computer Graphics; Display Devices; Visual Perception; Attention

19980072446

The effects of caffeine on performance and stress in an abbreviated vigilance task

Temple, Jon G., Cincinnati, Univ., USA; Dember, William N., Cincinnati, Univ., USA; Warm, Joel S., Cincinnati, Univ., USA; Jones, Keith S., Cincinnati, Univ., USA; 1997, pp. 1293-1297; In English; Copyright; Avail: Aeroplus Dispatch

Recently, Temple et al. (1996) described a 12-min computerized vigilance task which duplicates the vigilance decrement and the workload and stress characteristics of vigils lasting 30 min or more. The abbreviated task may be useful in situations wherein long-duration tasks are precluded, e.g., performance assessment batteries, neuropsychological testing, and brain imaging. The present experiment extended this line of investigation by demonstrating that performance on the abbreviated task is enhanced (signal detections were increased and the decrement attenuated) by caffeine - a drag which benefits long-duration vigilance tasks. The

enhancement effect associated with caffeine was limited to performance, however, suggesting that the drug influences factors which control signal detection but not those which control task-induced stress.
Author (AIAA)
Caffeine; Human Performance; Attention; Stress (Psychology); Visual Tasks; Mental Performance

19980072447
Effects of cueing and knowledge of results on workload and boredom in sustained attention
Hitchcock, Edward M., Cincinnati, Univ., USA; Dember, William N., Cincinnati, Univ., USA; Warm, Joel S., Cincinnati, Univ., USA; Moroney, Brian W., Cincinnati, Univ., USA; See, Judi E., Logicon Technical Services, USA; 1997, pp. 1298-1302; In English; Copyright; Avail: Aeroplus Dispatch

Two accounts of the recently reported high workload associated with vigilance tasks are the direct-cost and indirect-cost views. The former attributes this effect to the need for continuous observing in discriminating signals from noise; the latter attributes the effect to combating the boredom associated with vigilance tasks. These opposing views were tested by providing monitors with reliable cueing which rendered observing necessary only when low probability critical signals were imminent. On the basis of the direct-cost model, it was anticipated that cueing would lead to low workload but high boredom, since observers would have little to do during most of the vigil; the indirect-cost model would lead to a prediction of both high workload and high boredom. The results clearly supported the direct cost view that the workload of vigilance is task induced. Also as predicted from the direct cost account, cueing led to lower workload than did knowledge of results.
Author (AIAA)
Workloads (Psychophysiology); Attention; Cues; Knowledge; Boredom; Mental Performance

19980072448
Assessment of computer modeling of operator mental workload during target acquisition
See, Judi E., Logicon Technical Services, Inc., USA; Vidulich, Michael A., USAF, Armstrong Lab., USA; 1997, pp. 1303-1307; In English; Copyright; Avail: Aeroplus Dispatch

The predictive validity of computer simulation modeling of operator mental workload and situational awareness (SA) during a simulated air-to-ground combat mission was assessed in the present study. In Phase I, 12 participants completed a series of combat missions in a laboratory flight simulator and provided subjective ratings of workload (using the SWAT) and SA (using the SART). In Phase II, computer models of the mission were constructed using the Micro Saint modeling tool. The visual, auditory, kinesthetic, cognitive, and psychomotor components of the workload associated with each task were estimated and used to obtain measures of average and peak workload. The results from the simulated combat missions versus the Micro Saint models were similar but not identical, indicating that the computer models were partially but not completely valid predictors of mental workload and SA. The computer modeling appeared to be a more effective predictor of SA rather than mental workload.
Author (AIAA)
Computerized Simulation; Workloads (Psychophysiology); Target Acquisition; Performance Prediction; Human Performance; Mental Performance

19980072454
Perception of accelerating self-motion - Global optical flow rate dominates discontinuity rate
Dyre, Brian P., Idaho, Univ., Moscow, USA; 1997, pp. 1333-1337; In English
Contract(s)/Grant(s): NAG2-308; Copyright; Avail: Aeroplus Dispatch

Owen et al. (1984) proposed that egospeed may be perceived from global optical flow rate, discontinuity rate, or both. Previous psychophysical research found that both sources of information influence judgments of acceleration and control of egospeed, but that discontinuity rate dominated. However, the validity of these results is questionable due to problems with the visual stimuli used, such as confounding of discontinuity rate with proximal flow rate and low frame rates. The current study examined the relative contributions of global optical flow rate and discontinuity rate to perception of accelerating self-motion with stimuli that lacked these problems. I found that global optical flow rate accounted for 60 percent of the variability in acceleration judgments, compared with 0.86 percent for discontinuity rate. This result indicates that discontinuity rate exerts only a minor influence, and global optical flow rate is the primary basis for perception of accelerating self-motion, and hence, egospeed.
Author (AIAA)
Motion Perception; Visual Perception; Acceleration (Physics)

19980072455

Multi-channel auditory search - Toward understanding control processes in polychotic auditory listening

Lee, Mark D., NCR Corp., USA; 1997, pp. 1343-1347; In English; Copyright; Avail: Aeroplus Dispatch

Two experiments are presented which develop a framework for exploring auditory information processing. The framework is referred to as polychotic listening or auditory search, and it requires a listener to aurally scan multiple simultaneous auditory streams for the appearance of a target. The first experiment examined the participant's ability to aurally scan between two and six simultaneous auditory streams of letter and digit names for the name of a target letter. The main independent variable was auditory load, or the number of active audio streams. The primary dependent variable was accuracy. Accuracy and sensitivity measures showed that as load increased, performance decreased. The second study required participants to practice the same task for 10 sessions. Results indicated that even with extensive practice, performance was still affected by auditory load. The relation between the present results and similar results in the visual search literature are discussed.

Author (AIAA)

Auditory Perception; Channels (Data Transmission); Data Processing; Auditory Tasks

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

19980049057

Theory and experiment of 3D sensing based on eye-hand camera

Lee, Sukhan, Southern California, Univ., Los Angeles; JPL, USA; Ahn, Sang C., Southern California, Univ., USA; Meyyappan, Ashok, Southern California, Univ., USA; Schenker, Paul, JPL, USA; 1997, pp. 272-280; In English; Copyright; Avail: Aeroplus Dispatch

A new method of extracting depth from blurring and magnification of objects or local scene has been presented. Assuming no active illumination, the images are taken at two camera positions of a small displacement, using a single standard camera with telecentric lens. Thus, the depth extraction method is simple in structure and efficient in computation. Fusing the two disparate sources of depth information, magnification and blurring, the proposed method provides more accurate and robust depth estimation. This paper describes various experiments performed to validate this concept and describes the present work that has been done in that field. The experimental result shows less than one percent error for an optimal depth range. The ultimate aim of this concept would be the construction of dense 3D maps of objects and real time continuous estimation of depth.

Author (AIAA)

Eye (Anatomy); Hand (Anatomy); Depth; Robot Control; Cameras; Blurring

19980049071

Agent-based control architecture for teleoperation

Brooks, B., Reading, Univ., UK; McKee, G. T., Reading, Univ., UK; 1997, pp. 200-211; In English; Copyright; Avail: Aeroplus Dispatch

A model for agent-based control within teleoperation environments is proposed. Their role in providing automated assistance for task viewing is illustrated. The paper reviews existing approaches to viewing support, which tend to focus on augmented displays. The authors outline their approach to providing viewing support, based on 'visual acts'. Agent-based architectures are reviewed and their application to viewing support under the visual acts model is presented. Communication is a key requirement for agent architectures. Channels, a system which is currently being developed to support the implementation of the agent model, is presented.

Author (AIAA)

Teleoperators; Robot Control

19980049150

Potato tuber formation in the spaceflight environment

Brown, Christopher S., Dynamac Corp., USA; Tibbitts, Theodore W., Wisconsin, Univ., Madison; Croxdale, Judith G., Wisconsin, Univ., Madison; Wheeler, Raymond M., NASA Kennedy Space Center, USA; Life Support & Biosphere Science; 1997; ISSN 1069-9422; Volume 4, no, nos. 1-2, pp. 71-76; In English

Contract(s)/Grant(s): NAGW-4022; Copyright; Avail: Aeroplus Dispatch

Five potato (Solanum tuberosum L.) leaf cuttings were flown on STS-73 in late October, 1995 as part of the 16-day USML-2 mission. Preflight studies were conducted to study tuber growth, determine carbohydrate concentrations, and examine the developing starch grains within the tuber. In these tests, tubers attained a fresh weight of 1.4 g/tuber after 13 days. Tuber fresh mass was significantly correlated to tuber diameter. Greater than 60 percent of the tuber dry mass was starch and the starch grains varied in size from 2 to 40 microns in the long axis. For the flight experiment, cuttings were obtained from seven-week-old Norland potato plants, kept at 5 C for 12 h then planted into arcillite in the ASTROCULTURE flight hardware. The flight package was loaded on-board the orbiter 22 h prior to launch. During the mission, the flight hardware maintained an environment around the cuttings of 22 +/- 2 C, 81 +/-7 percent RH, and a 12 h photoperiod using red and blue light-emitting diodes at a photosynthetic photon flux of 150 micromol/sq m/s. CO2 concentration exceeded 4000 ppm during the dark period and was controlled during the light period to approximately 400 ppm. Video downlinks of images of the plants and CO2 exchange data during the flight demonstrated plant vitality for the first 12 days of the mission followed by senescence of the leaves. Four out of the five space-grown cuttings produced tubers that were similar in appearance and dimension to the ground control tubers.
Author (AIAA)
Space Flight; Vegetation Growth; Potatoes; Preflight Analysis; Carbohydrates; Gas Exchange

19980049151

A simple mass balance model of nitrogen flow in a bioregenerative life support system

Loader, Colleen A., Dynamac Corp., USA; Garland, Jay L., Dynamac Corp., USA; Raychaudhuri, Soumya, Stanford Univ., USA; Wheeler, Raymond M., NASA Kennedy Space Center, USA; Life Support & Biosphere Science; 1997; ISSN 1069-9422; Volume 4, no, nos. 1-2, pp. 31-41; In English; Copyright; Avail: Aeroplus Dispatch

A mathematical model of the nitrogen cycle in a bioregenerative life support system (BLSS) was developed to help conceptualize and quantify nitrogen flux and storage in BLSS processes and subsystems. The mathematical model was initially designed as a simple mass balance, donor-controlled system that quantified the amount of nitrogen in moles/person. Dynamic equations were then applied to describe certain relationships more accurately. Comparison of nitrogen fluxes suggests that even at very low atmospheric leakage rates, loss of nitrogen gas would account for the largest nitrogen movement in the 'closed' system. This observation decreases the relative importance of denitrification and nitrification in closed system nitrogen balances. Sensitivity analysis was used to determine the relative stability of various model subsystems, and demonstrated the importance of plant nitrogen uptake on overall system dynamics of nitrogen.
Author (AIAA)
Life Support Systems; Regeneration (Physiology); Gas Flow; Nitrogen; Mass Distribution

19980049188

Experimental testing of a power-assisted space suit glove joint

Sorenson, E. A., Maryland, Univ., College Park, USA; Sanner, R. M., Maryland, Univ., College Park; Ranniger, C. U., Maryland, Univ., College Park; 1997, pp. 2619-2625; In English
Contract(s)/Grant(s): NASW-96015; Copyright; Avail: Aeroplus Dispatch

Utilizing new glove designs in conjunction with state-of-the-art robotics technology, the University of Maryland Space Systems Laboratory and ILC Dover, Inc. have developed a prototype power-assisted space suit glove joint. Previous results have established the ability of this system to significantly decrease the torques required to extend the joint. This paper describes additional design refinements and more precisely quantifies the performance of the system by examining range of motion and EMG-derived metrics from human subjects performing a repetitive manual task. The results indicate that power assist significantly decreases the physiological effort required to flex and extend the joint, while at the same time greatly increasing the achievable range of motion. Power assist enables a 440 percent increase in average range of motion while simultaneously decreasing by 30-40 percent the effort required to accomplish these motions. Moreover, the effects of muscle fatigue are not apparent when the assist mechanism is active, while in unassisted trials fatigue decreases the observed range of motion by more than 40 percent during the task.
Author (AIAA)
Space Suits; Gloves; Performance Tests; Robotics; Fatigue (Biology); Motion Stability

19980049200

Complexity and its certification in aeronautics

Javaux, D., Liege, Univ., Belgium; De Keyser, V., Liege, Univ., Belgium; 1997, pp. 2120-2124; In English; Copyright; Avail: Aeroplus Dispatch

Amongst the factors that contribute to human errors in man-machine interaction situations is complexity. In comercial aviation in particular, some recent incidents or accidents can be directly related to the inherent complexity of the highly automated systems present on the flight deck. This paper describes some methods for characterizing and measuring the (cognitive) complexity of these situations. Such methods could be used in new innovative procedures for certifying future flight decks.
Author (AIAA)
Commercial Aircraft; Aeronautics; Task Complexity; Decision Making

19980049201
Skill evaluation of human operators
Koivo, A. J., Purdue Univ., USA; Repperger, D. W., USAF, Armstrong Lab., USA; 1997, pp. 2103-2108; In English
Contract(s)/Grant(s): F49620-93-C-0063; F41624-95-C-6014; Copyright; Avail: Aeroplus Dispatch

The skills of humans performing tasks can be evaluated using Fitts' law, which is described by a straight line in the coordinate system of execution time and task difficulty index. The inverse of the slope of the straight line is called the execution capacity of a human. The aforementioned variables can be calculated from experimental data collected for a task. Experimental data were collected in the task in which a peg attached to the hand of an exoskeleton guided by a human arm was placed into a hole. We have determined the mean and standard deviations for individual performances and also for the performances of a group of individuals. Thus, the numerical values calculated to describe the skills of an individual form a basis for comparison of the skills of the individuals. Since Fitts' law is a geometric one-dimensional approach to skill evaluation, it is difficult to apply when the task performance is characterized by two or more variables. Our study introduces a novel probabilistic skill index to evaluate skills of operators performing tasks characterized by two or more variables. The probabilistic skill index provides a broader basis for the skill evaluations of the individuals. Moreover, the skills of the individuals performing tasks can be compared objectively by using the probabilistic skill index introduced.
Author (AIAA)
Operator Performance; Decision Making; Arm (Anatomy); Task Complexity

19980049203
Robotic deployment of mine detection equipment
Suart, Robert D., Defence Research Establishment Suffield, Canada; 1997; In English; Copyright; Avail: Aeroplus Dispatch

At Defence Research Establishment Suffield (DRES), a generic system for the guidance and control of unmanned vehicles has been developed. This system, called ANCAEUS, has been applied to the development of training targets for the Canadian Forces (CF). More recently, the requirement to detect land mines in the peacekeeping operations of the CF has led to the development of teleoperated land-mine detector equipment that permits rapid and reliable detection of these hazardous weapons, while affording the operators the security of remote operation of the equipment.
Author (AIAA)
Mine Detectors; Robotics; Deployment; Surface Vehicles; Robot Control

19980049208
Speech input control for networked virtual environments
Stanger, V. J., GEC-Marconi Materials Technology, Ltd., Hirst Div., UK; GEC Journal of Technology; 1997; ISSN 1367-0476; Volume 14, no. 2, pp. 90-97; In English; Copyright; Avail: Aeroplus Dispatch

Although the use of speech recognition as an input modality for users of virtual environments is in its infancy, hands-free interaction of this type should provide considerable benefits for users of virtual reality systems, because the input devices they use are often unsuited to simultaneous 3D navigation and control tasks. The work carried out has integrated a speech recognition system with a commercial virtual reality system and developed a sophisticated vocabulary and command structure that enables users to control virtual entities. This capability has been demonstrated in the project's networked 'Virtual Fashion' pilot, but has many potential uses in mainstream applications, such as control systems for virtual cockpits.
Author (AIAA)
Virtual Reality; Speech Recognition; Three Dimensional Motion; Voice Control; Command and Control

19980049338
Computational dynamic analysis of extravehicular activity - Large-mass handling
Newman, Dava J., MIT, USA; Schaffner, Grant, MIT, USA; Journal of Spacecraft and Rockets; Apr. 1998; ISSN 0022-4650; Volume 35, no. 2, pp. 225-227; In English
Contract(s)/Grant(s): NAGW-4336; Copyright; Avail: Aeroplus Dispatch

A computational multibody dynamics model is here used to solve the equations of motion entailed by the simulation of EVAs involving manipulation of a large-mass payload. The two different dynamic simulations conducted employ a multisegment astronaut model and dynamic analysis of EVA tasks, enhancing simulations that yield either high resolution 3D computer images based on anthropometric representations or empirically derived predictions of astronaut strength based on lean-body mass and the velocity of the body joints.
AIAA
Extravehicular Activity; Dynamic Characteristics; Computerized Simulation; Astronauts; Payload Transfer; Joints (Anatomy)

19980049526
Mobile military robots - The impact of the reality in their architecture
Caligiani, G. C., Alenia Defence, OTOBREDA Div., Italy; 1997; In English; Copyright; Avail: Aeroplus Dispatch
While the last decades of this century will be remembered as the time of early development of modern robots, during the twenty-first century we will assist in a revolution in ground tactics thanks to the advent of mature and reliable unmanned systems. The use of robotized ground vehicles in the battlefield scenario offers significant benefits to military planners by increasing soldier survivability in hostile environments, by enhancing surveillance, logistic, and reconnaissance, and by increasing the effectiveness of existing manpower resources. This paper highlights the main constraints imposed to the robot by the peculiar character of the military operational context that is expressed mainly through the limitation in the assistance expected from the operator. The above has a strong impact not only in the architectural approach, but also in the 'operational modes' which advocate a minimum level of robot autonomy and intelligence. Finally, the potential roles and the related payloads of an unmanned ground vehicle in the battlefield are considered.
Author (AIAA)
Robots; Military Vehicles; Architecture (Computers); Surface Vehicles; Robot Control

19980049527
The use of unmanned ground vehicles during Demo II - Lessons learned
Shoemaker, Charles, U.S. Army, Research Lab., USA; 1997; In English; Copyright; Avail: Aeroplus Dispatch
There is growing military interest in the capabilities of, and future applications for, unmanned ground vehicles (UGVs). This interest stems from major increases in the functionality of these systems as well as increasing experience with them in the field. Demo II, a Department of Defense (DoD) UGV field experiment with UGVs was conducted at Ft. Hood, TX, in June 1996 and was a decisive event for the DoD ground robotics program. This paper describes the background of the Demo II program, provides detail on the field experiments, gives initial assessments of the utility of the technology, and addresses areas of improvement required for UGV applications during the next 20 years.
Author (AIAA)
Surface Vehicles; Remotely Piloted Vehicles; Technology Assessment; Remote Control

19980049588
The application of value-driven decision-making in air combat simulation
Lazarus, Earl, Decision Science Applications, Inc., USA; 1997, pp. 2302-2307; In English; Copyright; Avail: Aeroplus Dispatch
The two main components of a constructive air combat simulation are the hardware models and the model of the pilot decision makers. A model of human pilot behavior must be able to capture the primary drivers of air-to-air combat outcomes: surprise, confusion, and cooperation. Such a model must also be able to perform in a highly complex decision space. Traditional approaches using rule bases are hard-pressed to provide the flexibility and maintainability required in such a decision-making environment. Value-driven based decision models, used in air-to-air combat models such as BRAWLER (aircraft) and TRACES (helicopters), are based upon a relatively straightforward paradigm much like the one used implicitly by many chess players. Using this approach, the selection of a course of action consists of: (1) the selection of a set of alternative courses of actions which span the decision space, (2) projection of each alternative into the future, (3) evaluation (scoring) of the future for each alternative using a value function, and (4) selection of the highest scoring alternative. Since the value function is constructed to be sensitive to the many goals of a given decision, it intrinsically performs tradeoffs among conflicting objectives. In addition, the effects of orders from higher level entities in the decision hierarchy are easily implemented by passing weights to the decision-maker which affect the importance of various components of his or her value-scoring function.
Author (AIAA)
Aircraft Pilots; Human Behavior; Decision Making; Air to Air Missiles; Biological Models (Mathematics)

19980049591

Whole body kinesthetic displays for immersive virtual reality applications

Roston, Gerald P., Cybernet Systems Corp., USA; Endsley, Eric, Cybernet Systems Corp., USA; Riggs, A. J., Cybernet Systems Corp., USA; Jacobus, Charles J., Cybernet Systems Corp., USA; 1997, pp. 2357-2362; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes a system that provides a full body, digitally programmed, kinesthetic display for virtual reality applications. This design begins by providing a four-axis motion platform for each foot of the operator. From this base design, kneeling boards are added to support rolling, kneeling, and prone postures; and a vertical feature presentation mechanism is appended which allows the operator to interact with realistic walls, windows, doors, and other vertical obstacles features in his or her movement space. The design of this complex device was driven by a variety of requirements including the need for system modularity, enhanced safety, and the need to emulate all significant physical activities. This paper describes the user's requirements, the high-level design tradeoffs, and the device currently under development.

Author (AIAA)

Human Body; Virtual Reality; Computer Programs; Kinesthesia; User Requirements; Programming Environments

19980049592

Actively controlled mockups for EVA training in neutral buoyancy

Carignan, Craig R., Maryland, Univ., College Park, USA; Akin, David L., Maryland, Univ., College Park; 1997, pp. 2369-2374; In English

Contract(s)/Grant(s): NAGW-2245; Copyright; Avail: Aeroplus Dispatch

The drive for more accurate and easily 'reconfigurable' EVA simulation has spawned the development of 'robotic' payloads for use in microgravity simulation. This paper describes work in progress at the University of Maryland to develop actively controlled mockups for EVA training in neutral buoyancy. The strengths and weaknesses of parallel mechanism designs such as the Charlotte IVA Robot flown aboard a laboratory orbiter are compared with more commonly available manipulators used in industry. Preliminary experiments performed on a Ranger manipulator arm validate the feasibility of the control approach being considered. Simulation results are encouraging even for payload masses as low as 125 kg and force loop rates of 40 Hz. Design tradeoffs indicate a Charlotte derivative to have many advantages, particularly in the size of the workspace and the stiffness of the assembly. A joint industrial effort has been proposed to build a neutral buoyancy version, and preliminary designs are currently in progress.

Author (AIAA)

Extravehicular Activity; Active Control; Neutral Buoyancy Simulation; Astronaut Training; Microgravity

19980049613

Human-agent interaction in a target identification task

Lenox, Terri L., Pittsburgh, Univ., USA; Roberts, Linda L., Pittsburgh, Univ., USA; Lewis, Michael, Pittsburgh, Univ., USA; 1997, pp. 2702-2706; In English; Copyright; Avail: Aeroplus Dispatch

Due to the complex and dynamic nature of our world it is increasingly common for decisions to be made in teams rather than by individuals. Team members must exchange and fuse information and resources from a variety of sources to make effective decisions. While the variety of information and resources brought together by a team may be needed for complex real-time decision making, members must be able to communicate and interpret one another's communications to realize these benefits. In natural settings which are plagued by unreliable data and data sources, the difficulty of improving reliability through aggregation of data increases with available resources. Effective teams must develop a shared task language, shared perceptions of the task, and knowledge of one another and of the reliability of each other's communications to derive full value from pooled resources. While our understanding of the informational dynamics of human teams remains incomplete, even less is known about teams combining human and software agents.

Author (AIAA)

Human-Computer Interface; Decision Making; Real Time Operation; Tasks; Software Development Tools

19980049622

Capturing situational awareness in combat simulations

West, Paul D., U.S. Military Academy, USA; Barr, Donald R., U.S. Military Academy, USA; 1997, pp. 2800-2805; In English; Copyright; Avail: Aeroplus Dispatch

Military situational awareness results from the synthesis of battlefield data into human understanding. It is formed through the bonding of information, training, experience, and the personality of the commander. Computers can readily gather information; training can be assumed, but experience and personality are major challenges for the combat modeler. The Battlefield Knowl-

edge Index (BKI) is one approach under investigation at the U.S. Military Academy to measure situational awareness in Army simulations.
Author (AIAA)
Combat; Computerized Simulation; Military Operations; Personality Tests

19980049666
CELSS-3D - A broad computer model simulating a controlled ecological life support system
Schneegurt, Mark A., Notre Dame, Univ., USA; Sherman, Louis A., NASA, USA; Life Support & Biosphere Science; 1997; ISSN 1069-9422; Volume 4, no, nos. 1-2, pp. 3-20; In English
Contract(s)/Grant(s): NAGW-2329; Copyright; Avail: Aeroplus Dispatch

CELSS-3D is a dynamic, deterministic, and discrete computer simulation of a controlled ecological life support system (CELSS) focusing on biological issues. A series of linear difference equations within a graphics-based modeling environment, the IThink program, was used to describe a modular CELSS system. The overall model included submodels for crop growth chambers, food storage reservoirs, the human crew, a cyanobacterial growth chamber, a waste processor, fixed nitrogen reservoirs, and the atmospheric gases, CO2, O2, and N2. The primary process variable was carbon, although oxygen and nitrogen flows were also modeled. Most of the input data used in CELSS-3D were from published sources. A separate linear optimization program, 'What'sBest', was used to compare options for the crew's vegetarian diet. CELSS-3D simulations were run for the equivalent of three years with a one h time interval. Output from simulations run under nominal conditions was used to illustrate dynamic changes in the concentrations of atmospheric gases. The modular design of CELSS-3D will allow other configurations and various failure scenarios to be tested and compared.
Author (AIAA)
Computerized Simulation; Three Dimensional Models; Environment Models; Spacecrews; Space Flight Feeding

19980049667
Computer modeling for advanced life support system analysis
Drysdale, Alan, Boeing Co., USA; Life Support & Biosphere Science; 1997; ISSN 1069-9422; Volume 4, no, nos. 1-2, pp. 21-29; In English; Copyright; Avail: Aeroplus Dispatch

This article discusses the equivalent mass approach to advanced life support system analysis, describes a computer model developed to use this approach, and presents early results from modeling the NASA JSC BioPlex. The model is built using an object oriented approach and G2, a commercially available modeling package. Cost factor equivalencies are given for the Volosin scenarios. Plant data from NASA-Kennedy and Utah State University are used, together with configuration data from the BioPlex design effort. Initial results focus on the importance of obtaining high plant productivity with a flight-like configuration.
Author (AIAA)
Life Support Systems; Computerized Simulation; Object-Oriented Programming; Plants (Botany)

19980049668
A modified CROPGRO model for simulating soybean growth in controlled environments
Cavazzoni, James, New York Univ., USA; Volk, Tyler, New York Univ., USA; Stutte, Gary, Dynamac Corp., USA; Life Support & Biosphere Science; 1997; ISSN 1069-9422; Volume 4, no, nos. 1-2, pp. 43-48; In English
Contract(s)/Grant(s): NAS1-12180; NAGW-4125; Copyright; Avail: Aeroplus Dispatch

The CROPGRO crop growth model is adapted in order to analyze experimental data from a soybean (cv. Hoyt) experiment conducted at elevated CO2 levels (1200 micromol/mol) at NASA-Kennedy. The following adaptations to original CROPGRO produced model agreement with gas-exchange data: the input of square-wave temperature and photosynthetically active radiation (PAR) profiles; the input of the appropriate hydroponic substrate PAR albedo; modified biomass partitioning and developmental parameters; an increased leaf area expansion rate through the fifth vegetative node; a decreased specific leaf area after the fifth vegetative node; and an increased incident diffuse PAR fraction over typical field values. The model demonstrated here suggests that with continued development, modified CROPGRO will be a useful tool in the analysis and eventual optimization of legume production in bioregenerative life support systems.
Author (AIAA)
Soybeans; Biological Models (Mathematics); Carbon Dioxide; Gas Exchange; Photosynthesis

19980049669

Phasic temperature control appraised with the Ceres-Wheat model

Volk, Tyler, New York Univ., USA; Bugbee, Bruce, Utah State Univ., Logan; Tubiello, Francesco, NASA Goddard Inst. for Space Studies, USA; Life Support & Biosphere Science; 1997; ISSN 1069-9422; Volume 4, no, nos. 1-2, pp. 49-54; In English
Contract(s)/Grant(s): NAGW-4125; NCC2-139; Copyright; Avail: Aeroplus Dispatch

Phasic control refers to the specification of a series of different environmental conditions during a crop's life cycle, with the goal of optimizing some aspect of productivity. Because of the enormous number of possible scenarios, phasic control is ideal for modeling to provide guidance prior to experiments. Here we use the 'Ceres-Wheat' model, modified for hydroponic growth chambers, to examine temperature effects. We first establish a baseline by running the model at constant temperatures from 10-30 C. Grain yield per day peaks at 15 C at a value that is 25 percent higher than the yield at the commonly used 23 C. We show results for phasic control limited to a single shift in temperature and, finally, examine scenarios that allow each of the five phases of the life cycle to have a different temperature. Results indicate that grain yield might be increased by 15-20 percent over the best yield at constant temperature, primarily from a boosted harvest index, which has the additional advantage of less waste biomass. Such gains, if achievable, would help optimize food production for life support systems. Experimental work should first verify the relationship between yield and temperature, and then move to selected scenarios of phasic control, based on model predictions.
Author (AIAA)

Life Support Systems; Crop Growth; Wheat; Temperature Control; Biological Models (Mathematics); Hydroponics

19980049670

In vitro food production for isolated closed environments - Formation of ripe tomato fruits from excised flower buds

Applewhite, Philip B., Yale Univ., USA; K-Sawhney, Ravindar, Yale Univ., USA; Galston, Arthur W., Yale Univ., USA; Life Support & Biosphere Science; 1997; ISSN 1069-9422; Volume 4, no, nos. 1-2, pp. 55-59; In English; Copyright; Avail: Aeroplus Dispatch

Excised preanthesis flower buds of young Pixie Hybrid tomato plants develop into red ripe fruits in aseptic culture on a modified Murashige-Skoog medium with 3 percent sucrose at pH 5.8. The addition of certain synthetic auxins (IAA, NAA, IBA), auxin precursors (ISA), or cytokinins (KIN, IPA, ZEA, BAP) to the medium improved the percentage of buds developing into fruits, the weight of the ripe fruits, or both. The best results were obtained by an auxin-cytokinin combination of 10 micro-M IBA with 1 micro-M BAP. Storage of the excised buds at low temperature (6 C) for up to four weeks before transfer to 27 C caused only minimal deterioration in size and number of the fruit crop. Extension of low-temperature storage to eight weeks produced smaller fruits that took longer to develop. This system could produce fresh, ripe small tomatoes on a sustained basis for up to two months for an isolated environment such as a space vehicle or submarine.
Author (AIAA)

Aerospace Vehicles; Food; Tomatoes; Weight (Mass); Low Temperature; Storage

19980049671

Microbial colonization of a closed growth chamber during hydroponic cultivation of lettuce

Koenig, David W., KRUG Life Sciences, Inc., USA; Bruce, Rebekah J., KRUG Life Sciences, Inc., USA; Molina, Thomas C., KRUG Life Sciences, Inc., USA; Barta, Daniel J., NASA Johnson Space Center, USA; Pierson, Duane L., NASA Johnson Space Center, USA; Life Support & Biosphere Science; 1997; ISSN 1069-9422; Volume 4, no, nos. 1-2, pp. 61-69; In English; Copyright; Avail: Aeroplus Dispatch

The goal of this study was to characterize sessile and planktonic microbiota that developed during two successive hydroponic cultures of lettuce in a closed chamber system. Coupons of polyvinyl chloride (PVC) placed in the nutrient solution lines were removed periodically, as were samples of the nutrient solutions and condensate from the air-handling system. The bacteria and fungi present on the coupons and in fluid samples were enumerated by direct plate counts. Disinfecting the hydroponic system with 0.1 percent hypochlorite and 0.1 N nitric acid reduced the bacterial densities in biofilm samples from 1 x 10 exp 7 CFU/10 sq cm to 1 x 10 CFU/10 sq cm and eliminated culturable fungi; Staphylococcus sp., Pseudomonas sp., and Micrococcus sp. survived this procedure. Bacterial and fungal concentrations in all samples returned to predisinfection levels after two days of plant growth. Pseudomonas and Acremonium predominated both before and after disinfection. Fungal concentrations never exceeded 7 x 10 exp 2 CFU/10 sq cm. The coupon microbiota differed from that of the rhizoplane at harvest. Overall, the greatest numbers of species were found on the rhizoplane samples collected during the second crop. The microbial community changed little during individual crops or between successive crops. Diversity indices remained relatively constant for all samples.
Author (AIAA)

Microbiology; Hydroponics; Vegetation Growth; Plankton; Nutrients; Bacteria

19980049672

Diffuse light and wheat radiation-use efficiency in a controlled environment

Tubiello, Francesco, NASA Goddard Inst. for Space Studies, USA; Volk, Tyler, New York Univ., USA; Bugbee, Bruce, Utah State Univ., Logan; Life Support & Biosphere Science; 1997; ISSN 1069-9422; Volume 4, no, nos. 1-2, pp. 77-85; In English
Contract(s)/Grant(s): NAGW-4125; NCC2-139; Copyright; Avail: Aeroplus Dispatch

Radiation-use efficiency (dry matter produced/unit absorbed radiation) of a spring wheat was 40 percent higher in controlled growth chamber experiments than under optimal field conditions. Simulations with CERES-Wheat, a field model modified to account for growth chamber conditions, suggest that the observed increase in radiation-use efficiency was due to the large fraction of diffuse light in the experimental chamber. Under optimal conditions in the field, the highest crop growth rates occur when the daily photosynthetic photon flux (PPF) is at its highest levels (50-60 mol/sq m/d). However, these high growth rates do not appear to be associated with the highest radiation-use efficiency. High PPF levels in the field occur on clear days when the fraction of direct radiation is high and the diffuse fraction is low. In controlled environments with reflective walls, high PPF levels with a large fraction of diffuse radiation can be obtained. Diffuse radiation penetrates to the lower leaves of a canopy better than direct radiation, with the result that the upper leaves are less light saturated and the lower leaves receive more light, increasing radiation-use efficiency, and thus growth rates. The data and model simulations presented here suggest that when diffuse light is a high fraction of the total PPF crop productivity can exceed the highest values attainable in the field under optimal conditions.
Author (AIAA)

Test Chambers; Vegetation Growth; Radiation Effects; Photosynthesis; Diffuse Radiation; Crop Vigor

19980049696

The influence of CO2 in a space-like environment: Study design. I

Wenzel, Juergen, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Luks, Norbert, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Plath, Gernot, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Wilke, Doris, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Gerzer, Rupert, DLR, Inst. fuer Luft- und Raumfahrtmedizin, Germany; Aviation, Space, and Environmental Medicine; Mar. 1998; ISSN 0095-6562; Volume 69, no. 3, pp. 285-290; In English; Copyright; Avail: Aeroplus Dispatch

In order to obtain more information about the permissible CO2 level for future space missions and also to clarify Space Station design criteria, NASA-ESA-DARA have initiated a ground-based simulation study with two different CO2 levels: 0.7 percent (first campaign) and 1.2 percent CO2 (second campaign). The deep diving facility of DLR was used to provide atmospheric control and long-term habitation for the test subjects in studying the effect of increased CO2 on physiological and psychological functions. A number of experiments were implemented, which tested selected effects of raised CO2 on humans. Four male subjects stayed in the chamber for 26 d in each campaign, in order to perform the different tests in repeated trials, with the aim of evaluating possible long-term effects. CO2 was controlled by absorption with soda lime, flushing with fresh air and the addition of CO2, if necessary. Essentially, the CO2 produced by the subjects was used to maintain the level at 0.7 and 1.2 percent, respectively. The results of the experiments support the current CO2 limits for space operations, insofar as values around 1 percent do not impose any severe restrictions to human habitation for at least several weeks, whereas life sciences experiments especially sensitive to CO2 influences have to be carefully evaluated for possible interferences.
Author (AIAA)

International Space Station; NASA Space Programs; European Space Programs; Space Habitats; Carbon Dioxide Concentration; Gravitational Physiology

19980050108

Development and evaluation of a cognitive model of human performance in fighter aircraft

Bautsch, Holly S., Logicon Technical Services, Inc., USA; Narayanan, S., Wright State Univ., USA; McNeese, Michael D., USAF, Armstrong Lab., USA; 1997, pp. 2109-2113; In English; Copyright; Avail: Aeroplus Dispatch

As fighter aircraft become more technologically complex, the major tasks of the pilot become cognitively demanding. Models and theories that represent the domain complexity and associated operator activities are useful in human-centered design. This article describes a human performance model of a fighter pilot developed through cognitive task analysis. The analysis was conducted based on empirically driven concept maps and semi-structured interviews with fighter pilots. The resulting model highlights salient decision points, key concepts, information requirements, problems, and problem solutions encountered in mission scenarios in the context of data collected through human-in-the-loop simulations of prototypical fighter aircraft tasks. This paper outlines the cognitive task analysis, model development, and evaluation.
Author (AIAA)

Fighter Aircraft; Aircraft Pilots; Pilot Performance; Biological Models (Mathematics); Cognitive Psychology; Tasks

19980050109

Human-machine cooperation in air traffic control

Lemoine, M. P., Valenciennes et Hainaut-Cambresis, Univ., France; Millot, P., Valenciennes et Hainaut-Cambresis, Univ., France; Debernard, S., Valenciennes et Hainaut-Cambresis, Univ., France; 1997, pp. 2114-2119; In English; Copyright; Avail: Aeroplus Dispatch

A dynamic task allocation between two human operators and two assistance tools has been evaluated in the Air Traffic Control domain. The tactical operator, the radar controller, was assisted by an assistance tool for solving traffic conflicts (SAINTEX). The strategical operator, the planning controller, was assisted by a second tool (PLAF) for traffic conflict detection and for allocating the traffic conflicts between the radar controller and SAINTEX. Three series of experiments were compared: (1) a first series used as a reference (with no assistance tool), (2) an explicit mode (controllers in charge of the allocation), and (3) an assisted explicit mode (PLAF-proposed conflict allocations which could be changed by the planning controller). Comparisons were made on the basis of performance analysis, answers to questionnaires, and an original method of cognitive analysis of verbal reports.

Author (AIAA)

Man Machine Systems; Air Traffic Control; Tasks; Air Traffic Controllers (Personnel)

19980050110

Pilot non-conformance to alerting system commands

Pritchett, Amy R., Georgia Inst. of Technology, Atlanta, USA; 1997, pp. 2125-2130; In English

Contract(s)/Grant(s): NAG2-716; Copyright; Avail: Aeroplus Dispatch

Instances of pilot non-conformance to alerting system commands have been identified in previous studies. Pilot non-conformance changes the final behavior of the system, and therefore may reduce actual performance from that anticipated. Two simulator studies have examined pilot non-conformance, using the task of collision avoidance during closely spaced parallel approaches as a case study. The first study discovered subjects' decisions to alert, and their selected avoidance maneuver, differed from those typically commanded by collision avoidance systems. The second study found that consonance between the display and the alerting system improved subject agreement with automatic alerts. Based on these results, a general discussion of the factors involved in pilot conformance is given, and design guidelines for alerting systems are suggested.

Author (AIAA)

Aircraft Pilots; Biological Models (Mathematics); Collision Avoidance; Aircraft Maneuvers; Commands

19980050111

Using digital information on the shop floor - Requirements from the technician's perspective

Hastings, Philip A., Galaxy Scientific Corp., USA; 1997, pp. 2131-2136; In English; Copyright; Avail: Aeroplus Dispatch

Under grant from the FAA Office of Aviation Medicine, the Galaxy Scientific Corporation conducted task analysis and job aiding research to identify the human factors issues related to communication and information flow in the turbine repair shop at Delta Air Lines. We created prototype software that was designed to support maintenance technicians working in the repair shop environment. The Turbine Repair Automated Control System (TRACS) was constructed to integrate a number of traditionally separate tasks, such as electronic sign-off on work cards, the ordering of parts, and the lookup of information in digital manuals. The current paper discusses the steps involved in designing the prototype and offers recommendations for approaching similar situations.

Author (AIAA)

Aircraft Maintenance; Floors; Digital Techniques; Information Flow; Human Factors Engineering; Turbine Engines

19980050443

Head-mounted eye movement tracking display and its image display method

Iwamoto, Kazuyo, AIST-MITI, Japan; Tanie, Kazuo; Maeda, Taro; Systems and Computers in Japan; June 30, 1997; ISSN 0882-1666; Volume 28, no. 7, pp. 89-99; In English; Copyright; Avail: Issuing Activity

As a visual image presentation device in virtual reality and telerobotics, the head-mounted display (HMD) is attracting attention. The basic principle of HMD is as follows. Two small displays are arranged in front of the two eyes, and present images with parallax, conveying a stereo feeling to the operator. The number of scan lines of the displays used in these conventional HMDs is generally limited. For that reason, it is difficult to construct a stereo feeling which will present sufficient images to cover the human view field while maintaining resolution, and this is an obstacle in presenting highly realistic images. For solving this problem, an eye-movement tracking type HMD which can present images with a wide view field and high resolution has been proposed. Human vision can observe objects with high resolution only near the gaze point. Paying attention to this visual characteristic, the eye-movement tracking type HMD is developed as a system which presents images of high resolution in a small

region in the view-line direction and presents images of low resolution but wide view field in its surroundings, and thus equivalently presents images of wide view field and high resolution. In this paper, we will propose an image presentation scheme for the embodiment of an eye-movement tracking type HMD and will also describe efforts to confirm its appropriateness by experiments with simple images.
Author (EI)
Eye Movements; Head Movement; Recognition; Display Devices; Virtual Reality; Human-Computer Interface; Image Reconstruction

19980050526
Processing modules for hybrid, real-time, distributed robot architectures
Chernett, Paul, Essex, Univ., UK; Colley, Martin, Essex, Univ., UK; Callaghan, Vic, Essex, Univ., UK; 1997, pp. 212-219; In English; Copyright; Avail: Aeroplus Dispatch

New experimental hardware for research into architectures for distributed intelligent embedded systems is proposed that will provide a wide range of communication media including non-deterministic broadcast such as Ethernet, deterministic broadcast such as CAN, and processor busses such as VME. The emphasis is on large scale system integration rather than provision for individual capabilities. A prototype implementation of some of the proposed hardware and software modules is described together with their use in several research projects.
Author (AIAA)
Real Time Operation; Artificial Intelligence; Robot Control; Systems Integration

19980050527
Underwater robot society doing internal inspection and leak monitoring of water systems
Halme, Aarne, Helsinki Univ. of Technology, Finland; Vainio, Mika, Helsinki Univ. of Technology, Finland; Appelqvist, Pekka, Helsinki Univ. of Technology, Finland; Jakubik, Peter, Helsinki Univ. of Technology, Finland; Schoenberg, Torsten, Helsinki Univ. of Technology, Finland; Visala, Arto, Helsinki Univ. of Technology, Finland; 1997, pp. 190-199; In English; Copyright; Avail: Aeroplus Dispatch

In the field of civil engineering, an effective internal monitoring of pipes and water storage is very problematic. Normally the sensors used for the task are either fixed or manually movable. Thus they will only provide locally and temporally restricted information. As a solution, an underwater robotic sensor/actuator society is presented. The system is capable of operating inside a fluid environment as a kind of distributed sensory system. The value of the system emerges from the interactions between the members. Through a communication system the society fuses information from individual members and provides a more reliable estimate of the conditions inside water systems. Test results in a transparent demo process consisting of tanks and pipes with a volume of 700 liters are presented.
Author (AIAA)
Robot Control; Leakage; Underwater Tests; Inspection; Multisensor Fusion

19980050528
A modular planning/control architecture for the semi-autonomous control of telerobots in a hazardous environment
Tarn, Tzyh-Jong, Washington Univ., USA; Brady, Kevin, Washington Univ., USA; Xi, Ning, Washington Univ., USA; Love, Lonnie, Oak Ridge National Lab., USA; Lloyd, Peter, Oak Ridge National Lab., USA; Burks, Barry, Oak Ridge National Lab., USA; Davis, Hurley, Oak Ridge National Lab., USA; 1997, pp. 182-189; In English; Copyright; Avail: Aeroplus Dispatch

The Oak Ridge National Laboratory (ORNL) has demonstrated, evaluated, and deployed a telerobotic approach for the remote retrieval of hazardous and radioactive wastes from undergound storage tanks. The telerobotic system, built by Spar Aerospace Ltd., is capable of dislodging and removing sludge and gravel-like wastes without endangering the human operators through contact with the environment. Working in partnership with Washington University, ORNL has implemented an Event Based Planner/Function Based Sharing Control (FBSC) as an integral part of their overall telerobotic architecture. These aspects of the system enable the seamless union of the human operator and an autonomous controller in such a way to emphasize safety without any loss of performance. The cooperation between ORNL, Spar, and Washington University requires an open and modular control software architecture to enable the parallel development of various components of the system. ControlShell has been used as the underlying software architecture to help meet these criteria of generality and modularity.
Author (AIAA)
Telerobotics; Robot Control; Hazards; Waste Disposal

19980050530

A unique sensor fusion system for coordinate measuring machine tasks

Nashman, Marilyn, NIST, USA; Yoshimi, Billibon, NIST, USA; Hong, Tsai H., NIST, USA; Rippey, William G., NIST, USA; Herman, Martin, NIST, USA; 1997, pp. 145-156; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes a real-time hierarchical system that fuses data from vision and touch sensors to improve the performance of a coordinate measuring machine (CMM) used for dimensional inspection tasks. The system consists of sensory processing, world modeling, and task decomposition modules. It uses the strengths of each sensor - the precision of the CMM scales and the analog touch probe and the global information provided by the low resolution camera - to improve the speed and flexibility of the inspection task. In the experiment described, the vision module performs all computations in image coordinate space. The part's boundaries are extracted during an initialization process and then the probe's position is continuously updated as it scans and measures the part surface. The system fuses the estimated probe velocity and distance to the part boundary in image coordinates with the estimated velocity and probe position provided by the CMM controller. The fused information provides feedback to the motion controller as it guides the touch probe to scan the part. We also discuss integrating information from the vision system and the probe to autonomously collect data for 2-D to 3-D calibration, and work to register Computer Aided Design (CAD) models with images of parts in the workplace.

Author (AIAA)

Multisensor Fusion; Real Time Operation; Multisensor Fusion; Computer Vision; Computer Aided Design; Control Systems Design

19980050531

A vision-guided, semi-autonomous system applied to a robotic coating application

Seelinger, M. J., Notre Dame, Univ., USA; Robinson, M., Notre Dame, Univ., USA; Dieck, Z., Notre Dame, Univ., USA; Skaar, S. B., Notre Dame, Univ., USA; 1997, pp. 133-144; In English

Contract(s)/Grant(s): N00014-95-1-G010; NSF EEC-97-00702; Copyright; Avail: Aeroplus Dispatch

This paper describes a new semi-autonomous, calibration-free system which integrates a user-friendly graphical interface, several cameras, a laser pointer mounted on a two-axis pan/tilt unit, and a six degree-of-freedom robot. The details of the system will be discussed in reference to the problem of coating a workpiece of unknown geometry that is positioned arbitrarily with respect to the robot and the vision sensors. The remote user specifies the region of the workpiece that is to be coated simply by 'pointing' and 'clicking' on the region of interest as it appears in a single image on the user's computer monitor. By means of a simple and robust control strategy, the laser pointer mounted on the pan/tilt unit is autonomously actuated to a user-specified number of approximate positions in the region of the surface of interest. This is used to create compatible maneuver objectives in the participating vision sensors. Then, using the method of camera-space manipulation, the robot is controlled to make several passes across the region. Regardless of the geometry of the workpiece, the manipulated nozzle always remains perpendicular to the surface at a user-specified distance from the surface. Upon completion of the coating process, the laser pointer is again actuated to pass through a specified number of points on the new surface. This information is used to make a very precise inference of the thickness of the build-up of the coat that has been applied. If the coat is not sufficiently thick, the robot makes more passes as required. The paper also presents experimental results of the high accuracy of position and orientation control of the manipulated tool, as well as the depth inference of the surface coat applied.

Author (AIAA)

Robotics; Computer Graphics; Robot Control; Computer Vision; Cameras; Inspection

19980050532

Target specification error optimal camera configuration for vision-based robotics

Kucuk, Haluk, Michigan Technological Univ., Houghton, USA; Parker, Gordon G., Michigan Technological Univ., Houghton; Klymyshyn, Nicholas A., Battelle Pacific Northwest Lab, USA; Baumgartner, Eric T., JPL, USA; 1997, pp. 124-132; In English; Copyright; Avail: Aeroplus Dispatch

Applications of vision based remotely operated robotic systems range from planetary exploration to hazardous waste remediation. For space applications, where communication time-lags are large, the target selection and robot positioning tasks may be performed sequentially, differing from conventional tele-robotic maneuvers. For these point-and-move systems, the desired target must be defined in the image planes of the cameras either by an operator or through image processing software. Ambiguity of the target specification will naturally lead to end-effector positioning errors. In this paper, the target specification error covariance is shown to transform linearly to the end-effector positioning error. In addition, a methodology for target specification error opti-

mal estimation of camera view parameters of a vision based robotic system is presented. A cost function is examined based on minimizing the end-effector error covariance matrix. Simulation and experimental results are presented.
Author (AIAA)
Robotics; Computer Vision; Cameras; End Effectors

19980050538
Self-calibration of eye-hand coordination system with decentralized data fusion
Lee, Sukhan, Southern California, Univ., Los Angeles; JPL, USA; Ro, Sookwang, Southern California, Univ., USA; Schenker, Paul, JPL, USA; 1997, pp. 35-45; In English; Copyright; Avail: Aeroplus Dispatch

A method of automatically reducing uncertainties and calibrating possible biases involved in sensed data and extracted features by a system based on geometric data fusion is presented. The perception net, as a structural representation of the sensing capabilities of a system, connects features of various levels of abstraction, referred to here as logical sensors, with their functional relationships such as feature transformations, data fusions, and constraints to be satisfied. The net maintains the consistency of logical sensors based on the forward propagation of uncertainties as well as the backward propagation of constraint errors. A novel geometric data fusion algorithm is presented as a unified framework for computing forward and backward propagations through which the net achieves the self-reduction of uncertainties and self-calibration of biases. The effectiveness of the proposed method is validated through simulation.
Author (AIAA)
Self Adaptive Control Systems; Calibrating; Multisensor Fusion; Eye (Anatomy); Hand (Anatomy); Robotics

19980050567
Multimedia modeling of Autonomous Mobile Robots
Zada, F., Arab Academy for Science and Technology, Egypt; Guirguis, S., Alexandria Univ., Egypt; 1997, pp. 315-328; In English; Copyright; Avail: Aeroplus Dispatch

Modeling of Autonomous Mobile Robots (AMRs) is sought to enable the designers to investigate various aspects of the design before the actual implementation takes place. Simulation techniques are undoubtedly enriching the design tools, by which the designer would be able to vary the design parameters as appropriate until achieving some optimal performance point. Although they are general purpose, multimedia tools, especially authoring tools, can give the AMR designer some degree of assistance in fulfilling his simulation task as fast as possible. This rapid prototyping tool is rather cost effective, and allows the designer to interactively manipulate his design in simple steps. A multimedia environment has been constructed to enable designers to simulate AMRs in order to investigate aspects concerning their kinematics and dynamics. It is also sought to gather and categorize these design experiences in a tutoring system that could be used by practitioners and students enrolled in highly technical courses such as robotics. The rich multimedia environment can assist the learner in so many ways by devising examples, suggesting solutions and design tradeoffs that have been experienced before.
Author (AIAA)
Multimedia; Robot Control; Mobility; Autonomy

19980050568
Automated creation of image-based virtual reality
Bourque, Eric, McGill Univ., Canada; Dudek, Gregory, McGill Univ., Canada; 1997, pp. 292-303; In English; Copyright; Avail: Aeroplus Dispatch

While virtual reality is a powerful tool for a range of applications, it has the following two associated overheads that fundamentally limit its usefulness: (1) the creation of realistic synthetic virtual environment models is difficult and labor intensive; (2) the computing resources needed to render realistic complex environments in real time are substantial. The authors describe an approach to the fully automated creation of image based virtual reality (VR) models: collections of panoramic images (cylindrical or spherical images) that illustrate an environment. Traditionally, a key bottleneck for this kind of modeling is the selection and acquisition of sample data. The approach is based on using a small mobile robot to navigate in the environment and collect the image data of interest. A critical issue is selecting the appropriate sample locations of the modeling process: this is addressed using a computational mechanism that resembles human attention. The objective is to select regions that differ from the surrounding environment. This is done by using statistical properties of the output of an edge operator. Specifically, a camera-carrying mobile robot is guided through an environment and it acquires data with which a VR model is constructed. The effectiveness of this approach is demonstrated using real data.
Author (AIAA)
Virtual Reality; Robot Control

19980050569

Virtual reality hardware for use in interactive 3D data fusion and visualization

Gourley, C. S., Tennessee, Univ., Knoxville, USA; Abidi, M. A., Tennessee, Univ., Knoxville; 1997, pp. 281-291; In English Contract(s)/Grant(s): DE-FG02-86NE-37968; Copyright; Avail: Aeroplus Dispatch

A VR system has been designed and built for use in range data fusion and visualization. One major VR tool is the CAVE. This is the ultimate visualization tool, but it comes with a large price tag. The design uses a unique CAVE whose graphics are powered by a desktop computer instead of a larger rack machine making it much less costly. The system consists of a screen eight feet tall by twenty-seven feet wide giving a variable field-of-view currently set at 160 deg. A Silicon Graphics Indigo2 MaxImpact with the Impact Channel Option is used for display. This gives the capability to drive three projectors at a resolution of 640 x 480 for use in displaying the virtual environment and one 640 x 480 display for a user control interface. This machine is also the first desktop package which has built-in hardware texture mapping. This feature allows one to quickly fuse the range and intensity data and other multi-sensory data. The final goal is a complete 3D texture mapped model of the environment. A dataglove, magnetic tracker, and spaceball are to be used for manipulation of the data and navigation through the virtual environment. This system gives several users the ability to interactively create 3D models from multiple range images.

Author (AIAA)

Virtual Reality; Multisensor Fusion; Laser Range Finders; Three Dimensional Models

19980050929

An overview of ISS ECLSS life testing at NASA, MSFC

Tatara, James D., ION Corp., USA; Roman, Monsi C., NASA Marshall Space Flight Center, USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 13-21; In English; Copyright; Avail: Aeroplus Dispatch

Numerous components have been developed for use in the International Space Station (ISS) Environmental Control and Life Support System (ECLSS). Although these components have performed admirably for short-duration subsystem tests, there is little long-range operational (life test) data available. It is important to know not only how long a subsystem is anticipated to perform, but also the problems that can be expected should subsystem components fail. For this reason, NASA at the Marshall Space Flight Center (MSFC) developed the ECLSS Life Test program. to date, assemblies and subassemblies that are being or have been tested include the Trace Contaminant Control Subassembly (TCCS), the Vapor Compression Distillation Urine Processor Assembly (VCD-UPA), the Four-Bed Molecular Sieve Carbon Dioxide Removal Assembly (4BMS-CDRA), and the Solid Polymer Electrolyzer Oxygen Generation Assembly (SPE-OGA). Also included in life testing are noncomponent life test studies. These include the Water Degradation Study and the Biofilm Life Test. The Water Degradation Study looks at water quality changes after exposure to simulated ISS pre-Water Recovery Management (WRM) conditions. The Biofilm Life Test will examine microbial accumulation on surfaces in a simulated ISS water delivery system. This article will briefly review the objectives of each life test program, the results of completed tests, and the major problems observed during the tests.

Author (AIAA)

Performance Tests; Service Life; NASA Programs; International Space Station; Life Support Systems; Space Station Payloads

19980050930

The use of biofilters to improve indoor air quality - The removal of toluene, TCE, and formaldehyde

Darlington, Alan, Guelph, Univ., Canada; Dixon, Michael A., Guelph, Univ., Canada; Pilger, Charles, Ryerson Univ., Canada; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 63-69; In English; Copyright; Avail: Aeroplus Dispatch

A biofilter composed of a scrubber, a hydroponic planting system, and an aquatic system with green plants as a base maintained air quality within part of a modern office building. The scrubber was composed of five parallel fiberglass modules with external faces of porous lava rock. The face, largely covered with mosses, was wetted by recirculating water. Air was drawn through the scrubber and the immediately adjacent hydroponic region by a dedicated air handling system. The system was challenged for four weeks with three common indoor organic pollutants and removed significant amounts of all compounds. A single pass through the scrubber removed 10 percent of the trichloroethylene (TCE) and 50 percent of the toluene. A single pass lowered formaldehyde air concentrations to 13 micrograms/cu m irrespective of influent levels (ranging between 30 and 90 micrograms/cu m). The aquatic system accumulated TCE but neither toluene nor formaldehyde, suggesting the rapid breakdown of these materials. The botanical components removed some pollutants.

Author (AIAA)

Filters; Filtration; Indoor Air Pollution; Toluene; Chloroethylene; Formaldehyde; Air Quality; Air Purification; Buildings

19980050931

Maintaining safe oxygen levels in semiclosed underwater breathing apparatus

Nuckols, M. L., U.S. Naval Academy, USA; Clarke, John, U.S. Navy, Naval Experimental Diving Unit, USA; Grupe, Cara, Oxford, Univ., UK; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 87-95; In English; Copyright; Avail: Aeroplus Dispatch

Semiclosed circuit underwater breathing apparatus (UBAs) are far more conserving of limited gas supplies than either steady-flow, open-circuit, or demand open circuit systems. Semiclosed systems recirculate most of the diver's breathing gases, while injecting only a small percentage of the total circuit flow with a fresh makeup supply. The fresh injected gas supply delivers the necessary makeup to compensate for the oxygen that the diver consumes during each pass through the lungs. This gas-conserving feature makes the utility for semiclosed UBAs for long-duration deep-diving applications more practical than either of the open-circuit designs. However, although more gas-conservative, these systems maintain variable oxygen levels during a dive that can fluctuate widely with changes in the diver's activity level, depth of the dive, makeup gas composition, or variations in the total circuit volume. It is essential that the oxygen levels in the circuit always remain within physiologically safe limits: neither too low to avoid the onset of hypoxia, nor too high to risk oxygen toxicity. This article presents an analytical assessment of the oxygen levels in semiclosed UBAs. This model allows the designers of semiclosed circuits to predict the effects of UBA circuit volumes, makeup gas compositions, injection rates for the makeup gas, diver depths, and initial circuit oxygen levels on the time-dependent levels of oxygen in these circuits. by using this analytical tool, judicious selection of these design variables can result in the most efficient utilization of the fresh gas supply carried by the diver, and ensure the safe operation of these UBA designs.
Author (AIAA)

Oxygen; Underwater Breathing Apparatus; Toxicity; Hypoxia; Oxygen Supply Equipment

19980050995

Automation, flight management and pilot training - Issues and considerations

Mouloua, Mustapha, Central Florida, Univ., USA; Gilson, Richard D., Central Florida, Univ., USA; Koonce, Jefferson, Central Florida, Univ., USA; Aviation training: Learners, instruction and organization; 1997, pp. 78-86; In English; Copyright; Avail: Aeroplus Dispatch

The aviation industry has experienced a considerable level of automation control in the past 20 years. For almost any task, pilots, crew members, maintenance operators, air traffic controllers, as well as other specialized personnel, can now benefit from the use of automation. For pilots, automation has reduced the burden of excessive in-flight workload and resulted in fuel efficiency and enhanced all-weather flying. However, this use of automation has also resulted in a number of behavioral problems related to flight management and systems safety. These problems include a loss of situational awareness, monitoring inefficiency, increased mental workload, and sometimes, a pilot's inability to effectively revert to manual control in cases of system breakdowns or malfunctions. Clearly, these pitfalls can be attributed to technology-centered 'conventional' automation, in which the function between the pilot and automation remains fixed at all times. Understanding how pilots interact with automation in the cockpit is crucial for safety, pilot, and system performances, as well as for system design. The present chapter describes some of the human factors issues associated with automation design and presents some considerations for future pilot training and system design.
Author (AIAA)

Automation; Pilot Training; Training Analysis; Training Evaluation; Flight Management Systems; Flight Training

19980050997

The roles of learning, instruction and the organization in aviation training

Telfer, Ross A., Newcastle, Univ., Australia; Moore, Phillip J., Newcastle, Univ., Australia; Aviation training: Learners, instruction and organization; 1997, pp. 1-13; In English; Copyright; Avail: Aeroplus Dispatch

There are significant potential differences in the perspectives on learning and instruction held by pilots, instructors, and the range of organizations which administer aviation training and testing. These organizations include flying schools, regulatory authorities, and airline management. The degree to which congruence or alignment occurs across the three groups - trainees, trainers, and system - determines the potency or dilution of training effectiveness. At this stage, in the absence of substantiating data, this argument has to remain an assertion. It has, however, high face validity and our ongoing research offers encouraging results. The presence and extent of a lack of congruence - or conflicts - in expectations suggest the extent to which training effectiveness (the extent to which it attains its goals) and efficiency (the cost of doing so) are impaired. Our research has developed ways in which aviation training organizations can assess: pilots' perspectives on learning; the learning that instructors encourage; and the learning that management and organizational culture shape. These three contributors to learning are detailed.
Author (AIAA)

Learning Theory; Training Analysis; Training Evaluation; Pilot Training

19980051211

Proposed minimum requirements for the operational characteristics and testing of closed circuit life support system control electronics

Kirk, James C., Johns Hopkins Univ., APL, USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 97-105; In English; Copyright; Avail: Aeroplus Dispatch

The popularization and transformation of scuba diving into a broadly practiced sport has served to ignite the interest of technically oriented divers into ever more demanding areas. This, along with the gradual release of military data, equipment, and techniques of closed circuit underwater breathing apparatus, has resulted in a virtual explosion of semiclosed and closed circuit systems for divers. Although many of these systems have been carefully thought out by capable designers, the impulse to rush to market with equipment that has not been fully developed and carefully tested is irresistible to marketers. In addition, the presence of systems developed by well-intentioned and otherwise competent designers who are, nonetheless, inexperienced in the field of life support can result in the sale of failure-prone equipment to divers who lack the knowledge and skills to identify deficiencies before disaster occurs. For this reason, a set of industry standards establishing minimum requirements and testing is needed to guide the designers of this equipment, and to protect the user community from incomplete or inadequate design. Many different technologies go into the development of closed circuit scuba. One key area is the design of electronics to monitor and maintain the critical gas mixtures of the closed circuit loop. Much of the system reliability and inherent danger is resident in the design of the circuitry and the software (if any) that runs it. This article presents a set of proposed minimum requirements, with the goal of establishing a dialog for the creation of guidelines for the classification, rating, design, and testing of embedded electronics for life support systems used in closed circuit applications. These guidelines will serve as the foundation for the later creation of a set of industry specifications.

Author (AIAA)

Electronic Control; Underwater Breathing Apparatus; Oxygen Supply Equipment; Life Support Systems; Environmental Control; Closed Cycles

19980051212

Food processing in an enclosed environment - Hydroponically grown wheat to bread

Vodovotz, Yael, NASA Johnson Space Center, USA; Barta, Daniel, NASA Johnson Space Center, USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 79-86; In English; Copyright; Avail: Aeroplus Dispatch

A food system based on raw products obtained from higher plants may be a central feature of a biologically based Advanced Life Support System (ALSS) used on long-duration missions to the moon or Mars. Such a food system is dramatically different from previous systems used on the Shuttle or from what is currently planned for the International Space Station. ALSS requires an integrated approach addressing all aspects of food production, from cultivation through processing to meal preparation. This article characterizes the full process of adding bread to the food system, from production of grain through the baking. Bread, baked using controlled environment-grown wheat, was found to be highly acceptable in sensory analysis tests when compared to bread baked using conventional commercial flour. Chief volatiles released during the rising and baking process included ethanol and acetaldehyde. Flour milled from controlled environment-grown wheat was higher in potassium, sodium, iron, and phosphorus than conventional commercial flour. The impacts of these findings are discussed.

Author (AIAA)

Food Processing; Food Production (In Space); Wheat; Hydroponics; Closed Ecological Systems; Long Duration Space Flight; Flour

19980051213

Advances in food systems for space flight

Bourland, Charles T., NASA Johnson Space Center, USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 71-77; In English; Copyright; Avail: Aeroplus Dispatch

Food for space has evolved from cubes and tubes to normal Earth-like food consumed with common utensils. U.S. space food systems have traditionally been based upon the water supply. When on-board water was abundant (e.g., Apollo and Shuttle fuel cells produced water) then dehydrated food was used extensively. The International Space Station will have limited water available for food rehydration, so there is little advantage for using dehydrated foods. Experience from Skylab and the Russian Mir space station emphasizes that food variety and quality are important elements in the design of food for closed systems. The evolution of space food has accentuated Earth-like foods, which should be a model for closed environment food systems.

Author (AIAA)

Space Flight Feeding; International Space Station; Food; Mir Space Station; Closed Ecological Systems; Technology Assessment

19980051214

Nutrient recovery and biodegradation of inedible tomato plant residues by activated sludge cultures and Phanerochaete chrysosporium

Christodoulatos, Christos, Stevens Inst. of Technology, USA; Vaccari, David A., Stevens Inst. of Technology, USA; Korfiatis, George P., Stevens Inst. of Technology, USA; Bhaumik, Syamalendu, Stevens Inst. of Technology, USA; Davies, Kimberley, Stevens Inst. of Technology, USA; Su, Tsan-Liang, Stevens Inst. of Technology, USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 53-61; In English; Copyright; Avail: Aeroplus Dispatch

The biodegradation of inedible biomass and the recovery of nutrients from hydroponically grown tomato plant material were investigated under various growth conditions of activated sludge and the fungus Phanerochaete chrysosporium. The experiments were carried out in shaker flasks at three incubation temperatures (25, 40, and 60 C for the activated sludge and 25, 40, and 50 C for the fungi) with heat-pretreated samples at 150 C for 30 min, and without pretreatment of the inedible residues. Under the experimental conditions tested, both cultures exhibited similar performance in terms of solids reduction and nutrient recovery. Solids reduction as high as 70 percent was obtained in both systems. Most of the solids degradation occurred the first 16 days of incubation. Cellulose degradation reached about 90 percent, but no significant reduction in the solids lignin content was observed. Recovery of nitrogen (as NO2-N and NO3-N) and other micronutrients was sufficiently high and was accompanied by an average 70 percent reduction in COD, indicating that the final effluent is suitable for hydroponic plant growth. Incubation temperature had a minimal effect on solids degradation but appeared to influence the leachability of certain nutrients.
Author (AIAA)

Nutrients; Biodegradation; Tomatoes; Activated Sludge; Long Duration Space Flight; Waste Treatment; Life Support Systems; Space Flight Feeding

19980051215

Assessment of biofilm formation in the International Space Station Water Recovery and Management System

Roman, Monsi C., NASA Marshall Space Flight Center, USA; Minton-Summers, Silvia, ION Corp., USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 45-51; In English; Copyright; Avail: Aeroplus Dispatch

Tests are being conducted at NASA/Marshall Space Flight Center with the purpose of assessing possible water quality changes and potential biofilm formation in the water distribution system of the International Space Station (ISS) Water Recovery and Management (WRM) System. The Biofilm Life Test and Water Degradation Study (WDS) will be discussed in this article. The Biofilm Life Test examines the potential for biofilm formation in the ISS water distribution plumbing and storage tanks. The test has two independent loops; one simulates the waste water prior to the processing by the ISS Water Processor (WP), and the other simulates the processed (clean) water after the ISS WP. The test setup design incorporates tube lengths and angles, material types, flow rates, and recommended hardware that represent the ISS water distribution system. The WDS purpose is to assess changes in water quality (chemical and microbiological) during stagnant long-term storage in distribution lines. Test results demonstrate that prior to the operation of the ISS WP, water can be stored in the ISS water distribution lines.
Author (AIAA)

International Space Station; Water Reclamation; Water Management; Life Support Systems; Space Station Payloads; Performance Tests

19980051216

Next generation physico-chemical systems for water reclamation aboard spacecraft, lunar and planetary habitats

Atwater, James E., Umpqua Research Co., USA; Akse, James R., Umpqua Research Co., USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 35-43; In English; Copyright; Avail: Aeroplus Dispatch

The extent to which bioregenerative processes will be incorporated into future life support systems is not known. Until biologically based processes reach a higher state of readiness, more advanced physico-chemical systems will be required that are capable of reliable operation for long periods with a minimal resupply penalty by minimizing the requirement for expendables. Water reclamation systems must perform three primary functions: (1) removal of suspended solids, (2) removal of dissolved contaminants, and (3) control of microbial growth. In this article, regenerable physico-chemical systems capable of performing these tasks are discussed. These systems may be appropriate for near-term deployments such as a space station retrofit, a lunar outpost, or a Mars transit vehicle.
Author (AIAA)

Water Reclamation; Space Habitats; Lunar Shelters; Planets; Closed Ecological Systems; Technology Assessment; Water Treatment; Spacecraft Environments

19980051217

Assessment of the viral removal capability of the International Space Station Water Recovery and Management System

Roman, Monsi C., NASA Marshall Space Flight Center, USA; Hurst, Christon J., EPA, National Risk Management Research Lab., USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 31-34; In English; Copyright; Avail: Aeroplus Dispatch

The development of the International Space Station (ISS) Water Reclamation and Management (WRM) system has been supported through integrated testing at NASA/Marshall Space Flight Center (MSFC). Assessment of the viral removal capabilities of the ISS water processor was performed as part of the hardware performance evaluation. For the Viral Challenge Test, a known concentration of viruses was mixed with human-generated waste water and reclaimed using the ISS Water Processor. The composition and concentrations of the different wastewaters used for this test represented the combination of contaminants expected to be found in the wastewater that will be collected and recycled on board the ISS. The results from the Viral Challenge Test clearly showed that the ISS WRM has the capacity to reduce the concentration of viruses in the waste water by 12 log(10) units.
Author (AIAA)

Viruses; International Space Station; Water Reclamation; Water Management; Water Treatment; Performance Tests; Waste Water; Space Station Payloads

19980051218

Life testing of the Vapor Compression Distillation Urine Processor Assembly (VCD/UPA) at the Marshall Space Flight Center

Wieland, Paul, NASA Marshall Space Flight Center, USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 23-29; In English; Copyright; Avail: Aeroplus Dispatch

Waste water and urine generated on the International Space Station (ISS) will be processed to recover pure water using vapor compression distillation (VCD). to verify the long-term reliability and performance of the VCD Urine Processor Assembly (UPA), life testing was performed at the Marshall Space Flight Center (MSFC) from January 1993 to April 1996. Two UPAs, the VCD-5 and VCD-5A, were tested for 204 days and 665 days, respectively. The compressor gears and the distillation centrifuge drive belt were found to have operating lives of approximately 4800 h, equivalent to 3.9 years of operation on ISS for a crew of three at an average processing rate of 1.76 kg/h (3.87 lb/h). Precise alignment of the flex-splines of the fluids and purge pump motor drives is essential to avoid premature failure after about 400 h of operation. Results indicate that, with some design and procedural modifications and suitable quality control, the required performance and operational life can be met with the VCD/UPA.
Author (AIAA)

Distillation Equipment; Compressors; Urine; Service Life; Space Station Payloads; Life Support Systems; Waste Treatment

19980051219

Overview of the Environmental Control and Life Support System (ECLSS) testing at MSFC

Traweek, Mary S., NASA Marshall Space Flight Center, USA; Tatara, James D., ION Corp., USA; Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1, pp. 5-12; In English; Copyright; Avail: Aeroplus Dispatch

Previously, almost all water used by the crew during space flight has been transported from Earth or generated in-flight as a by-product of fuel cells. Additionally, this water has been stored and used for relatively short periods. to achieve the USA' commitment to a permanent manned presence in space, more innovative techniques are demanded. Over 20,000 pounds of water and large quantities of air would have to be transported to the International Space Station (ISS) every 90 days with a corresponding amount of waste returned to Earth, for an eight-person crew. This approach results in prohibitive logistics costs, and necessitates near complete recovery and recycling of water. The potential hazards associated with long-term reuse of reclaimed water and revitalized air resulted in the recognition that additional characterization of closed-loop systems and products is essential. Integrated physical/chemical systems have been designed, assembled, and operated to provide air and potable water meeting ISS quality specifications. The purpose of the Environmental Control and Life Support System (ECLSS) test program at NASA's Marshall Space Flight Center (MSFC) is to conduct testing related to the performance of the ISS and its Environmental Control components. The ECLSS Test Program encompasses the Water Recovery Test (WRT), the Integrated Air Revitalization Test (IART), and Life Testing, which permits ECLSS design evaluation. These subsystems revitalize air and reclaim waste waters representative of those to be generated on-orbit. This article provides an overview of MSFC's ECLSS testing. Specific tests include: the Stage 10 Water Recovery Test, the Contaminant Injection Test, the Four-Bed Molecular Sieve Performance Enhancement Test, and Life Testing.
Author (AIAA)

Closed Ecological Systems; Life Support Systems; Water Reclamation; Air Purification; International Space Station; NASA Programs; Performance Tests

19980051220

International Conference on Life Support and Biosphere Science, 3rd, Lake Buena Vista, FL, Jan. 11-15, 1998, Proceedings

Life Support & Biosphere Science; 1998; ISSN 1069-9422; Volume 5,, no. 1; In English; Copyright; Avail: Aeroplus Dispatch

Papers are presented on an overview of the Environmental Control and Life Support System (ECLSS) testing at NASA's Marshall Space Flight Center (MSFC), an overview of the International Space Station (ISS) ECLSS life testing at NASA and at the MSFC, life testing of the Vapor Compression Distillation Urine Processor Assembly (VCD/UPA) at the MSFC, an assessment of the viral removal capability of the ISS Water Recovery and Management System, and next-generation physico-chemical systems for water reclamation aboard spacecraft, lunar, and planetary habitats. Additional papers are presented on an assessment of biofilm formation in the ISS Water Recovery and Management System, nutrient recovery and biodegradation of inedible tomato plant residues by activated sludge cultures and Phanerochaete chrysosporium, and the use of biofilters to improve indoor air quality, with emphasis on toluene, TCE, and formaldehyde removal. Papers are also presented on advances in food systems for space flight; food processing in an enclosed environment, citing the transformation from hydroponically grown wheat to flour and, finally, bread; maintaining safe oxygen levels in semi-closed underwater breathing apparatus; proposed minimum requirements for the operational characteristics and testing of closed circuit life support system control electronics; and an ecological life support system for fish for 100-day experiments.

AIAA

Conferences; Biosphere; Life Support Systems; Closed Ecological Systems

19980051614

Human factors - Training for organizational change

Hayward, Brent, Asia Pacific Resource Management, Australia; Aviation training: Learners, instruction and organization; 1997, pp. 336-347; In English; Copyright; Avail: Aeroplus Dispatch

From a human performance perspective, the major Australian airlines have been in a position to fund the development and implementation of quality human factors training initiatives for flight crews. While the explicit motivation for the introduction of such courses invariably centers on flight safety, some have also been precipitated by the need to address specific operational and/or cultural problems or deficiencies. This chapter reviews developments in Crew Resource Management (CRM) training, and focuses on two programs that are testament to the potential for organizations to detect and respond to such problems, and to affect changes in organizational culture through the introduction of human factors training principles.

Author (AIAA)

Organizations; Human Performance; Training Evaluation; Airline Operations

19980051619

Airline training for new technology

Bent, John, Cathay Pacific Airways, Hong Kong; Fry, Rick, Cathay Pacific Airways, Hong Kong; Aviation training: Learners, instruction and organization; 1997, pp. 268-285; In English; Copyright; Avail: Aeroplus Dispatch

This paper shows how Cathay Pacific Airways introduced a fleet of fly-by-wire aircraft using a variety of theory-into-practice strategies such as seamless training. Cathay's new approach to introducing high technology aircraft involves: analyzing the differences between the new technology and what currently exists; assessing the operational impact; finding ways to explain the differences to pilots as early and as simply as possible; establishing appropriate procedures; providing pretraining and advance information to trainees; and monitoring the process and providing feedback for modification and improvement.

AIAA

Airline Operations; Pilot Training; Training Evaluation; Training Analysis; Automation

19980051640

Introduction to Part 1 - Learners

Moore, Phillip J., Newcastle, Univ., Australia; Aviation training: Learners, instruction and organization; 1997, pp. 17-20; In English; Copyright; Avail: Aeroplus Dispatch

An overview of studies designed to examine the learner in the instructional cycle is presented. The literature on aging and pilot performance is reviewed, the characteristics of private license holders in the U.S. are examined, the nature of expertise is addressed, and the issue of individual preferences about learning is raised. Consideration is given to automation in the cockpit,

movements to automate instruction through computer-based training, and guidelines as to how crew members can get the most out of training courses.
AIAA
Flight Training; Learning; Training Evaluation; Training Analysis

19980053700
Driver models: how to avoid critical yaw movements of vehicles
Willumeit, H. -P., Technical Univ. of Berlin, Germany; International Journal of Vehicle Design; 1997; ISSN 0143-3369; Volume 18, no. 6, pp. 652-667; In English; Copyright; Avail: Issuing Activity

It is shown that most of the driver models combined with models of lateral vehicle dynamics are based on control theory. Because of the nonlinear behavior of human information processing and motor activities, the linear control theory is not an adequate model tool to describe humans general abilities in reacting in the area of longitudinal and lateral vehicle motions. Psychological motor research gives hints for more human-like modelling in connection with tools like Artificial Neural Networks and Fuzzy Set Theory. Despite the lack of knowledge about so-called 'critical driving situations', the heuristic knowledge of design engineers enables to create a system to detect and to avoid critical yaw movements of passenger cars.
Author (EI)
Automobiles; Operators (Personnel); Cybernetics; Mathematical Models

19980054106
Knowledge-based/expert systems technology in life support systems
Liebowitz, Jay; Kybernetes: An International Journal of Cybernetics and General Systems; 1997; ISSN 0368-492X; Volume 26, no. 4-5, pp. 555-573; In English; Copyright; Avail: Issuing Activity

Knowledge-based and expert systems are quickly becoming an important component of knowledge organizations, enterprise knowledge management, and core competences. They are being used in various applications ranging from usage in the US White House to chemical plants worldwide. Presents an overview of expert systems technology and then specifically addresses their use in a critical domain - life support systems.
Author (EI)
Expert Systems; Life Support Systems; Artificial Intelligence; Spacecraft Environments; Knowledge Based Systems; Technological Forecasting

19980055351
Signature strength metrics for camouflaged targets corresponding to human perceptual cues
Copeland, Anthony C., California, Univ., San Diego, USA; Trivedi, Mohan M., California, Univ., San Diego; Optical Engineering; Feb. 1998; ISSN 0091-3286; Volume 37, no. 2, pp. 582-591; In English
Contract(s)/Grant(s): DAAK70-93-C-0037; Copyright; Avail: Aeroplus Dispatch

Three perceptual cues, namely, contrast, texture differences, and boundary strength, were considered in an attempt to develop image metrics for target signature strength that closely correspond to the distinctness of a target as perceived by humans. A psychological experiment was conducted using camouflaged targets which involved paired comparisons of image stimuli that contain various target patterns embedded in varying background patterns. The results were used to evaluate the relative effectiveness of the target signature metrics as representing perceived target distinctness. The image metrics proposed here could ultimately be used to synthesize camouflage patterns and to assess their effectiveness.
AIAA
Camouflage; Man Machine Systems; Target Acquisition; Human Performance

19980055549
Microgravity Science Glovebox
Roark, Walt, NASA Marshall Space Flight Center, USA; Jan. 1998; In English
Report No.(s): AIAA Paper 98-0260; Copyright; Avail: Aeroplus Dispatch

This paper discusses the Microgravity Science Glovebox (MSG), a scientific research facility to be used aboard the International Space Station (ISS) beginning in 2000. It is the next step in microgravity research gloveboxes, evolving from the Shuttle Spacelab and Middeck gloveboxes. The MSG has numerous enhancements over previous gloveboxes and provides much more

freedom for the investigator to perform specialized research. Topics discussed here include the MSG's system concept, technical capabilities, functionality and some of the scientific investigations that may be performed in the MSG.
Author (AIAA)
Microgravity; International Space Station; Spaceborne Experiments; Research Facilities; NASA Space Programs; European Space Agency

19980056042
Thermodynamic analysis of an unsteady 3-D human thermal model
Boregowda, S. C., Old Dominion Univ., USA; Tiwari, S. N., Old Dominion Univ., USA; Chaturvedi, S. K., Old Dominion Univ., USA; Hou, G. J.-W., Old Dominion Univ., USA; Jan. 1998; In English
Contract(s)/Grant(s): NCC1-254
Report No.(s): AIAA Paper 98-0841; Copyright; Avail: Aeroplus Dispatch

The present study pertains to the thermodynamic investigation of the human thermoregulatory system based on the computer simulation results. The simulations are conducted with the help of an unsteady, 3D human thermal model. The model includes the effects of heat transfer mechanisms in tissue, internal organs, vascular structures, and circulatory and respiratory systems. The model is validated with the experimental data, and an extensive parametric study is conducted. The entropy generation term is developed from the principles of second law of thermodynamics, and it takes into account most of the energy transfer processes taking place between the body and the environment. Thus, the entropy generation term is expected to provide deeper insight that could lead to the development of an objective thermal stress index (OTSI).
Author (AIAA)
Human Body; Biological Models (Mathematics); Body Temperature; Three Dimensional Models; Thermoregulation; Human Performance

19980056107
Visualizing air traffic conflicts with the Advanced Proximity Warning System
Kokolios, Alexander, Science Applications International Corp., USA; Shin, Richard Y., U.S. Navy, Naval Air Warfare Center, USA; Jan. 1998; In English
Report No.(s): AIAA Paper 98-0918; Copyright; Avail: Aeroplus Dispatch

The Advanced Proximity Warning System (APWS) takes advantage of available computing power of personal computers and workstations to graphically display in near-real-time, air traffic in a region, allowing a ground traffic controller to visualize conflicts and act upon them before they lead to near-misses or midair collisions between two aircraft. Though other air traffic visualization tools exist, APWS is unique in that it forecasts aircraft position into the future. It does this based on knowledge of the aircraft and the current aircraft state, as determined by a Kalman filter, which updates dynamic model propagation with real-time measurements. Such a process is particularly useful at military test and evaluation ranges, where aircraft are often engaged in dynamic maneuvering. Aircraft positions, advisory zones surrounding the aircraft, and forecast regions showing the future path of the aircraft are all displayed through a visual display system, giving the controller an instant overview of the situation at hand. Visual and aural cues alert the controller when a potential conflict arises.
Author (AIAA)
Warning Systems; Proximity; Air Traffic Control; Kalman Filters; Human-Computer Interface

19980056202
Addressing the human element in Unmanned Aerial Vehicles
Monson, Conrad B., Boeing Defense & Space Group, USA; Fong, Craig S., Boeing Defense & Space Group, USA; Marsh, Richard A., Boeing Defense & Space Group, USA; Haas, Michael W., USAF, Armstrong Lab., USA; Jan. 1998; In English
Report No.(s): AIAA Paper 98-1032; Copyright; Avail: Aeroplus Dispatch

There is a growing effort by the military to develop and field Unmanned (Uninhabited) Aerial Vehicle (UAV) systems. This growth has been fueled by technology advances as well as the potentially lower costs of unmanned, relative to manned, aircraft systems. to take full advantage of the opportunities afforded by UAVs requires the effective integration of the human into the UAV system. Recognizing this need, the Air Force Armstrong Laboratory is conducting exploratory and advanced research to better understand human systems and technology requirements for current and future UAVs. As part of this work, the Boeing Defense and Space Group collected information from academia, research groups, UAV system developers, and UAV system users. Analyses of the collected information led to sets of research and technology development recommendations for addressing human sys-

tems integration needs in such areas as operator interface design, crew selection, training, force structure integration, automation and deployment. This paper describes several of the findings from these analyses.
Author (AIAA)
Pilotless Aircraft; Man Machine Systems; Military Aircraft; Cost Reduction; Operator Performance

19980056204
The impact of information fusion on crew performance
Garner, Karen T., U.S. Navy, Naval Air Warfare Center, USA; Assenmacher, Thomas J., ARINC, Inc., USA; Jan. 1998; In English
Report No.(s): AIAA Paper 98-1034; Copyright; Avail: Aeroplus Dispatch

The desire for information dominance drives data management, sensor management, and pilot aiding needs for next generation military airborne platforms. Information technology advances (sensors, linked networks, communications, and interfaces) impact human operation of complex weapon systems. Until recently, systems designers were of the opinion that 'more is better', suggesting that, with more data, an operator could achieve and maintain a high level of situation awareness. Legacy 'stovepipe' avionics systems, often having a unique data path and display, are still common in today's tactical aircraft. The sheer volume of data available from the multitude of distributed sensors, and other information sources, overtax tactical operators. Intelligent software is needed to rapidly process and transform data into knowledge-based information for use by the crew. R. S. Wurman's statement, 'The information supply available to us doubles every 5 years', is certainly applicable to the tactical situation. This paper discusses the impact of information fusion on crew performance and identifies system critical human system design issues to consider during the design and development phases.
Author (AIAA)
Information Systems; Multisensor Fusion; Flight Crews; Flight Management Systems; Aircraft Pilots

19980056205
Functional models of flight automation systems to support design, certification and operation
Vakil, Sanjay S., MIT, USA; Hansman, R. J., MIT, USA; Jan. 1998; In English
Contract(s)/Grant(s): FAA-95-G-017; NAG1-1581; NAG1-1857
Report No.(s): AIAA Paper 98-1035; Copyright; Avail: Aeroplus Dispatch

The incorporation of advanced flight automation systems into modern aircraft has resulted in an increase in errors in interaction with aircraft automation. A prior study identified the lack of a simple consistent model of the automation as a contributing component and found pilots creating their own ad-hoc models of aircraft automation. This work introduces the concept of a Common Conceptual Model (CCM), a representation of the automation articulated at the early design phases which is common to and consistent between pilots, certification officials and design engineers. Functional requirements of such a model by each of the parties are presented. Several candidate structures are discussed. to explore whether a consistent representation will be useful operationally, an experiment was setup to probe the effects of the structure of information on the ability of operators to predict vertical flight path on abstract Flight Management System.
Author (AIAA)
Automatic Flight Control; Support Systems; Aircraft Models; Flight Management Systems; Aircraft Design; Flight Safety

19980056774
Design and implementation of a teleautonomous Hummer
Bentivenga, Darrin C., Georgia Inst. of Technology, Atlanta, USA; Ali, Khaled S., Georgia Inst. of Technology, Atlanta; Arkin, Ronald C., Georgia Inst. of Technology, Atlanta; Balch, Tucker, Georgia Inst. of Technology, Atlanta; 1997, pp. 130-138; In English
Contract(s)/Grant(s): N00014-94-1-0215; Copyright; Avail: Aeroplus Dispatch

Autonomous and semi-autonomous full-sized ground vehicles are becoming increasingly important, particularly in military applications. Here we describe the instrumentation of one such vehicle, a 4-wheel drive Hummer, for autonomous robotic operation. Actuators for steering, brake, and throttle have been implemented on a commercially available Hummer. Control is provided by on-board and remote computation. On-board computation includes a PC-based control computer coupled to feedback sensors for the steering wheel, brake, and forward speed; and a UNIX workstation for high-level control. A radio link connects the on-board computers to an operator's remote workstation running the Georgia Tech MissionLab system. The paper describes the design and implementation of this integrated hardware/software system that translates a remote human operator's commands into directed motion of the vehicle. Telerobotic control of the Hummer has been demonstrated in outdoor experiments.
Author (AIAA)
Robot Dynamics; Autonomous Navigation; Feedback Control; Surface Vehicles; Actuators; Telerobotics

19980057343

Station life support advances technology

Dornheim, Michael A., USA; Aviation Week & Space Technology; Dec. 08, 1997; ISSN 0005-2175; Volume 147, no. 23, pp. 56, 58; In English; Copyright; Avail: Aeroplus Dispatch

When the International Space Station is completed, it will have separate, American and Russian atmospheric systems producing essentially the same habitable environment. During construction, however, the atmosphere will be provided by the Russian modules. The most critical inhabited component of ISS will be the Hab module, which provides living space in which a crew of four can sleep, eat, and bathe.

AIAA

Life Support Systems; International Space Station

19980057432

Cognitive evaluation of human-human and human-machine cooperation modes in air traffic control

Hoc, Jean-Michel, Valenciennes, Univ., France; Lemoine, Marie-Pierre, Valenciennes, Univ., France; International Journal of Aviation Psychology; 1998; ISSN 1050-8414; Volume 8,, no. 1, pp. 1-32; In English; Copyright; Avail: Aeroplus Dispatch

An experiment is described that aimed at evaluating a principle of dynamic task allocation (DTA) of conflict resolution between aircraft in air-traffic control on a large scale simulator. It included three cognitive agents: the radar controller (RC), in charge of conflict detection and resolution; the planning controller (PC), in charge of entry-exit coordination and of workload regulation; and a conflict resolution computer system (SAINTEX), able to manage only simple conflicts. Within this three-agent paradigm, three conditions were compared: (a) a control condition (without computer assistance); (b) an explicit condition (PC and RC in charge of the allocation); and (c) an assisted explicit condition (SAINTEX proposed allocations which could be changed by Pc). Comparisons were made on the basis of a detailed cognitive analysis of verbal protocols. The more the assistance, the more anticipative the mode of operation in controllers and the easier the human-human cooperation (HHC). These positive effects of the computer support are interpreted in terms of decreased workload and increased shared information space. In addition, the more the controllers felt responsible for task allocation, the more they criticized the machine operation.

Author (AIAA)

Man Machine Systems; Cognitive Psychology; Air Traffic Control; Air Traffic Controllers (Personnel); Employee Relations

19980057434

Automation bias - Decision making and performance in high-tech cockpits

Moisier, Kathleen L., NASA Ames Research Center, USA; Skitka, Linda J., Illinois, Univ., Chicago; Heers, Susan, NASA Ames Research Center, USA; Burdick, Mark, Illinois, Univ., Chicago; International Journal of Aviation Psychology; 1998; ISSN 1050-8414; Volume 8,, no. 1, pp. 47-63; In English

Contract(s)/Grant(s): NAS2-832; NCC2-798; NCC2-837; Copyright; Avail: Aeroplus Dispatch

Automated aids and decision support tools are rapidly becoming indispensable tools in high-technology cockpits and are assuming increasing control of cognitive flight tasks, such as calculating fuel-efficient routes, navigating, or detecting and diagnosing system malfunctions and abnormalities. This study was designed to investigate automation bias, a recently documented factor in the use of automated aids and decision support systems. The term refers to omission and commission errors resulting from the use of automated cues as a heuristic replacement for vigilant information seeking and processing. Glass-cockpit pilots flew flight scenarios involving automation events or opportunities for automation-related omission and commission errors. Although experimentally manipulated accountability demands did not significantly impact performance, post hoc analyses revealed that those pilots who reported an internalized perception of accountability for their performance and strategies of interaction with the automation were significantly more likely to double-check automated functioning against other cues and less likely to commit errors than those who did not share this perception. Pilots were also likely to erroneously ’remember’ the presence of expected cues when describing their decision-making processes.

Author (AIAA)

Cockpits; Decision Making; Technology Utilization; Automatic Flight Control; Cognitive Psychology; Aircraft Pilots

19980057435

Temporal management of flight strips in en route air traffic control - A full-scope simulation test on task analyses assumptions

Terrier, Patrice, Toulouse II, Univ., France; International Journal of Aviation Psychology; 1998; ISSN 1050-8414; Volume 8,, no. 1, pp. 65-73; In English; Copyright; Avail: Aeroplus Dispatch

In en route air traffic control, task analyses assume that the planning controller detects potential problems to alleviate the radar controllet's workload. Ten expert controllers were involved in a full-scope simulation study, and displacements of flight strips were analyzed as a function of the controller and as a function of the role these motor acts have in indicating problem detection, monitoring the ongoing resolution, or sending the aircraft to other control positions. Task analysis assumptions related to the ongoing resolution and to the end of problems were confirmed. But contrary to task analysis assumptions, results reveal that conflict situations are detected by the radar controller. In line with previous field observations, this striking result raises a serious problem about the validity of the putative anticipatory role attributed to the planning controller.
Author (AIAA)
Air Traffic Control; Control Simulation; Tasks; Air Traffic Controllers (Personnel); Flight Paths

19980057615
Telemanipulator and telepresence technologies IV; Proceedings of the Conference, Pittsburgh, PA, Oct. 14, 15, 1997
1997; In English
Report No.(s): SPIE-3206; ISBN 0-8194-2638-5; Copyright; Avail: Aeroplus Dispatch
The present conference discusses topics in the fields of telepresence and teleoperation control architecture, augmented-reality and haptic interfaces, and novel applications. Attention is given to the calibration of real and virtual worlds, cooperative supervisory modes of control for telerobotics, service operations of an intelligent mobile manipulator, a physically realistic haptic interaction with dynamic virtual worlds, and the discernment and modeling of tactile textures. Also discussed are a two-step fusion method for augmented reality, programmable ubiquitous telerobotic devices, the dynamic performance of a magnetic levitation haptic device, simulation sickness and head-mounted display configurations, and the status of the Ranger telerobotic Shuttle experiment.
AIAA
Conferences; Telerobotics; Manipulators

19980057616
Preliminary considerations on the design of controllers for haptic interfaces
Prisco, G. M., PERCRO, Italy; Bergamasco, M., PERCRO, Italy; 1997, pp. 2-11; In English; Copyright; Avail: Aeroplus Dispatch
The design of controllers for haptic interfaces is discussed. A general methodology to model and design such controllers is presented. Some useful tools for the analysis of stability and performance of haptic interfaces interacting with virtual environments are introduced. The design of a torque controller for a joint of an electrically actuated, tendon-driven haptic interface is analyzed as an example.
Author (AIAA)
Control Systems Design; Controllers; Man Machine Systems; Human-Computer Interface; Telerobotics; Robot Control

19980057617
Designing a user interface for service operations of an intelligent mobile manipulator
Xu, H., Leuven, Katholieke Univ., Belgium; Van Brussel, H., Leuven, Katholieke Univ., Belgium; Moreas, R., Leuven, Katholieke Univ., Belgium; 1997, pp. 12-21; In English; Copyright; Avail: Aeroplus Dispatch
User interfaces play an increasingly important role in robot applications. This paper presents the design and implementation of a multimodal user interface for a mobile manipulator, consisting of an autonomous vehicle with a manipulator on it. It is capable of navigating in a real world and doing useful manipulations. The system is intended to provide services for handicapped people. The user interface is crucial for such a user to benefit from the services. The user interface designed for the system makes advantage of multimedia technology and combines graphics, speech and visualization into a coherent multimodal interface. It serves as a user-command interpreter, robot monitor and simulator. A user-centered design approach is adopted for enhanced understandability and usability.
Author (AIAA)
Human-Computer Interface; Manipulators; Telerobotics; Control Systems Design; Robot Control

19980057618
Real-time environment for mission programming of telerobotics systems
Turchi, Herve, Montpellier, Lab d'Informatique, de Robotique et de Microelectronique, France; Crosnier, Andre, Montpellier, Lab d'Informatique, de Robotique et de Microelectronique, France; Fraisse, Philippe, Montpellier, Lab d'Informatique, de Robotique et de Microelectronique, France; 1997, pp. 22-29; In English; Copyright; Avail: Aeroplus Dispatch

This paper is focussed on the presentation of the functionalities and the architecture of a real time environment dedicated to the mission programming of telerobotics systems. This environment constitutes a framework providing the human operator with tools for the preparation, simulation and execution of missions in noncooperative environment. to overcome the delay time and to realize a mission with minimum cost and maximum safety, the preparation phase and the simulation phase of a mission are essential to obtain a well-tried scenario dedicated to the execution phase. An application that consists of teleoperating in a known and structured outdoor environment, namely a mobile manipulator, is also presented.
Author (AIAA)
Real Time Operation; Telerobotics; Mission Planning; Architecture (Computers); Virtual Reality

19980057619
Augmented reality - Calibration of the real and virtual worlds
Wheeler, A., Surrey, Univ., UK; Pretlove, J., Surrey, Univ., UK; Parker, G., Surrey, Univ., UK; 1997, pp. 30-40; In English; Copyright; Avail: Aeroplus Dispatch

Most augmented reality systems enhance the user's view of their immediate surroundings, either through an optical see-through head-mounted display or using a camera mounted on the head-mounted display (HMD) to provide input to the video displays. In our system the user, wearing an immersive HMD, views the stereoscopic video images of a remote scene, provided by a pair of miniature CCD cameras mounted on a stereohead which is located in a remote environment. This four-degree-of-freedom stereohead was developed for our Active Telepresence System and is controlled in real-time by the motion of the operator's head. Off-the-shelf software, designed for generating and controlling virtual environments, is used to create the stereographic overlays for our augmented reality application. In order for the virtual images to be accurately registered with a real scene, the virtual images must be drawn from the same viewpoint and perspective as the cameras. The paper reviews the calibration methods employed in other augmented reality systems to determine these viewpoint parameters and presents the results of our initial calibration experiments.
Author (AIAA)
Virtual Reality; Calibrating

19980057620
Investigations in telerobotics using cooperative supervisory modes of control
Zaatri, A., Leuven, Katholieke Univ., Belgium; Van Brussel, H., Leuven, Katholieke Univ., Belgium; 1997, pp. 41-52; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents some experimental investigations in the field of robotics and telerobotics using a cooperative and complementary supervisory mode of control. The system allows a very wide range of applications provided by the design of an advanced graphic user interface (GUI) and the use of a CCD camera with a force sensor mounted together on the end-effector of a Kuka361 industrial robot. The stereo-vision effect is obtained from two consecutive images separated by a known displacement of the CCD camera. Through the developed GUI, tasks can be carried out in 3D using a point-and-direct method. However, since the vision system is very sensitive with respect to the varying conditions of the real world, a Cooperative Error Recovery Scheme is proposed in order to improve efficiently the robustness of the system. This scheme involves the supervisor and the computer in a partnership relation and establishes a dialogue between them for recovering errors, avoiding failures, and saving time. For simulation purposes, a CAD model of the robot environment can be obtained from the 2D images and can be exploited under the CAD-based reaction force simulator software.
Author (AIAA)
Telerobotics; Robot Control; Human-Computer Interface; Man Machine Systems

19980057621
Teleoperations with shared explicit contact force control
Caiti, A., Genova, Univ., Italy; Cannata, G., Pisa, Univ., Italy; Casalino, G., Pisa, Univ., Italy; Reto, S., Pisa, Univ., Italy; 1997, pp. 53-64; In English; Copyright; Avail: Aeroplus Dispatch

The developement of a master-slave robotics system is presented. This developement is part of a research project devoted to the intelligent automation of in-service inspection of welded seams in nuclear plants using nondestructive ultrasonic-based techniques. The main feature of the system is a shared explicit control scheme of the contact force during the interaction of the end-effector with the remote environment. This unilateral master-slave operational scheme does not suffer from the drawbacks of the bilateral force reflection-based implementation. Moreover, it avoids the operator from damaging the remote manipulator during wrong maneuvers due to imperfect video feedback. The paper describes the control structure applied (belonging to the class

of explicit force control) and the hardware-software architecture of the system. Experimental results are given on the Ansaldo OLASAND manipulator.
Author (AIAA)
Telerobotics; Robot Control; Man Machine Systems; Human-Computer Interface; Force Distribution

19980057622
Real-time surface following for teleoperation in virtual environments
Gagnon, Eric, Spar Aerospace, Ltd., Canada; Greenspan, Michael, National Research Council of Canada, Ottawa; Ballantyne, John W., Spar Aerospace, Ltd., Canada; 1997, pp. 66-73; In English; Copyright; Avail: Aeroplus Dispatch

Surface following is achieved through the repetitive computation of the necessary 6-degree-of-freedom pose of an object for it to rest on the contour of a surface. This is needed for the simulation of a 3D vehicle 'riding' over virtual terrain. A novel algorithm is described allowing real-time following of the contour of a surface represented by range images, or point clouds. The developed algorithm is robust enough to compensate for holes or discontinuities in range images by filling in these discontinuities through surface approximation. Using a grid representation, the information is compressed into a lookup table allowing for real-time operation. A three-point representation of the base of an object following the surface contour is used to determine the pose of an object in a given position over the grid.
Author (AIAA)
Robot Control; Telerobotics; Real Time Operation; Virtual Reality; Surface Geometry

19980057623
Physically realistic haptic interaction with dynamic virtual worlds
Vedula, Sundar, Carnegie Mellon Univ., USA; Baraff, David, Carnegie Mellon Univ., USA; 1997, pp. 74-81; In English; Copyright; Avail: Aeroplus Dispatch

There has been increased interest in recent years in the use of the sensation of force as a supplement to visual and auditory feedback normally found in virtual environments. to produce a realistic feel of interacting with moving synthetic objects, the interactions between the objects and those between the user and the environment need to be based on physical laws. We present techniques for interaction of a human with a dynamic virtual environment through the haptic channel, specifically by integrating an articulated force feedback and with a graphical physically based interactive simulation system. A distributed simulation and control model, to separate two fundamental requirements on graphics and force control is used. We describe techniques used for elegant force display in a dynamic environment, and a physically-based algorithm to model surface friction between the probe and the objects. Three schemes for a local model update are also presented and compared.
Author (AIAA)
Virtual Reality; Man Machine Systems; Human-Computer Interface; Feedback Control

19980057624
Anthropomorphic tactile sensors for tactile feedback systems
Schuenemann, Matthias, Fraunhofer Inst. for Manufacturing and Automation, Germany; 1997, pp. 82-97; In English; Copyright; Avail: Aeroplus Dispatch

In order to realize tactile feedback systems, there is an increasing interest in sophisticated systems capable of detecting and processing mechanical and nonmechanical contact parameters, like normal and shear contact forces, temperature, and, for the purpose of the self-protection, reproducing a sensation similar to mechanically and thermally caused pain in humans. Because the tactile sensor system must interact with human operators within the framework of a tactile feedback system, an anthropomorphic approach was chosen. Conclusions regarding working principles, structures, number, arrangement, optimal placement and desired parameters, as well as the strategies of signal and information processing, are drawn upon for the purpose of a general design of a tactile sensing system. The state of the art in microsystems technology, and the requirements of assembly and packaging, capacitive and piezoresistive sensors are most promising for mechanical contact sensing.
Author (AIAA)
Feedback Control; Tactile Discrimination; Virtual Reality; Sensors

19980057625
Towards discerning and modelling tactile textures
Chen, Nongii, Surrey, Univ., UK; 1997, pp. 98-105; In English; Copyright; Avail: Aeroplus Dispatch

Tactile textures have been recognized to have an important impact on the sensation of exposure in virtual reality systems and play a subtle role in achieving a set of telerobotic applications like remote probing, feature recognition and quality assessment.

Their discerning and modeling in the context of virtual reality systems and telerobotic applications have been of increasing interest to a number of researchers and have so far proven to be very challenging. This paper provides a brief review of recent progress on modeling and rendering tactile textures, and presents some preliminary results of an ongoing research at Surrey that uses random field models to characterize some approximately repeatable patterns commonly encountered in tactile textures. It is believed that such an approach is able to capture the underlying trend of patterns in tactile textures and to give a more quantitative description. This will be valuable for achieving consistent feature extraction, registration and recognition in the context of virtual reality systems and telerobotic applications.
Author (AIAA)
Tactile Discrimination; Textures; Virtual Reality; Telerobotics

19980057626
Two-step fusion method for augmented reality
Conan, Vania, Thomson-CSF, France; Bisson, Pascal, Thomson-CSF, France; 1997, pp. 106-115; In English; Copyright; Avail: Aeroplus Dispatch

In augmented reality systems, the user looks at real objects, through a camera or a see-through head-mounted display (HMD), and is provided with an enhanced view. A CAD model of the object, once it is properly registered, is superimposed on top of the direct view. Hidden internal parts can be shown, certain components can be highlighted, or procedures can be demonstrated. Real time registration of a 3D model with its corresponding view in the image is thus a key feature of such systems. The goal of this paper is to explore the coupling of electromagnetic tracking and contour-based image processing to robustly track 3D objects in real time. The method keeps the robustness of electromagnetic tracking, adds precision using video information, without adding landmarks to the scene. We explain how to determine the different coordinate systems, using contour information to refine the camera pose estimate. We then investigate the use of real time pose estimation techniques, based on point information or on line contours.
Author (AIAA)
Multisensor Fusion; Image Processing; Tracking (Position)

19980057627
Development of a Polhemus-based telemanipulation system
Yu, Wai, Surrey, Univ., UK; Pretlove, John, Surrey, Univ., UK; 1997, pp. 116-124; In English; Copyright; Avail: Aeroplus Dispatch

A Polhemus-based telemanipulation system is being developed and tested in the Mechatronic System and Robotics Research group at the University of Surrey. This system provides a natural and intuitive operator input and easy remote control of a robot manipulator. The technique developed in this system will be applied to a telepresence system developed for performing teleoperations in an unstructured remote and potentially hazardous environments. An overview of the system architecture is provided. Some experiments have been conducted to evaluate this telemanipulation system and the evaluation and experimental results are presented.
Author (AIAA)
Telerobotics; Manipulators; Robot Control; Control Systems Design

19980057628
Teleoperation with large time-delay using a prevision system
Bergamasco, M., PERCRO, Italy; De Paolis, L., PERCRO, Italy; Ciancio, S., PERCRO, Italy; Pinna, S., PERCRO, Italy; 1997, pp. 125-130; In English; Copyright; Avail: Aeroplus Dispatch

In teleoperation technology, various techniques have been proposed in order to alleviate the effects of time delayed communication and to avoid the instability of the system. This paper describes a different approach to robotic teleoperation with large-time delay. A teleoperation system based on the teleprogramming paradigm has been developed with the intent to improve the slave autonomy and to decrease the amount of information exchanged between master and slave systems. The ’goal’ AI-concept has been used. In order to minimize the total task-completion time, a prevision system, is used to know in advance the slave’s choices taking into account both the operator’s actions and the information about the remote environment. The prevision system allows one, in case of environment changes, to understand whether the slave can solve the goal. Otherwise, Merlino is able to signal a ’fail situation’. Some experiments have been carried out by means of an advanced human-machine interface with force feedback, which gives a better sensation of presence in the remote environment.
Author (AIAA)
Telerobotics; Time Lag; Robot Control

19980057630

Dynamic performance of a magnetic levitation haptic device

Berkelman, P., Carnegie Mellon Univ., USA; Hollis, R. L., Carnegie Mellon Univ., USA; 1997, pp. 140-149; In English; Copyright; Avail: Aeroplus Dispatch

A new haptic interface device has been developed which uses Lorentz force magnetic levitation for actuation. With this device, the user grasps a floating rigid body to interact with the system. The levitated moving part grasped by the user contains curved oval wound coils and LEDs embedded in a hemispherical shell with a handle fixed at its center. The stationary base contains magnet assemblies facing the riotor coils and optical position sensors facing the riotor LEDs. A network connection provides communication with a workstation to allow interaction with simulated 3D environments in real time. Ideally, the haptic interface device should reproduce the dynamics of the modeled or remote environment with such high fidelity that the user cannot distinguish interaction with the device from interaction with a real object in a real environment. In practice, this ideal can only be approached with a fidelity that depends on its dynamic properties, such as position and force bandwidths, maximum forces and accelerations, position resolution, and realizable impedance range. The motion range of the moving part is approximately 25 mm and 15-20 deg in all directions.

Author (AIAA)

Levitation; Dynamic Characteristics; Man Machine Systems; Human-Computer Interface; Magnetic Effects; Lorentz Force

19980057631

Programmable ubiquitous telerobotic devices

Doherty, M., Colorado, Univ., Boulder, USA; Greene, M., Colorado, Univ., Boulder; Keaton, D., Colorado, Univ., Boulder; Och, C., Colorado, Univ., Boulder; Seidl, M., Colorado, Univ., Boulder; Waite, W., Colorado, Univ., Boulder; Zorn, B., Colorado, Univ., Boulder; 1997, pp. 150-158; In English; Copyright; Avail: Aeroplus Dispatch

Ubiquitous telepresence involves the design and implementation of low-cost robotic devices that can be programmed and operated from anywhere on the Internet. These devices, which we call 'ubots', can be used for academic purposes (e.g., a biologist could remote conduct a population survey), commercial purposes (e.g., a house could be shown remotely by a real-estate agent), and for recreation and education (e.g., someone could tour a museum remotely). We anticipate that such devices will become increasingly common due to recent changes in hardware and software technology. In particular, current hardware technology enables such devices to be constructed very cheaply, and current software and network technology allows highly portable code to be written and downloaded across the Internet. We present our prototype system architecture, and the ubot implementation we have constructed based on it. The hardware technology we use is the Handy Board, a 6811-based controller board with digital and analog inputs and outputs. Our software includes a network layer based on TCP/IP and software layers written in Java. Our software enables users across the Internet to program the behavior of the vehicle and to receive image feedback from a camera mounted on it.

Author (AIAA)

Telerobotics; Architecture (Computers); Human-Computer Interface; Man Machine Systems

19980057632

A Java interface for asserting interactive telerobotic control

DePasquale, Peter, Villanova Univ., USA; Lewis, John, Villanova Univ., USA; Stein, Matthew, Wilkes Univ., USA; 1997, pp. 159-169; In English; Copyright; Avail: Aeroplus Dispatch

Many current web-based telerobotic interfaces use HyperText Markup Language forms to assert user control on a robot. A Java interface can provide better client-server interaction. The Puma Paint project uses a Java applet to control a Unimation Puma 760 robot during the task of painting on a canvas. The interface allows the user to control the paint strokes as well as the pressure of a brush on the canvas and how deep the brush is dipped into a paint jar. To provide immediate feedback, a virtual canvas models the effects of the controls as the artist paints. Live color video feedback is provided, allowing the user to view the actual results of the robot's motions. Unlike the step-at-a-time model of many web forms, the application permits the user to assert interactive control. The greater the complexity of the interaction between the robot and its environment, the greater the need for high quality information presentation to the user. The use of Java allows the sophistication of the user interface to be raised to the level required for satisfactory control.

Author (AIAA)

Telerobotics; Robot Control; Human-Computer Interface; Programming Languages

19980057633

Simulator sickness and HMD configurations

Ehrlich, Jennifer A., Central Florida, Univ., USA; 1997, pp. 170-178; In English; Copyright; Avail: Aeroplus Dispatch

The helmet-mounted display (HMD), often used in nonvehicle-based virtual environments (VEs), can be configured as either a stereoscopic or bi-ocular display. As a stereoscopic display the computer modeling the VE calculates two different views for each eye, based upon the views each eye normally receives due to their separation in the head. On the other hand, the same view can be presented to each eye, resulting in a bi-ocular display. The normally linked processes of accommodation and vergence must be decoupled when viewing through an HMD. This may lead to physiological problems. For example, a common problem with VE is simulator sickness. Its symptoms are similar to those experienced in motion sickness, and include problems with eyestrain, disorientation, and nausea. A study was conducted in which both relative differences in simulator sickness and performance were examined for walking, tracking, distance estimation, and micromanipulation tasks. Using the self-report Simulator Sickness Questionnaire, data revealed that the stereoscopic condition was more nauseogenic. In addition, postexperimental disorientation, oculomotor discomfort and total severity measures correlated significantly with completion time on a task that required more near-far focal transitions within a short period of time than any other task.

Author (AIAA)

Training Simulators; Motion Sickness; Helmet Mounted Displays; Virtual Reality

19980057634

Space construction - An experimental testbed to develop enabling technologies

Schubert, H. C., Stanford Univ., USA; How, J. P., Stanford Univ., USA; 1997, pp. 179-188; In English; Copyright; Avail: Aeroplus Dispatch

We discuss a new testbed developed to address some of the key issues associated with semiautonomous construction in a hazardous environments such as space. The new testbed consists of a large two-link manipulator carrying two smaller two-link arms. This macro/mini combination was developed to be representative of actual space manipulators, such as the SSRMS/SPDM planned for the Space Station. This new testbed allows investigation of several key issues associated with space construction, including teleoperation versus supervised autonomy, dextrous control of a robot with flexibility, and construction with multiple robots. A supervised autonomy approach has several advantages over the traditional teleoperation mode, including operation with time delay, smart control of a redundant manipulator, and improved contact control. to mimic the dynamics found in space manipulators, the main arm was designed to include joint flexibility. The arm operates in 2D, with the end-point floating on an air-bearing. This setup allows cooperation with existing free-flying robots in the ARL. This paper reports the first experiments with the arm which explore the advantages of moving from teleoperation or human-in-the-loop control to the human supervisory or task-level control. A simple task, such as capturing a satellite-like object floating on a table, is attempted first with the human directly driving the end-point and second with the human directing the robot at a task-level.

Author (AIAA)

Space Erectable Structures; Orbital Assembly; Test Stands; Telerobotics

19980057635

The Ranger Telerobotic Shuttle Experiment - Status report

Parrish, Joseph C., NASA, USA; 1997, pp. 189-197; In English; Copyright; Avail: Aeroplus Dispatch

This paper updates the status of the Ranger Telerobotic Shuttle Experiment. Originally planned as the Ranger Telerobotic Flight Experiment, a free-flying spacecraft servicing telerobot to be launched on an expendable launch vehicle, the Ranger mission has been recast as a Space Shuttle-based flight experiment to demonstrate key telerobotic technologies associated with servicing the International Space Station and other orbital assets. Several modifications have been made to the flight system configuration and the operational concept, but the primary payload package (namely the four manipulator arms and their supporting structure) have remained relatively unchanged. This paper addresses these technical and operational modifications, and lays out the plans for the future of the flight experiment.

Author (AIAA)

Telerobotics; Space Shuttle Payloads; Orbital Servicing; Space Maintenance; Man Tended Free Flyers

19980057714

Examining the effects of cognitive consistency between training and displays

Adelman, Leonard, George Mason Univ., USA; Christian, Matthew, Value Behavioral Health, USA; Gualtieri, James, U.S. Navy, Air Warfare Center, USA; Johnson, Karen L., Iowa, Univ., Iowa City; IEEE Transactions on Systems, Man, and Cybernetics; Jan. 1998; ISSN 1083-4427; Volume 28, no. 1, pp. 1-16; In English

Contract(s)/Grant(s): MDA903-92-K-0134; DAAH04-93-G-0286; Copyright; Avail: Aeroplus Dispatch

An experiment was performed testing the 'display cognitive consistency hypothesis' proposed in Adelman and Bresnick (1992). This hypothesis states that the effectiveness of a display format for decision-aiding systems depends on the consistency between how the system displays its reasoning process and how the person is processing the information. Results of an experiment using a simulated Army air defense task and college students found support for the hypothesis, but only at a situation-specific, not global, level. Although unexpected, these results were consistent with other research indicating the importance of situation-specific context for understanding judgment and decision processes in individual and group settings.

Author (AIAA)

Display Devices; Man Machine Systems; Cognitive Psychology; Decision Making; Data Transmission; Air Defense

19980057718

Dynamic adjustment of stereo display parameters

Ware, Colin, New Brunswick, Univ., Canada; Gobrecht, Cyril, New Brunswick, Univ., Canada; Paton, Mark A., New Brunswick, Univ., Canada; IEEE Transactions on Systems, Man, and Cybernetics; Jan. 1998; ISSN 1083-4427; Volume 28, no. 1, pp. 56-65; In English; Copyright; Avail: Aeroplus Dispatch

This paper reports on an experimental approach to adjusting stereo parameters automatically and thereby providing a low eye strain, easily accommodated stereo view for computer graphics applications. to this end, the concept of virtual eye separation is defined. Experiment 1 shows that dynamic changes in virtual eye separation are not noticed if they occur over a period of a few seconds. Experiment 2 shows that when subjects are given control over their virtual eye separation, they change it depending on the amount of depth in the scene. Based partly on these results, an algorithm is presented for enhancing stereo depth cues for moving computer-generated 3D images. It has the effect of doubling the stereo depth in flat scenes and limiting the stereo depth for deep scenes. It also reduces the occurrence of double images and the discrepancy between focus and vergence. The algorithm is applied dynamically in real time with an optional damping factor applied so the disparities never change too abruptly. Finally, Experiment 3 provides a qualitative assessment of the algorithm with a dynamic 'flight' over a digital elevation map.

Author (AIAA)

Display Devices; Stereophotography; Computer Graphics

19980057720

Estimation of time-varying delay time in nonstationary linear systems - An approach to monitor human operator adaptation in manual tracking tasks

Boer, Erwin R., Nissan Cambridge Basic Research, USA; Kenyon, Robert V., Illinois, Univ., Chicago; IEEE Transactions on Systems, Man, and Cybernetics; Jan. 1998; ISSN 1083-4427; Volume 28, no. 1, pp. 89-99; In English

Contract(s)/Grant(s): NSF IRI-92-13822; Copyright; Avail: Aeroplus Dispatch

We introduce a discrete time recursive delay identifier (RDI) capable of simultaneously estimating a human operator's nonstationary delay time and linear model coefficients. At its core lies the extended Kalman filter (EKF). Our goal to obtain fractional delay time estimates was realized by using the bicubic interpolation scheme as part of the EKF to provide subsample magnitude and derivative estimates of the observed input/output time series. While this theoretically limits the RDI's applicability to bandlimited or differentiable signals, this is seldom a concern in practice. Based on data from simulated and experimental time varying tracking tasks, we show the RDI's potential to substantially increase our understanding about human adaptations, thus perhaps offering new avenues for machine adaptation.

Author (AIAA)

Operator Performance; Time Lag; Man Machine Systems

19980057722

Digital production of color Mach bands using a color human visual system model

Martin, Curtis E., USAF, Inst. of Technology, USA; Rogers, Steven K., Battelle Memorial Inst., USA; Kabrisky, Matthew, USAF, Inst. of Technology, USA; IEEE Transactions on Systems, Man, and Cybernetics; Jan. 1998; ISSN 1083-4427; Volume 28, no. 1, pp. 127-130; In English; Copyright; Avail: Aeroplus Dispatch

A model of the human color vision system is used to construct constant brightness color Mach band stimuli along two chromatic axes for display on a standard workstation color monitor. Chromatic (not brightness) Mach bands appear in the displayed stimuli as over- and under-shoots along the axis of the varied component. The stimuli are displayed on several different but similar

monitors without affecting the appearance of the Mach bands. Anomalous trichromats see no change in color when presented with a stimulus containing variations along only one of the two chromatic axes.
Author (AIAA)
Human Performance; Color Vision; Biological Models (Mathematics); Visual Stimuli; Display Devices

19980058078
Study of a human model in human-centered man-machine system design
Wang, Ligang, Beijing Univ. of Aeronautics and Astronautics, China; Yuan, Xiugan, Beijing Univ. of Aeronautics and Astronautics, China; Yang, Chunxin, Beijing Univ. of Aeronautics and Astronautics, China; Beijing University of Aeronautics and Astronautics, Journal; Oct. 1997; ISSN 1001-5965; Volume 23, no. 5, pp. 535-539; In Chinese; Copyright; Avail: Aeroplus Dispatch

In order to improve the performance of man-machine systems, the human-centered system design method has been developed. The main fields for human performance studies used by this method have been analyzed and research using human performance model involving the interaction of multiple factors is suggested.
Author (AIAA)
Man Machine Systems; Biological Models (Mathematics); Systems Engineering; Human Performance; Human Factors Engineering

19980058079
Human dynamics model of astronaut action based on computer animation simulation
Ji, Baihua, Beijing Univ. of Aeronautics and Astronautics, China; Yuan, Xiugan, Beijing Univ. of Aeronautics and Astronautics, China; Beijing University of Aeronautics and Astronautics, Journal; Oct. 1997; ISSN 1001-5965; Volume 23, no. 5, pp. 540-545; In Chinese; Copyright; Avail: Aeroplus Dispatch

A dynamics equation for humans under weightlessness conditions is presented. On the basis of vector dynamics, multi-rigid-body dynamics, and the law of conservation of momentum, a dynamics model of human in weightlessness was developed. The equation was first order and could be applied to computers easily. Only the parameters of human mass properties and regulations for controlling adjacent limbs were needed for this equation. As an example, the conic motion of legs was analyzed and it was shown that an astronaut could change his posture by some limb motion. An analytic integration solution of the motion was obtained.
Author (AIAA)
Astronaut Performance; Biological Models (Mathematics); Weightlessness Simulation; Computer Animation; Equations of Motion; Leg (Anatomy)

19980058082
Numerical simulation of human thermoregulation during simultaneous exposure to heat and vibration
Xi, Tianxiao, Beijing Univ. of Aeronautics and Astronautics, China; Sha, Bin, Beijing Univ. of Aeronautics and Astronautics, China; Yuan, Xiugan, Beijing Univ. of Aeronautics and Astronautics, China; Beijing University of Aeronautics and Astronautics, Journal; Oct. 1997; ISSN 1001-5965; Volume 23, no. 5, pp. 575-580; In Chinese; Copyright; Avail: Aeroplus Dispatch

A 2D mathematical model of the human thermoregulational system is established taking into account the effect of simultaneous exposure to heat and vibration on the human body. A numerical method is used to obtain solutions of this mathematical model of the human thermoregulation system, and the human temperature distribution and dynamic change during simultaneous exposure to heat and vibration are calculated. It is found that the calculated results agree generally with experimental data and the relative difference between them is within 5 percent.
Author (AIAA)
Human Body; Body Temperature; Thermoregulation; Two Dimensional Models; Vibration Perception; Temperature Distribution

19980058083
Effects of inflight environment multiple factors on the parameters of aircraft oxygen equipment
Xiao, Huajun, Beijing Univ. of Aeronautics and Astronautics, China; Yuan, Xiugan, Beijing Univ. of Aeronautics and Astronautics, China; Beijing University of Aeronautics and Astronautics, Journal; Oct. 1997; ISSN 1001-5965; Volume 23, no. 5, pp. 586-589; In Chinese; Copyright; Avail: Aeroplus Dispatch

The effects of mental stress in high-speed flight tests at low altitudes on pilots' respiratory systems are reported. The results show that though g-load is an important physiological workload in flying work, the pilots' psychological workload at high speed at low altitudes is a more important mental workload which causes significant increases in the pilots' pulmonary ventilation and

instantaneous oxygen demand reaching 255 L/min. The results are important in the design and computation of oxygen consumption, carrying volume of oxygen, and the instantaneous oxygen demand of aircraft oxygen-breathing equipment.
Author (AIAA)
Flight Tests; Flight Stress; Oxygen Breathing; Respiratory System; Aircraft Pilots; Mental Performance

19980058090
A comparison of stereopsis with ANVIS and F4949 night vision goggles
Knight, Kenneth K., USAF, School of Aerospace Medicine, USA; Apsey, Douglas A., USAF, School of Aerospace Medicine, USA; Jackson, William G., USAF, School of Aerospace Medicine, USA; Dennis, Richard J., USAF, School of Aerospace Medicine, USA; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 99-103; In English; Copyright; Avail: Aeroplus Dispatch

This study was undertaken to see if the model of NVG affects stereoacuity. We tested 13 male and two female aircrew with the Aviator's Night Vision Imaging System (ANVIS) and F4949 NVGs. Visual acuity was measured using the NVG Resolution Grid and stereopsis was determined using a modified Howard-Dolman test. In simulated light conditions, average stereoscopic threshold using the F4949 NVG (17.35 arcsec) was not significantly better than the ANVIS NVG (18.42 arcsec), the mean difference being 1.07 arcsec (95 percent confidence limits, -2.85 to 4.99). The Howard-Dolman test proved to be effective in eliminating monocular clues, thus validating its use in testing NVG stereopsis. The distribution of visual acuities across subjects and goggle models was too narrow to evaluate the effect of visual acuity on stereoacuity in NVGs. Differences in trial means during the course of the study indicated the presence of a learning effect on the Howard-Dolman test.
Author (AIAA)
Aircraft Pilots; Night Vision; Goggles; Stereoscopic Vision; Nap-Of-The-Earth Navigation; Imaging Techniques

19980058093
Improved anti-G protection boosts sortie generation ability
Tong, Andrew, USAF, Crew Technology Div., USA; Balldin, Ulf I., USAF, Crew Technology Div., USA; Hill, Ronald C., USAF, Crew Technology Div., USA; Dooley, James W., USAF, Crew Technology Div., USA; Aviation, Space, and Environmental Medicine; Feb. 1998; ISSN 0095-6562; Volume 69, no. 2, pp. 117-120; In English; Copyright; Avail: Aeroplus Dispatch

There is a need for evaluation of new G-protection equipment. There is no difference between the two anti-G ensembles on affecting subjects' ability to tolerate multiple simulated aerial combat sorties. There were 15 subjects wearing the standard CSU-13B/P anti-G ensemble (STD) or COMBAT EDGE/ATAGS (CE/ATAGS) ensemble who were exposed to three centrifuge-based simulated air combat sorties during a 2-h period. Each sortie consisted of four different G-profiles: a gradual onset profile; a simulated air combat maneuver consisting of +4.5 to +7 Gz plateaus; a simulated air combat maneuver derived from actual fighter maneuvers with peaks up to +9 Gz (TACM); and simulated air combat maneuver consisting of +5.0 to +9.0 Gz plateaus (5-9 SACM). Each sortie was separated by a 20-min rest period. We measured heart rate, peripheral light loss (PLL), subjective effort level, subjective fatigue level, and reported recovery time. There were no incidents of unintended G-induced loss of consciousness (G-LOC) with CE/ATAGS. There were four incidents of unintended G-LOC with STD. CE/ATAGS provided significantly greater G-protection than the standard anti-G ensemble. There was no G-LOC with CE/ATAGS. This greater protection should be of significant operational value in enhancing sortie generation capability by increasing fighter aircrew G-tolerance and decreasing aircrew fatigue.
Author (AIAA)
Antigravity; Flight Crews; Flight Stress; Acceleration Protection; Protective Clothing

19980058107
Extreme thermal stresses ***Les contraintes thermiques extremes***
Timbal, Jean, Paris, Univ., France; Nouvelle Revue d'Aeronautique et d'Astronautique; Oct. 1997; ISSN 1247-5793, no. 5, pp. 26-31; In French; Copyright; Avail: Aeroplus Dispatch

The limits of human thermal resistance are examined. The sensation of comfort is compatible with upward or downward variations of only one-half of one degree C with respect to the ideal body temperature of 37 C. Beyond this, there is not only a sensation of discomfort, but very quickly a drop in psychotechnical and intellectual performances. This is considerably altered to the point of becoming a real hazard in such activities as piloting an aircraft, when the internal temperature exceeds 38 C or when it falls below 35.5 C. Beyond these limits, degradation progresses rapidly and life expectancy is jeopardized. Death from hyperthermia can occur when the body's internal temperature exceeds 42 C. Death from hypothermia is possible through heart failure as soon as the internal temperature drops to 30 C. The human body's natural means of defense against thermal aggression, its thermoregulatory system, is described. Non-natural protection against thermal stress is discussed. Passive systems are used most of the time.

These systems must take into account the following six properties: thermal insulation, permeability to air, permeability to water vapor, waterproofness, fire resistance, and emissivity of external surfaces. Active systems are reserved for special situations such as space walks or deep-sea diving. They characteristically require a source of power and equipment able to transfer calories so as to allow the individual, depending on the particular case, to be heated or cooled. These various heating and cooling systems are addressed.
AIAA
Thermal Stresses; Thermal Comfort; Thermal Protection

19980058108
Life in artificial atmospheres - Example of a space suit ***La vie en atmosphere artificielle - Exemple d'un scaphandre***
Barer, Arnold S., NPO 'Zvezda', Russia; Nouvelle Revue d'Aeronautique et d'Astronautique; Oct. 1997; ISSN 1247-5793, no. 5, pp. 32-37; In French; Copyright; Avail: Aeroplus Dispatch

The physiological and emotional problems encountered during space extravehicular activity (EVA) are reviewed. The following topics concerning space suits with regard to EVA environmental factors are reviewed: composition and pressure-related problems, thermal control, visual problems, and the optimum utilization of automatic devices. The physical stress generated by EVAs and the consequences of those stresses are explained. The influential factors pertaining to the emotional stress of EVAs are presented. They include the astronaut's emotional stability, motivation, task complexity, and emergency situations. The extreme importance of professional training for EVAs is pointed out. Steps that are needed to be taken in order to increase EVA safety are outlined.
AIAA
Space Suits; Extravehicular Activity; Space Flight

19980058178
An experimental study on regeneration device for urine and waste water in space station
Zhou, Kanghan, Inst. of Space Medico-Engineering, China; Shang, Chuanxun, Inst. of Space Medico-Engineering, China; Liu, Chengliang, Inst. of Space Medico-Engineering, China; Zheng, Chuanxian, Inst. of Space Medico-Engineering, China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 323-327; In Chinese; Copyright; Avail: Aeroplus Dispatch

The principle, structure, and function of a regeneration system for urine and waste-water treatment are introduced. The experimental results demonstrated that the treatment capacity was 1.2 to about 1.9 kg/h and that the regeneration efficiency exceeded 92 percent. The treated water had the following qualities: a TOC of less than 20 g/cu m, an (NH3 + NH4(+)) content of less than 10 g/cu m, an electrical conductivity of less than 100 microsec/cm, and a pH of 6 to about 8.
Author (AIAA)
Urine; Regeneration (Engineering); Waste Water; Waste Treatment; Space Stations; Water Reclamation; Membranes

19980058189
Investigation on the elimination of organic substances in urine by Supercritical Water Oxidation
Wang, Tao, Tsinghua Univ., China; Yang, Ming, Tsinghua Univ., China; Xiang, Botao, Tsinghua Univ., China; Shen, Zhongyao, Tsinghua Univ., China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 370-372; In Chinese; Copyright; Avail: Aeroplus Dispatch

The application of Supercritical Water Oxidation (SCWO) to the processing of human metabolic wastes in a Controlled Ecological Life Support System was studied for organic substance elimination in urine and for recovery of potable water. The SCWO of simulated urine was investigated with oxygen as the oxidant at 400 to about 500 C and 24 to about 30 MPa in a continuous flow reactor. The organic substance elimination efficiency was obviously affected by temperature, pressure, and reaction time. It is lower than 10 percent at 400 C but more than 95 percent at 550 C, with a reaction time of 2 min.
Author (AIAA)
Urine; Oxidation; Human Wastes; Water Reclamation; Metabolic Wastes; Organic Materials; Potable Water

19980058190
Study on effects of combined hearing protector on communication quality and noise protection
Li, Daode, Inst. of Space Medico-Engineering, China; Zheng, Suxian, Inst. of Space Medico-Engineering, China; He, Yanjun, Inst. of Space Medico-Engineering, China; Space Medicine & Medical Engineering; Oct. 1997; ISSN 1002-0837; Volume 10, no. 5, pp. 373-375; In Chinese; Copyright; Avail: Aeroplus Dispatch

To study the communication quality and the protection effects of a single protector and combined ones, sound attenuation communication experiments were conducted on 14 male subjects. The results showed that the sound attenuation of combined protectors were 13 or 6 dB more than that of a single earplug or earmuff, respectively, and combined protectors could avoid sound attenuation caused by the harmonics on some frequency bands in a single one. After combined usage, the single protector reduced the distortion which came from the overload of hearing organs and maintained communication quality. The combined protector is an effective hearing protection device in a high-noise environment in the aerospace field.
Author (AIAA)
Ear Protectors; Noise Reduction; Hearing; Acoustic Attenuation; Sound Transmission

19980058812 NASA Marshall Space Flight Center, Huntsville, AL USA
Overview of the International Space Station System Level Trace Contaminant Injection Test
Tatara, James D., ION Systems, USA; Perry, Jay L., NASA Marshall Space Flight Center, USA; Franks, Gerald D., NASA Marshall Space Flight Center, USA; 1997; 9p; In English; 28th; International Conference on Environmental Systems (ICES), 13-16 Jul. 1998, Danvers, MA, USA
Report No.(s): NASA/TM-1997-208137; NAS 1.15:208137; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

Trace contaminant control onboard the International Space Station will be accomplished not only by the Trace Contaminant Control Subassembly but also by other Environmental Control and Life Support System subassemblies. These additional removal routes include absorption by humidity condensate in the Temperature and Humidity Control Condensing Heat Exchanger and adsorption by the Carbon Dioxide Removal Assembly. The Trace Contaminant Injection Test, which was performed at NASA's Marshall Space Flight Center, investigated the system-level removal of trace contaminants by the International Space Station Atmosphere Revitalization, and Temperature/Humidity Control Subsystems, (November-December 1997). It is a follow-on to the Integrated Atmosphere Revitalization Test conducted in 1996. An estimate for the magnitude of the assisting role provided by the Carbon Dioxide Removal Assembly and the Temperature and Humidity Control unit was obtained. In addition, data on the purity of Carbon Dioxide Removal Assembly carbon dioxide product were obtained to support Environmental Control and Life Support System Air Revitalization Subsystem loop closure.
Author
Air Purification; Trace Contaminants; International Space Station; Performance Tests; Cabin Atmospheres

19980059022
JEM EVA design verification using Weightless Environment Simulation Test
Yamaguchi, Takao, NASDA, Japan; Mawatari, Tadatoshi, NASDA, Japan; Usui, Hideo, NASDA, Japan; 1997, pp. 581-595; In English
Report No.(s): AAS Paper 97-457; Copyright; Avail: Aeroplus Dispatch

The Weightless Environment Simulation Test (WEST) for the JEM Extra Vehicular Activities (EVA) design verification was conducted at NASDA's Tsukuba Space Center during January to February 1997. The purpose of WEST was to verify the on-orbit assembly and maintainability by EVA astronauts. The facility NASDA used for WEST is a pool which is 53 feet in diameter and 35 feet in depth. In the pool, the test subjects are in a neutral buoyancy environment similar to what astronauts experience on orbit. Five astronauts participated in WEST as test subjects. They were required to perform JEM maintenance tasks in the pool and then evaluated its design feasibility by providing subjective comments. This paper reports the crew comments, the performance and specifications of the WEST facility, test procedure, and test results to be incorporated in the JEM design.
Author (AIAA)
Space Environment Simulation; Weightlessness Simulation; Extravehicular Activity; Spacecraft Maintenance

19980059024
Japan's activities on CELSS in space
Kibe, Seishiro, NASDA, Japan; Suzuki, Katsunori, NASDA, Japan; 1997, pp. 605-616; In English
Report No.(s): AAS Paper 97-459; Copyright; Avail: Aeroplus Dispatch

This paper describes Japan's CELSS-related activities, aiming at its application in space. In 1994, under the framework of the Frontier Joint Research Program, one of the authors organized the committee on CELSS IN SPACE which consists of three subgroups, the higher plant cultivation system group, the aquatic zone system group, and the total system study group. This paper introduces results obtained so far and future study issues to be pursued in each subgroup and the total system study group.
Author (AIAA)
Japanese Space Program; International Cooperation; Closed Ecological Systems; Spacecraft Environments

19980059504

How do we search?

Cartier, J. F., Inst. for Defense Analyses, USA; Hsu, D. H., Inst. for Defense Analyses, USA; Nicoll, J. F., Inst. for Defense Analyses, USA; 1997, pp. 56-71; In English

Contract(s)/Grant(s): DASW01-94-C-0054; Copyright; Avail: Aeroplus Dispatch

A target attractiveness model is used for field of view search. The model describes the search as a two-step process. The observer first decides to move to some location based on its attraction and size. These attractive points are further divided by a second decision which determines whether or not an observer will perform a detailed examination of the area or will choose a new attractive point. The model is tested on human performance experiments performed by the U.S. Night Vision and Electronic Sensors Directorate.

Author (AIAA)

Target Acquisition; Field of View; Human Performance; Clutter; Saccadic Eye Movements

19980059505

Novel applications of hyperstereo vision

Watkins, Wendell R., U.S. Army, Research Lab., USA; Jordan, Jay B., New Mexico State Univ., Las Cruces; Trivedi, Mohan M., Southern California, Univ., USA; 1997, pp. 72-88; In English; Copyright; Avail: Aeroplus Dispatch

Recent stereo vision experiments show potential in enhancing vehicular navigation, target acquisition, and optical turbulence mitigation. The experiments involved the use of stereo vision headsets connected to visible and 8-12 micron IR imagers. The imagers were separated by up to 50 m (i.e., wider platform separation than human vision, or hyperstereo) and equipped with telescopes for viewing at ranges of tens of meters up to 4 km. The important findings were: (1) human viewers were able to discern terrain undulations for obstacle avoidance, (2) human viewers were able to detect depth features within the scenes that enhanced the target acquisition process over using monocular viewing, and (3) human viewers noted appreciable reduction in the distorting effects of optical turbulence over that observed through a single monocular channel. For navigation, stereo goggles were developed for headset display and simultaneous direct vision for vehicular navigation enhancement. For detection, the depth cues can be used to detect even salient target features. For optical turbulence, the human mechanism of fusing two views into a single perceived scene can be used to provide nearly undistorted perception. These experiments show significant improvement for many applications.

Author (AIAA)

Stereoscopic Vision; Target Acquisition; Navigation Instruments; Man Machine Systems; Display Devices; Visual Perception

19980059656

A Framework for Immersive Virtual Environments (FIVE) - Speculations on the role of presence in virtual environments

Slater, Mel, Univ. College, UK; Wilbur, Sylvia, Queen Mary and Westfield College, UK; Presence: Teleoperators and Virtual Environments; Dec. 1997; ISSN 1054-7460; Volume 6,, no. 6, pp. 603-616; In English; Copyright; Avail: Aeroplus Dispatch

This paper reviews the concepts of immersion and presence in virtual environments (VEs). We propose that the degree of immersion can be objectively assessed as the characteristics of a technology, and has dimensions such as the extent to which a display system can deliver an inclusive, extensive, surrounding, and vivid illusion of virtual environment to a participant. Other dimensions of immersion are concerned with the extent of body matching, and the extent to which there is a self-contained plot in which the participant can act and in which there is an autonomous response. Presence is a state of consciousness that may be concomitant with immersion, and is related to a sense of being in a place. Presence governs aspects of autonomic responses and higher-level behaviors of a participant in a VE. The paper considers single and multiparticipant shared environments, and draws on the experience of Computer Supported Cooperative Working (CSCW) research as a guide to understanding presence in shared environments. The paper finally outlines the aims of the FIVE Working Group, and the 1995 FIVE Conference in London, UK.

Author (AIAA)

Virtual Reality; Software Development Tools; Environment Simulation

19980059658

Thermal feedback in virtual environments

Bergamasco, Massimo, Scuola Superiore S. Anna, Italy; Alessi, A. A., Scuola Superiore S. Anna, Italy; Calcara, M., Scuola Superiore S. Anna, Italy; Presence: Teleoperators and Virtual Environments; Dec. 1997; ISSN 1054-7460; Volume 6,, no. 6, pp. 617-629; In English; Copyright; Avail: Aeroplus Dispatch

We study of thermal contact phenomena modeling for tactile feedback in virtual environments applications. The results of the modeling aspects for thermal replication are collected in specific functions that are used by the renderer of a virtual application.

The finger temperature distribution versus time and contacted object temperature are the fundamental ways to approach, according to a specific modeling technique, the computation of the contact temperature occurring at the interface between the virtual hand and virtual object. Finger temperature distribution is then used for the control of thermal effectors. The modeling of the spatial and temporal distribution of the temperature in the human finger, when contact occurs with an external object at a defined temperature, is carried out in two phases: (1) determination of the temperature distribution in the finger when no contact is detected: and (2) determination of the temperature distribution in the finger when contact is detected. Results of the modeling are given and a procedure describing how these results can be used in the framework of a real application is presented.
Author (AIAA)
Virtual Reality; Skin Temperature (Biology); Feedback Control; Biological Models (Mathematics)

19980059659

An evaluation of level of detail degradation in head-mounted display peripheries

Watson, Benjamin, Alberta, Univ., Canada; Walker, Neff, Georgia Inst. of Technology, Atlanta; Hodges, Larry F., Georgia Inst. of Technology, Atlanta; Reddy, Martin, Edinburgh, Univ., UK; SRI International, USA; Presence: Teleoperators and Virtual Environments; Dec. 1997; ISSN 1054-7460; Volume 6,, no. 6, pp. 630-637; In English; Copyright; Avail: Aeroplus Dispatch

A paradigm for the design of systems that manage level of detail in virtual environments is proposed. As an example of the prototyping step in this paradigm, a user study was performed to evaluate the effectiveness of high-detail insets used with head-mounted displays. Ten subjects were given a simple search task that required the location and identification of a single target object. All subjects used seven different displays (the independent variable), varying in inset size and peripheral detail, to perform this task. Frame rate, target location, subject input method, and order of display use were all controlled. Primary dependent measures were search time on trials with correct identification, and the percentage of all trials correctly identified. Analyses of variance of the results showed that insetless, high-detail displays did not lead to significantly different search times or accuracies than displays with insets. In fact, only the insetless, low-detail display returned significantly different results. Further research is being performed to examine the effect of varying task complexity, inset size, and level of detail.
Author (AIAA)
Head-Up Displays; Virtual Reality; Systems Engineering; Man Machine Systems

19980059661

A comparison of cybersickness incidences, symptom profiles, measurement techniques, and suggestions for further research

Kennedy, Robert S., Essex Corp., USA; Lanham, D. S., Essex Corp., USA; Drexler, Julie M., Essex Corp., USA; Massey, Catherine J., Essex Corp., USA; Lilienthal, Michael G., U.S. Naval Medical Research and Development Center, USA; Presence: Teleoperators and Virtual Environments; Dec. 1997; ISSN 1054-7460; Volume 6,, no. 6, pp. 638-644; In English; Copyright; Avail: Aeroplus Dispatch

The widespread use of virtual environment (VE) systems in a variety of applications has serious implications for the user. Users with access to these sophisticated interactive immersions in multisensory 3D synthetic environments have been shown to experience motion sickness-like symptoms (eyestrain, ataxia, fatigue, drowsiness) and aftereffects such as visual flashbacks, disorientation, and balance disturbances occasionally occurring up to 12 hours after VE exposure. This is a significant health and safety concern. Technical improvements of VE systems need to be initiated to reduce these potential aftereffects that could result in adverse legal, economic, individual, and social consequences. Many different types of symptoms have been reported that appear to make up the cybersickness syndrome. From our extensive database of virtual environment and flight simulator exposures, we offer examples of these symptoms profiles along with suspected mechanisms and origins. We discuss these issues as well as various assessment techniques and methods used to determine the presence of VE sickness in individuals.
Author (AIAA)
Virtual Reality; Motion Sickness; Flight Simulators

19980059663

Autonomous virtualization of real environments for telepresence applications

Geist, Robert, Clemson Univ., USA; Stinson, Todd, Clemson Univ., USA; Schalkoff, Robert, Clemson Univ., USA; Gurbuz, Sabri, Clemson Univ., USA; Presence: Teleoperators and Virtual Environments; Dec. 1997; ISSN 1054-7460; Volume 6,, no. 6, pp. 645-657; In English
Contract(s)/Grant(s): DE-FG07-96ER-14728; Copyright; Avail: Aeroplus Dispatch

The autonomous, noncontact creation of virtual environments from existing, real environments is described. The technique uses structured light to provide direct estimation of 3D surface patch parameters. Active (laser) cameras are used to determine

3D object models, and passive camera images are used to generate color and texture. This process, termed virtualization, has immediate application to providing telepresence in previously unmodeled or unstructured environments. An example of the process is shown and directions for future research are indicated.
Author (AIAA)
Virtual Reality; Teleoperators; Laser Applications; Three Dimensional Bodies; Visual Perception; Pattern Recognition

19980059664
Managing level of detail in virtual environments - A perceptual framework
Reddy, Martin, SRI International, USA; Watson, Benjamin, Georgia Inst. of Technology, Atlanta; Walker, Neff, Georgia Inst. of Technology, Atlanta; Hodges, Larry F., Georgia Inst. of Technology, Atlanta; Presence: Teleoperators and Virtual Environments; Dec. 1997; ISSN 1054-7460; Volume 6,, no. 6, pp. 658-666; In English; Copyright; Avail: Aeroplus Dispatch

The effectiveness of using perceptual criteria to select the amount of detail that is displayed in an immersive virtual reality (VR) is used as the basis of the development of a principled, perceptually oriented framework to automatically select the appropriate level of detail (LOD) for each object in a scene, taking into consideration the limitations of the human visual system. We apply knowledge and theories from the domain of visual perception to the field of VR, thus optimizing the visual information presented to the user based upon solid metrics of human vision. Through a series of contrast grating experiments, a user's visual acuity may be assessed in terms of spatial frequency and contrast. The results of these tests can be modeled mathematically using a contrast sensitivity function (CSF). Therefore, we can use the CSF results to estimate how much visual detail the user can perceive in an object at any instant. Then, if we could describe this object in terms of its spatial frequencies, this would enable us to select the lowest LOD available without the user being able to perceive any visual change.
Author (AIAA)
Virtual Reality; Space Perception; Visual Perception; Man Machine Systems; Visual Acuity

19980059666
Health and safety implications of virtual environments - Measurement issues
Nichols, Sarah, Nottingham, Univ., UK; Cobb, Sue, Nottingham, Univ., UK; Wilson, John R., Nottingham, Univ., UK; Presence: Teleoperators and Virtual Environments; Dec. 1997; ISSN 1054-7460; Volume 6,, no. 6, pp. 667-675; In English; Copyright; Avail: Aeroplus Dispatch

Investigations of the potential impact of virtual environments on user health and safety require a methodological framework to identify both the effects of VE participation and the role of influential factors in causing those effects. This first in a series of 12 experiments was designed to evaluate methods, but also provided preliminary data regarding psychological and physiological effects. This discussion centers upon the value of self-reports and performance measures and the general methodological problems of evaluating participation in virtual environments.
Author (AIAA)
Virtual Reality; Safety Factors; Psychological Effects; Physiological Effects

19980059667
Virtual Life Network - A body-centered networked virtual environment
Pandzic, Igor-Sunday, Geneva, Univ., Switzerland; Thalmann, Nadia M., Geneva, Univ., Switzerland; Capin, Tolga K., Swiss Federal Inst. of Technology, Switzerland; Thalmann, Daniel, Swiss Federal Inst. of Technology, Switzerland; Presence: Teleoperators and Virtual Environments; Dec. 1997; ISSN 1054-7460; Volume 6,, no. 6, pp. 676-686; In English; Copyright; Avail: Aeroplus Dispatch

In order to feel the sense of presence in a virtual environment, it is important for the participants to become a part of this environment and interact with it through natural behaviors. This interaction is even more important in networked collaborative virtual environments, in which the participants need to see and interact with each other. We present the Virtual Life Network (VLNET), a joint research effort in the field of networked collaborative virtual environments. In VLNET, each participant is represented by a virtual human actor with realistic appearance and movements similar to the actual body. Interacting with the environment through his virtual body, the participant is perceived himself and others in a natural way. Since it is generally not possible to track all degrees of freedom of the human body in order to reproduce realistic body motion, we introduce the motor functions that generate natural motion for standard tasks such as walking and arm motion. to further enhance the realistic feel of the virtual environment and to simplify object manipulation we provide the facility of defining object behaviors by attaching motor functions to the objects.
Author (AIAA)
Virtual Reality; Human Body; Human Reactions; Man Machine Systems

19980059669

Speech-based multimodal interaction in virtual environments - Research at the Thomson-CSF Corporate Research Laboratories

Normand, Veronique, Thomson-CSF Corporate Research Labs., France; Pernel, Didier, Thomson-CSF Corporate Research Labs., France; Bacconnet, Beatrice, Thomson-CSF Corporate Research Labs., France; Presence: Teleoperators and Virtual Environments; Dec. 1997; ISSN 1054-7460; Volume 6,, no. 6, pp. 687-700; In English; Copyright; Avail: Aeroplus Dispatch

The Thomson-CSF Corporate Research Laboratories are investigating the issues of user-interface design, spoken and multimodal interaction design and realization in virtual environments. This paper describes our technical approach to speech-enabled multimodal virtual environments, based on our past achievements in the multimodal interaction domain, and presents our main supporting projects in this area. These projects involve augmented reality for maintenance, military situation building and assessment, and collaborative virtual environments.

Author (AIAA)

Virtual Reality; Speech Recognition; Human Reactions; Graphical User Interface; Architecture (Computers); Man Machine Systems

19980059814

A neuromorphic microphone for sound localization

Pu, Chiang-Jung, Florida, Univ., Gainesville, USA; Harris, John G., Florida, Univ., Gainesville; Principe, Jose C., Florida, Univ., Gainesville; 1997, pp. 1469-1474; In English; Copyright; Avail: Aeroplus Dispatch

We propose a localization model which uses monaural spectral cues for localizing a sound source in a 1D plane. A neuromorphic microphone is constructed to implement this model. The Head-Related Transfer Function (HRTF) plays a critical role for human monaural localization since the shape of the external ear spectrally shapes the sound differently for each sound source direction. Using HRTFs, humans can perceive the difference between front and back and the sound source's different elevation positions using only a single ear. The neuromorphic microphone relies on a specially shaped reflecting structure that allows echo-time processing to localize the sound. Since our recorded signal is composed of the direct sound and its echo, the sound is a simplified version of actual HRTF recordings which are composed of the direct sound and its reflections from the external ear, head, shoulder, and torso. The recorded signal from our special microphone is first processed using a gamma filter. The gamma filter generalizes the standard transversal filter by adding the ability to choose an optimal time-scale. Our studies have shown that the gamma filter solutions require on the order of five parameters while the more typical FIR filter solutions require hundreds of parameters. A multilayer perceptron neural network is then used to learn the elevation angle of the sound, allowing the microphone to correctly localize sounds.

Author (AIAA)

Sound Waves; Position (Location); Microphones

19980059825

Perceptual performances of force rendering methods

Fukui, Yukio, NIST, Japan; Yamashita, Juli, NIST, Japan; Shimojo, Makoto, NIST, Japan; 1997, pp. 1401-1405; In English; Copyright; Avail: Aeroplus Dispatch

In virtual reality techniques, the force feedback method becomes important especially when manipulating shapes interactively. The present study used two methods of presenting haptic stimuli and compared their perceptual effects. One method involved generating undulations by spatially varying the positions where reaction forces were generated while keeping the directions of them constant, the other by spatially varying the directions of reaction forces while keeping the positions constant. The subjective intensities of undulations generated by the two methods were compared. The results indicated that the subjective intensities depend on their spatial frequencies. Then, two stimuli were superimposed 180 degrees out of phase to check if two stimuli generated by different methods offset each other. No offset was observed regardless of the spatial frequencies of the stimuli.

Author (AIAA)

Virtual Reality; Feedback Control; Man Machine Systems; Shapes

19980059841

Dynamic simulation of human hand motion using an anatomically correct hierarchical approach

Ip, Horace H. S., Hong Kong, City Univ, China; Chan, C. S., Hong Kong, City Univ, China; 1997, pp. 1307-1312; In English; Copyright; Avail: Aeroplus Dispatch

We present a technique to realistically simulate the movements of human fingers. The technique utilizes a hierarchical approach having real anatomical basis. With the dynamic simulation built upon the real human hand anatomy, not only physical

correctness but also kinematics and biological correctness, which are often more important in human modelling, are guaranteed. The hierarchical approach here uses four layers of abstraction: anatomical, physical, geometry, and image. The use of a hierarchical approach allows the animator to specify hand motion without knowing the underlying representations and computations. Since dynamic correctness alone is insufficient to guarantee realism in simulating human hand motion, we combine dynamics and kinematics computation to achieve naturalness. There are dependencies among motion of different fingers and realistic simulation cannot be achieved without taking the dependencies into consideration. We addressed this issue by using a mesh-based physical model of flesh around the lumbricales which simulates flesh deformation incurred in finger motion and activates execution of motion dependencies. A user interface is developed to facilitate changing of input parameters and visualization of results.
Author (AIAA)
Computerized Simulation; Hand (Anatomy); Fingers

19980059852
Collision handling in virtual environments - Facilitating natural user motion
Jacobson, Jeffrey, Pittsburgh, Univ., USA; Lewis, Michael, Pittsburgh, Univ., USA; 1997, pp. 1704-1709; In English; Copyright; Avail: Aeroplus Dispatch

We studied three prototypical methods of collision handling in virtual reality (VR) in which either the user goes through an object like a ghost, stops dead on contact, or slides around it. In two experiments, subjects used a screen-and-mouse interface to navigate clutter virtual mazes. We found that the third method, sliding, enables superior navigation. While it does not simulate human avoidance behaviors, it does model their effect in terms of object avoidance. Significantly, screen-and-mouse is the both the most used and least studied VR interface.
Author (AIAA)
Collision Avoidance; Virtual Reality; Motion

19980059853
User-model based design of adaptive human-computer interfaces
Averbukh, E., Kassel, Univ., Germany; Gavrilova, T., St. Petersburg State Technical Univ., Russia; Johannsen, G., Kassel, Univ., Germany; Voinov, A., Inst. for High Performance Computing, Russia; 1997, pp. 1693-1697; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents one approach to user modeling, which can be efficiently implemented for industrial control applications. The focus is made on the analysis and evaluation of quasi-static individual user characteristics, particularly personal cognitive styles of users for initial and/or periodical adjusting interfaces to the individual users. The following individual cognitive factors: brain hemisphere asymmetry and deductive vs. inductive strategies, are taken into consideration. The appropriate Interface Model corresponding to the main parameters of the user model is proposed. It includes such substantial features of interface design as layout, navigation, dynamics, help monitoring organization, etc. Game process control facilities for identification of correspondent user and interface models are presented and evaluated within a pilot study.
Author (AIAA)
Human-Computer Interface; Cognition; Adaptive Control

19980059855
Can motion increase user interface bandwidth in complex systems?
Bartram, Lyn, Simon Fraser Univ., Canada; 1997, pp. 1686-1692; In English; Copyright; Avail: Aeroplus Dispatch

Current user interfaces to complex systems suffer from data displays which are increasingly cumbersome since the representation techniques exceed the human's perceptual capacity to efficiently interpret them. New display dimensions are required to support the user in integrating and relating information across displays and representations. Advances in technology have made animation a viable alternative. Motion holds promise as a perceptually rich and efficient display dimension but little is known about its properties for information display. We summarize types of movement characterization from diverse disciplines and proposes an initial taxonomy of motion properties and application to serve as a framework for further empirical investigation into motion as a useful display dimension.
Author (AIAA)
Complex Systems; Man Machine Systems; Bandwidth; Computer Animation

19980059863

Interactive modular graphical user interface development for telesensation systems

De Rossi, Victor, Florida International Univ., Miami, USA; Batsomboon, Pattaraphol, Florida International Univ., Miami; Tosunoglu, Sabri, Florida International Univ., Miami; Repperger, Daniel W., USAF, Armstrong Lab., USA; 1997, pp. 1604-1608; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents the ongoing work on an advanced GUI software for telesensation systems which is being developed at the Robotics and Automation (R&A) Laboratory at Florida International University. The interface package is mainly developed for controlling robots in remote sites, but it can also be used to control mobile platforms or any remote system. The package accepts various standard inputs from different devices such as video cameras, CCD cameras, force-reflecting manual controllers, virtual reality units and a variety of sensors particular to the application. Additionally, the remote system can be simulated graphically and presented as part of the GUI. The same task can be viewed from different windows simultaneously and the characteristics presented to the operator to enhance his perception of the remote site and ease the control task considerably.

Author (AIAA)

Computer Graphics; Human-Computer Interface; Teleoperators

19980059865

Human/robot interface and mission management in MAUVE, a multi-purpose autonomous underwater vehicle

Tigli, J.-Y., Nice, Univ., France; Workert, M., Nice, Univ., France; Thomas, M. C., Nice, Univ., France; 1997, pp. 1592-1597; In English; Copyright; Avail: Aeroplus Dispatch

The overall objective of the MAUVE project is to develop and test a mobile and autonomous instrumented underwater vehicle dedicated to multipurpose survey. One of the main points of this project is the implementation of the navigation and mission management systems. This paper describes the principal results achieved so far in the design of Human/Autonomous Underwater Vehicle interactions in the specification phase of the robot mission.

Author (AIAA)

Man Machine Systems; Underwater Vehicles; Management Systems; Robots; Autonomy; Computer Aided Design

19980059877

Animation of deformable 3D objects in virtual reality systems

Schneider, Bruno de O., Sao Carlos, Univ. Federal, Brazil; Kirner, Claudio, Sao Carlos, Univ. Federal, Brazil; 1997, pp. 1084-1088; In English; Copyright; Avail: Aeroplus Dispatch

Deformable objects give virtual reality a natural look for user interaction. The problem with these objects is that they require extensive physical simulation to look natural, requiring costly systems to run on. We show that deformable objects can be represented by 3D animation, instead of simulation, in virtual reality applications. The cost of increased performance is greater memory requirements and some loss of deformation freedom.

Author (AIAA)

Computer Animation; Virtual Reality; Three Dimensional Models; Deformation

19980059878

Feasibility of using eye tracking to increase resolution for visual telepresence

Sharkey, Paul M., Reading, Univ., UK; Murray, David W., Oxford, Univ., UK; 1997, pp. 1078-1083; In English

Contract(s)/Grant(s): EPSRC-GR/J/44049; Copyright; Avail: Aeroplus Dispatch

Visual telepresence seeks to extend existing teleoperative capability by supplying the operator with a 3D interactive view of the remote environment. This is achieved through the use of a stereo camera platform which, through appropriate 3D display devices, provides a distinct image to each eye of the operator and which is slaved directly from the operator's head and eye movements. However, the resolution within current head mounted displays remains poor, thereby reducing the operator's visual acuity. This paper reports on the feasibility of incorporation of eye tracking to increase resolution and investigates the stability and control issues for such a system. Continuous domain and discrete simulations are presented which indicates that eye tracking provides a stable feedback loop for tracking applications, though some empirical testing of such a system will be required to overcome indicated stability problems associated with microsaccades of the human operator.

Author (AIAA)

Teleoperators; Visual Acuity; Display Devices; Three Dimensional Models; Eye Movements

19980059879

Evaluation of preferred motor torque levels for force feedback

Sudarsan, Sundaravalli P., Cybernet Systems Corp.; Michigan, Univ., Ann Arbor, USA; Yocum, Todd, Michigan, Univ., Ann Arbor; Haanpaa, Douglas P., Michigan, Univ., Ann Arbor; Riggs, Alan J., Michigan, Univ., Ann Arbor; Jacobus, Charles J., Michigan, Univ., Ann Arbor; 1997, pp. 1073-1077; In English

Contract(s)/Grant(s): DAAL01-96-C-0050; Copyright; Avail: Aeroplus Dispatch

Force feedback peripheral devices are being increasingly used in virtual reality simulators, particularly in the video game industry. The amount of force provided to the user through the peripheral device needs to take into account several factors such as user strength, device controllability, the nature of the task, and personal preference. This work is an initial attempt to study the user response to varying magnitudes of force feedback for a video game application, using qualitative evaluation by the user and quantitative measurement of task performance as defined by the time to complete the task. A total of 16 subjects participated in the study. Each subject was tested at various levels of force feedback and at one level of the subject's choice. Preliminary results indicate the presence of a characteristic subjective preference for force feedback. They also show an absence of significant differences in the quantitative measure of performance, namely the driving time. Implications of these findings are discussed in relationship to the design and application of force feedback devices.

Author (AIAA)

Torque; Feedback Control; Game Theory; Video Signals; Virtual Reality; Computerized Simulation

19980059880

Causal volumes in distributed virtual reality

Ryan, Matthew D., Reading, Univ., UK; Sharkey, Paul M., Reading, Univ., UK; 1997, pp. 1067-1072; In English; Copyright; Avail: Aeroplus Dispatch

Research to date has tended to concentrate on bandwidth considerations to increase scalability in distributed interactive simulation and virtual reality systems. This paper proposes that the major concern for latency in user interaction is that of the fundamental limit of communication rate due to the speed of light. Causal volumes and surfaces are introduced as a model of the limitations of causality caused by this fundamental delay. The concept of virtual world critical speed is introduced, which can be determined from the causal surface. The implications of the critical speed are discussed and relativistic dynamics are used to constrain object speed in the same way speeds are bounded in the real world.

Author (AIAA)

Virtual Reality; Bandwidth; Computerized Simulation; Wide Area Networks

19980059882

Influence of video characteristics of simulator images on remote driving performance

Sudarsan, Sundaravalli P., Cybernet Systems Corp.; Michigan, Univ., Ann Arbor, USA; Cohen, Charles J., Michigan, Univ., Ann Arbor; Du, Loc Q., Michigan, Univ., Ann Arbor; Cobb, Paul N., Michigan, Univ., Ann Arbor; Yager, Eric S., Michigan, Univ., Ann Arbor; Jacobus, Charles J., Michigan, Univ., Ann Arbor; 1997, pp. 1062-1066; In English

Contract(s)/Grant(s): DAAL01-96-C-0050; Copyright; Avail: Aeroplus Dispatch

Driving simulators are finding potential use as display devices in specialized applications such as the remote control and manipulation of vehicles. This work is an attempt to understand how driving control is affected by the video characteristics of simulator images, in particular the update frequency, and the image delay. Five subjects took part in this study. The experimental task was to drive a car displayed on the monitor at different combinations of update frequency and image delay, and the time to complete the task was used as a measure of performance. Results show the presence of characteristic changes in driving time with alterations in update frequency and frame lag. Implications of these findings are discussed in relationship to the video characteristics of visual displays in driving simulators used for the remote control of vehicles by human operators.

Author (AIAA)

Remote Control; Display Devices; Remotely Piloted Vehicles; Teleoperators; Video Signals

19980059883

Computer supported collaborative learning environment for abstract knowledge

Nakatani, Yoshio, Mitsubishi Electric Corp., Japan; Fukuda, Toyoo, Kwansei Gakuin Univ., Japan; 1997, pp. 1050-1055; In English; Copyright; Avail: Aeroplus Dispatch

We propose a computer support learning environment of novice workers who learn new concepts in their unfamiliar domains, especially abstract knowledge domains, such as computer operating systems. Based on cognitive science, our system, called SOPHIA, provides a machine expert neighbor which advises novices in their daily work. When the novices encounter troubles,

the system can advise by referring to the textbook knowledge and its analogical concept in their familiar domains in the form of the document, figures, and/or videos. The novices can cruise in the textbook knowledge space through the hypertext-ike interface, which enables novices to learn relevant knowledge with interest. The system also supports novices asking questions of their colleagues through the computer network.
Author (AIAA)
Machine Learning; Operating Systems (Computers)

19980059885
Human-computer cooperation for building controller
Shiraz, G. M., New South Wales, Univ., Australia; 1997, pp. 1039-1044; In English; Copyright; Avail: Aeroplus Dispatch

This paper proposes a new interactive method called Parvaz in which an expert and a learning program cooperate with each other to create a controller for dynamic systems. This method has been demonstrated for the skill of flying an aircraft in a flight simulator. Dynamic Ripple Down Rules have been developed for those parts of the system where it is possible for the pilot to verbalize his or her control strategy. For those parts of the flight where it is difficult or impossible for the pilot to formulate his or her strategy, Learning Dynamic Ripple Down Rules (LDRDR) have been developed to automatically produce rules from the logged data of the expert's behavior. Parvaz has been tested using three volunteers. All the subjects were successful in creating a set of rules that can fly an aircraft through a given flight plan.
Author (AIAA)
Human-Computer Interface; Control Systems Design; Machine Learning; Expert Systems; Flight Simulators

19980059919
Detection algorithm for conceptual difference among different persons - As an example of emergence in the human interaction
Yoshida, Tetsuya, Osaka Univ., Japan; Kondo, Teruyuki, Osaka Univ., Japan; Saiwaki, Naoki, Osaka Univ., Japan; Nishida, Shogo, Osaka Univ., Japan; 1997, pp. 1216-1221; In English
Contract(s)/Grant(s): MOESC-07243105; MOESC-09450159; Copyright; Avail: Aeroplus Dispatch

We consider emergence in the human interaction by taking the discovery of conceptual difference as an example. Conceptual difference is a serious problem in group knowledge acquisition systems, especially when different people with different background participate in a group. We deal with the conceptual difference, in which different symbols are used to express the same meaning and/or the same symbol is used to express different meanings. We propose a method to detect such types of conceptual difference by utilizing decision trees which are constructed with the ID3 algorithm and genetic algorithms (GAs). Our method is discussed in terms of the realization of emergence in the human interaction. We tackle the 'vague' concept of emergence in the human interaction by constructing 'concrete' structures to express conceptual difference. Our method ensures the variety in the conceptual structures by utilizing GAs to explore various possibilities. The various structures constructed by the system play the role of pointing out conceptual difference from another viewpoint, which is different from those of the members in the group. This function enables the members to understand each other as well as their own concepts, which is expected to contribute to developing new ideas as a group and to promoting the activity of the group.
Author (AIAA)
Genetic Algorithms; Behavior; Human Performance

19980059922
Investigating human/system interfaces and interactions in a 'lights-out' operational environment
Truszkowski, Walt, NASA Goddard Space Flight Center, USA; Grubb, Tom, NASA Goddard Space Flight Center, USA; Murphy, Elizabeth D., Maryland, Univ., College Park; Norman, Kent L., Maryland, Univ., College Park; 1997, pp. 1168-1173; In English; Copyright; Avail: Aeroplus Dispatch

The concepts of 'lights-out' operations and human/computer interfaces and interactions are not incongruous ideas. The concept of automated operations without the immediate presence of people raises interesting and complicated issues associated with human/computer interfaces and interactions when, in fact, people are integrated back into and must interact with the automated operational environment for some complicated problem-solving exercise. Cognitive research proposed to investigate these issues focuses first on the representation question, that is, how best to represent system status to the remotely-located analyst. Studies are conducted to test the efficacy of several 3D techniques for problem representation which have been developed at NASA-Goddard Space Flight Center.
Author (AIAA)
Man Machine Systems; Human-Computer Interface

19980059924

'Strong and silent' machine agents - In need of improved communication and coordination skills

Sarter, Nadine B., Illinois, Univ., Urbana, USA; 1997, pp. 1163-1167; In English; Copyright; Avail: Aeroplus Dispatch

There are several possible ways of addressing these problem of breakdowns in the communication and coordination between humans and machines. Training can be modified to better support operators in developing an appropriate model of their system or the communication and coordination skills of modem technology can be improved. The latter approach aims at enabling systems to determine when and how to share information with their human counterparts. One promising candidate for achieving this goal is the (re)introduction of multisensory feedback to support functions such as attention capture and guidance and to allow for parallel processing of information. Yet another avenue towards improving human-automation coordination is to better understand and utilize proposed and currently practiced styles of automation management which can affect the level of shared awareness of intentions, actions, and limitations between operators and their systems. The (re)introduction of multisensory feedback and the examination and well-founded choice of automation management styles have received relatively little attention up to this point. We suggest that more empirical evidence is needed on the effectiveness and limitations of these approaches in the interest of making progress towards a more human- and use-oriented design of modem technology. For illustration purposes, we use examples from the aviation domain.

Author (AIAA)

Automation; Man Machine Systems; Pilot Performance

19980059926

Development and integration of an automated satellite control center - Results and lessons learned for future applications

Penafiel, Catherine, Lockheed Martin Corp., USA; 1997, pp. 1157-1162; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes a model of control center operations. A prototype automated system supports real-time satellite operations during two unstaffed shifts each day. The system architecture is described. Results and lessons learned are discussed.

Author (AIAA)

Satellite Control; Automatic Control; Extreme Ultraviolet Explorer Satellite

19980059929

Designing automation to reduce operator errors

Leveson, Nancy G., Washington, Univ., Seattle, USA; Palmer, Everett, NASA Ames Research Center, USA; 1997, pp. 1144-1150; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes an approach to dealing with mode confusion errors by first modeling blackbox software behavior and then using analysis methods and tools to assist in searching the models for predictable error forms, i.e., for features that contribute to operator mistakes. The analysis results can be used to redesign the automation, to change operator training and procedures, or to design appropriate human-computer interfaces to help avoid mistakes. The approach requires a model of the blackbox behavior that is both formal and easily readable and reviewable by humans. The models we use are part of the software specifications in a methodology called SpecTRM (Specification Tools and Requirements Methodology) and thus the analysis is done directly on the system requirements specification and does not require extra modeling effort. SpecTRM includes a suite of analysis tools to detect errors and potentially hazardous behavior early in system development when tradeoffs and changes can more easily be made. In addition to providing design guidance, this approach might provide a way of 'measuring' or evaluating the cognitive demands involved in working with specific automated devices. The use of this approach on a commonly reported mode confusion error called a 'kill-the-capture' bust is illustrated.

Author (AIAA)

Automation; Pilot Performance

19980060355

Virtual maintenance - Real-world applications within virtual environments

Abshire, Kevin J., Lockheed Martin Tactical Aircraft Systems, USA; Barron, Mike K., Lockheed Martin Tactical Aircraft Systems, USA; 1998, pp. 132-137; In English; Copyright; Avail: Aeroplus Dispatch

The creation of a virtual maintenance capability within LMTAS has led supportability engineering into the world of virtual reality. Achievements in applying this technology are described. Insight is provided into the challenges met and benefits derived as a result of applying this emerging technology to real-world requirements.

Author (AIAA)

Human Factors Engineering; Maintenance; Virtual Reality; F-16 Aircraft; Computer Aided Design; Biological Models (Mathematics)

19980060446

Specifying training needs in dynamic judgment tasks using a lens model approach

Bisantz, Ann M., Georgia Inst. of Technology, Atlanta, USA; Gay, Paul, Georgia Inst. of Technology, Atlanta; Phipps, Donita A., Georgia Inst. of Technology, Atlanta; Walker, Neff, Georgia Inst. of Technology, Atlanta; Kirlik, Alex, Georgia Inst. of Technology, Atlanta; Fisk, Arthur D., Georgia Inst. of Technology, Atlanta; 1997, pp. 1849-1854; In English

Contract(s)/Grant(s): N61339-95-K-0018; Copyright; Avail: Aeroplus Dispatch

An important aspect of developing training interventions for complex environments is the characterization of individual performance in order to tailor training to the needs of each individual. Individual judgment performance in a command and control environment was modeled as linear combinations of environmental cue values using a lens model approach. Results showed that overall, all participants had accurate knowledge of the environment but that good and poor performers were distinguished by the consistency with which they executed judgment strategies based on this knowledge.

Author (AIAA)

Knowledge; Education; Decision Making; Complex Systems; Aircraft Models

19980060447

The Case-Based Intelligent Tutoring System - An architecture for developing and maintaining operator expertise

Chappell, Alan R., Georgia Inst. of Technology, Atlanta, USA; Mitchell, Christine M., Georgia Inst. of Technology, Atlanta; 1997, pp. 1855-1860; In English

Contract(s)/Grant(s): NCC2-961; Copyright; Avail: Aeroplus Dispatch

The Case-Based Intelligent Tutoring System (CB-ITS) is a proposed architecture for a computer-based training system for operators of complex dynamic systems. Intended for individuals who have already completed formal training, the goal of the CB-ITS is to help operators enhance and maintain expertise. The CB-ITS provides experience with prototypical and unusual operational situations (cases). The CB-ITS includes a simulator that allows a student to experience and practice the cases under the guidance of a computer-based tutor. The architecture uses the operator function model and OFMspert to provide intelligence and instructional control. This paper describes the CB-ITS architecture and enhancements to the operator function model and OFMspert to support an intelligent tutor that uses cases as pedagogy.

Author (AIAA)

Machine Learning; Complex Systems; Dynamical Systems; Architecture (Computers); Operators (Personnel)

19980060448

Training in open dynamic environment management - The case of operational management in public safety

Rogalski, Janine, Paris VIII, Univ., France; Antolin, Patricia, Paris VIII, Univ., France; 1997, pp. 1867-1872; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents theoretical and methodological issues applied to the design and analysis of didactical situations for training to manage open dynamic environment. The study deals with the case of fire-fighter officers' training. Operational training aims at developing collective competencies in decision making at a tactical level in unforeseen situations. At this level, actors have to develop analytical reasoning without having direct information about the 'perceived and acted' objects of action. In this paper, analysis is focused on training officers to act in headquarters at lower and upper levels. The notion of transposition of real situations is used for analyzing training situations from the point of view of trainees, on the one hand, and instructor's activity, on the other hand. It is shown how doctrinal knowledge of reference was orienting the design of training situation and organizing the interaction between trainees and trainers. A brief survey of the evolution of officer training at the upper level is presented. Trainees' evolution through a series of situations of simulation is then analyzed through the main results of a series of questionnaires. Instructor's activity in managing situation of simulation is then analyzed on the basis of the verbal interactions with trainees. The issue of designing computer-based systems as tools for instructors in managing training situations is discussed.

Author (AIAA)

Dynamical Systems; Safety; Fire Fighting; Education

19980060449

SMART Center - A distance training approach for aviation maintenance personnel

Chandler, Terrell N., Galaxy Scientific Corp., USA; Earon, Craig, Galaxy Scientific Corp., USA; 1997, pp. 1873-1877; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes the SMART Center (Safe Maintenance in Aviation Resource Training Center) developed for the FAA Office of Aviation Medicine to teach human factors concepts to aviation maintenance personnel. The intent of this paper is to illus-

trate possibilities of training through a virtual campus. The issues that one must consider when implementing such a facility are highlighted, as are the advantages of such an approach. During the conference presentation, the SMART Center is demonstrated.
Author (AIAA)
Aircraft Maintenance; Human Factors Engineering; Maintenance Training

19980060461
Pilot performance with predictive system status information
Trujillo, Anna C., NASA Langley Research Center, USA; 1997, pp. 1972-1977; In English; Copyright; Avail: Aeroplus Dispatch

Research has shown a strong pilot preference for predictive information of aircraft system status in the flight deck. However, the benefits of predictive information have not been quantitatively demonstrated. The study described here attempted to identify and quantify these benefits if they existed. In this simulator experiment, three types of predictive information (none, whether a parameter was changing abnormally, and the time for a parameter to reach an alert range) and four initial times to an alert (1 minute, 5 minutes, 15 minutes, and ETA+45 minutes) were found to affect when subjects accomplished certain actions, such as accessing pertinent checklists, declaring emergencies, diverting, and calling the flight attendant and dispatch.
Author (AIAA)
Pilot Performance; System Failures; Flight Simulators; Flight Safety

19980060463
Designing to control flight crew errors
Schutte, Paul C., NASA Langley Research Center, USA; Willshire, Kelli F., NASA Langley Research Center, USA; 1997, pp. 1978-1983; In English; Copyright; Avail: Aeroplus Dispatch

NASA Langley Research Center has initiated an effort to design a human-centered flight deck without constraints of existing designs. The effort will be based on recent research in human-centered design philosophy and mission management categories. This design will match the human's model of the mission and function of the aircraft to reduce unnatural or nonintuitive interfaces. The product of this effort will be a flight deck design description, including training and procedures, and a cross reference or paper trail back to design hypotheses, and an evaluation of the design. The present paper discusses the philosophy, process, and status of this design effort.
Author (AIAA)
Flight Crews; Errors; Aircraft Accidents; Human Factors Engineering

19980061731
Subjective evaluation of car seat comfort with fuzzy set techniques
Levrat, E., Universite Henri Poincare, France; Voisin, A.; Bombardier, S.; Bremont, J.; International Journal of Intelligent Systems; Nov-Dec, 1997; ISSN 0884-8173; Volume 12, no. 11-12, pp. 891-913; In English; Copyright; Avail: Issuing Activity

Subjective evaluation is a central problem in the life cycle of most products. Automotive companies use subjective evaluation of car seat comfort to check the adequacy between specifications and effective realization. A great deal of time and money are spent to achieve this goal. to solve these problems, our project's goal is to save the expert knowledge and to automate this phase in order to achieve more flexibility. This article presents some of the first steps in saving the expert know-how in addition to help for decision making. We propose tools for the expert assessment acquisition and processing using a fuzzy set technique called expertons. Expertons are applied to a typical example related to our application. It emphasizes the suitability of expertons for the help for decision making.
Author (EI)
Fuzzy Sets; Expert Systems; Automobiles; Seats; Decision Making; Support Systems

19980062842
Facilitating human interactions in mixed initiative systems through dynamic interaction generation
Penner, Robin R., Honeywell Technology Center, USA; Nelson, Kyle S., Honeywell Technology Center, USA; Soken, Nelson H., Honeywell Technology Center, USA; 1997, pp. 714-719; In English; Copyright; Avail: Aeroplus Dispatch

In our work to develop mixed-initiative, collaborative multi-agent societies, we have found that the introduction of automated reasoning capabilities into already complex systems that aid human process management exacerbates the already serious problem of human interaction with automation. Our solution is to incorporate a specially designed team of agents, the Interaction Management Team, into the collaborative agent society. The team's main function is to facilitate the interaction between the society's human participants and the software participants. The Interaction Management Team utilizes an automated object process, called Dynamic Interaction Generation (DIG), to react to the dynamic interaction needs of the human and software collaborators. This

paper presents an overview of the team's role in a multi-agent system, followed by a deeper discussion of the design and implementation of Dynamic Interaction Generation (DIG).
Author (AIAA)
Teams; Man Machine Systems; Software Development Tools

19980064475
Commercialization of regenerative life support systems
Flynn, Michael, NASA Ames Research Center, USA; Bubenheim, David, NASA Ames Research Center, USA; 1998, pp. 835-839; In English; Copyright; Avail: Aeroplus Dispatch

Over the past 30 years NASA has funded research into the development of self-sustained habitats for use as future lunar and Martian outposts. A key element of this work has been the development of small-scale liquid and solid waste processors. A secondary goal of this research has been to transfer this technology base to the private sector. This paper describes several programs which are involved in this Advanced Life Support technology transfer activity. The two programs highlighted in this paper are the CELSS Antarctic Analog Program and the Advanced Life Support for Extreme Environments program.
Author (AIAA)
Space Commercialization; Regeneration (Physiology); Life Support Systems; Closed Ecological Systems

19980064605
Investigation of PACE software and VeriFax's Impairoscope device for quantitatively measuring the effects of stress
Morgenthaler, George W., Colorado, Univ., Boulder, USA; Nunez, German R., Colorado, Univ., Boulder; Botello, Aaron M., Colorado, Univ., Boulder; Soto, Jose, Colorado, Univ., Boulder; Shrairman, Ruth, VeriFax Corp., USA; Landau, Alexander, VeriFax Corp., USA; 1998, pp. 609-615; In English; Copyright; Avail: Aeroplus Dispatch

PACE is a software model used to measure reaction time. VeriFax's Impairoscope measures the deterioration of neuromuscular responses. During the 1997 summer semester, various reaction time experiments were conducted on University of Colorado faculty, staff, and students using the PACE system. The tests included both two-eye and one-eye unstressed trials and trials with various stresses, such as fatigue, distractions in which subjects were asked to perform simple arithmetic during the PACE tests, and stress due to rotating-chair dizziness. Various VeriFax Impairoscope tests, both stressed and unstressed, were conducted to determine the Impairoscope's ability to quantitatively measure this impairment. In the 1997 fall semester, a Phase II effort was undertaken to increase test sample sizes in order to provide statistical precision and stability.
Author (AIAA)
Software Development Tools; Responses; Stress (Psychology)

19980064693
Using decision requirements to guide the design process
Klein, Gary, Klein Associates, Inc., USA; Klinger, Dave, Klein Associates, Inc., USA; Miller, Tom, Klein Associates, Inc., USA; 1997, pp. 238-244; In English; Copyright; Avail: Aeroplus Dispatch

It makes little sense to develop information management systems and human-computer interfaces (HCIs) to support routine tasks if these systems and interfaces become clumsy and obstructive when operators are faced with critical and difficult decisions. Yet this result occurs too often when developers use a systems-centered design approach (focusing on the technology rather than on the users' needs) or a data-centered design approach (identifying all the relevant information and packing it into the systems and displays). Even when developers rely on the users to specify what they want, there can be problems. Users are in a better position to describe how they perform their current tasks than to speculate about systems that will usually change those tasks. One solution is to use a decision-centered design approach that provides developers with tools for supporting the critical and difficult decisions. It identifies the users' critical decisions and tries to develop a system that will assist the users, without expecting the users to dream up their own solutions. A decision-centered design approach uses technology, as it provides meaningful support. It presents data and higher-order relationships that are needed for effective decision making.
Author (AIAA)
Information Management; Decision Making; Human Factors Engineering

19980064696
An analysis of human error in skill task and visual recognition under auditory interruption
Sugimoto, Futoshi, Toyo Univ., Japan; Toyabe, Toru, Toyo Univ., Japan; Sato, Akira, Toyo Univ., Japan; 1997, pp. 211-216; In English; Copyright; Avail: Aeroplus Dispatch

We have set up an experimental environmental consisting of three tasks on a computer screen to quantitatively analyze the mutual effect of these tasks. The first task is a tracking task, which is a typical skill-based one. The second task is to recognize the visual information that is indicated by four different media on a computer screen and to respond as soon as possible. The third task is to listen to a conversation and answer a question about the conversation. This task is supposed to be the same as using a cellular phone while driving a car. In this paper we examine the effect of the third task on the first and second tasks. The third task did not affect the performance of the tracking task. The time needed to respond after obtaining the information was affected a little by the third task.
Author (AIAA)
Error Analysis; Visual Tasks; Mental Performance; Human Performance; Auditory Stimuli; Interruption

19980064703
Determining the benefit of knowledge management activities
Kotnour, Tim, Central Florida, Univ., USA; Orr, Colleen, NASA Kennedy Space Center, USA; Spaulding, Jeff, NASA Kennedy Space Center, USA; Guidi, John, NASA Kennedy Space Center, USA; 1997, pp. 94-99; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents a process for determining the benefit of knowledge management tools, such as a lessons-learned system. Knowledge management is defined as the set of human, process, and tool interventions to support the creation, assimilation, dissemination, and application of knowledge. Determining the benefits of knowledge management is based on understanding the organizational-learning process which is the process knowledge management aims to support. The aim of organizational learning is to increase an organization's performance through the application of better knowledge in decision making which leads to the performance of tasks. The benefit of knowledge management is composed of three factors: change in knowledge, change in decision-making performance, and change in task performance. The change in knowledge should lead to a change in decision-making performance which will then increase the performance of the task a person or organization is completing. The process to determine the benefit involves collecting quantitative as well as qualitative data.
Author (AIAA)
Information Management; Knowledge Based Systems; Management Information Systems; Systems Management

19980064705
Decision support for the general aviation pilot
Painter, John H., Texas A & M Univ., College Station, USA; Kelly, Wallace E., III, Texas A & M Univ., College Station; Trang, Jeffrey A., Texas A & M Univ., College Station; Lee, Christopher A., Texas A & M Univ., College Station; Branham, Paul A., Texas A & M Univ., College Station; Crump, John W., Knowledge Based Systems, Inc., USA; Ward, Donald T., Texas A & M Univ., College Station; Krishnamurthy, Karthik, Texas A & M Univ., College Station; Woo, Dick L. Y., Texas A & M Univ., College Station; Alcorn, William P., Texas A & M Univ., College Station; 1997, pp. 88-93; In English; Copyright; Avail: Aeroplus Dispatch

We present an on-board computational system that increases pilot situational awareness, decreases diversion to routine computations, and anticipates upcoming needs. The key to anticipatory flight management is an expert system that uses knowledge of ATC procedures, aircraft operating procedures and limitations, and aircraft performance to infer current flight operating 'mode' without direct pilot intervention or input. A flight mode interpreter (FMI) enables automatic display selection, pilot advice, and warning. This paper reports the development of an FMI-based flight management system, called General Aviation Pilot Advisory and Training System (GAPATS), that is being developed jointly by Texas A & M University and Knowledge Based Systems, Inc. Software development is carried out using a fixed-base engineering flight simulator. Pilot participation in all phases of development and evaluation is the norm. Flight tests have begun on an instrumented research light twin owned by the Texas A & M University Flight Mechanics Laboratory.
Author (AIAA)
Decision Making; General Aviation Aircraft; Aircraft Pilots; Flight Management Systems

19980064743
NASA's Wireless Augmented Reality Prototype (WARP)
Agan, Martin, JPL, USA; Voisinet, Lee-Ann, JPL, USA; Devereaux, Ann, JPL, USA; 1998, pp. 236-241; In English; Copyright; Avail: Aeroplus Dispatch

The objective of the WARP effort is to develop and integrate advanced technologies for real-time personal display of information relevant to the health and safety of Space Station/Shuttle personnel. The WARP effort will develop and demonstrate technologies that will ultimately be incorporated into operational Space Station systems and that have potential Earth applications, such

as aircraft pilot alertness monitoring and in various medical and consumer environments where augmented reality is required. to this end a two-phase effort will be undertaken to rapidly develop a prototype (Phase I) and an advanced prototype (Phase II) to demonstrate the following key technology features that could be applied to astronaut internal vehicle activity (IVA) and potentially EVA as well: mobile visualization, and distributed information system access. Specifically, Phase I will integrate a low power, miniature wireless communication link and a commercial biosensor with a head mounted display. Phase II will put increased effort on miniaturization, power consumption reduction, increased throughput, higher resolution, and 'wire removal' of the subsystems developed in Phase I.
Author (AIAA)
Real Time Operation; Systems Integration; Display Devices; Aerospace Safety; Space Stations; Space Shuttles

19980064904
User-centered interface design of tactical aircraft displays
Hutchins, Susan G., U.S. Naval Postgraduate School, USA; Hutchins, Robert G., U.S. Naval Postgraduate School, USA; Jan. 1998; In English
Report No.(s): AIAA Paper 98-1036; Copyright; Avail: Aeroplus Dispatch

Tactical aviators must perform under highly complex, dynamic, multitask decisionmaking situations. At any point in time, a number of different tasks may demand attention, and each of these tasks is typically knowledge intensive and procedurally complex. Contact identification alone often involves time-compressed, ambiguous decision problems. The memory and cognitive processing requirements of these tasks often exceed the human's capacity to perform the requisite subtasks. A user-centered design approach was taken with deference to human performance capacities and limitations. Design features include the use of graphics to support intuitive processes and reduce cognitive processing requirements and structuring and presenting information in a format that parallels the decisionmaker's natural cognitive strategies. These decision support display features are directed at improving information sampling, reducing processing complexity, making information conform to human memory and cognitive strategy characteristics, avoiding cognitive overload, and enhancing the speed, coherence, and efficiency with which decisionmakers are able to shift attention and thought between the various tasks that arise. Topics include a discussion of decision support and human-system interaction principles and examples of modules designed to enhance decisionmaking.
Author (AIAA)
Fighter Aircraft; Aircraft Instruments; Display Devices; Graphical User Interface; Decision Support Systems

19980064905
Use of design reference scenarios in a user-centered design process
Folds, Dennis J., Georgia Inst. of Technology, Atlanta, USA; Jan. 1998; In English
Report No.(s): AIAA Paper 98-1039; Copyright; Avail: Aeroplus Dispatch

Human factors analyses include analysis of system requirements at the mission, function, and task levels. The use of detailed design reference scenarios can greatly enhance the usefulness of these analyses and provides a mechanism for linking the three levels of analysis. The scenarios can be used to define and illustrate the scope of mission requirements, and to provide a basis for workload predictions. Users should be involved in developing and validating the scenarios. As the design process continues, the scenarios can be implemented in dynamic mission simulation and in human factors test and evaluation.
Author (AIAA)
Human Factors Engineering; Graphical User Interface; Reference Systems; Operator Performance; Aircraft Design

19980065236
An analysis of the process of handing over an object and its application to robot motions
Shibata, Satoru, Ehime Univ., Japan; Sabhi, Benlamine M., Ehime Univ., Japan; Tanaka, Kanya, Ehime Univ., Japan; Shimizu, Akira, Ehime Univ., Japan; 1997, pp. 64-69; In English; Copyright; Avail: Aeroplus Dispatch

The interaction of humans and robots is a new problem. One strategy for generating smooth robot motions is to follow the interaction between humans. In this paper, we analyze the process of handing over an object from one human to another and discuss the possible application of the obtained characteristics to the motions of a 1D robot handing over an object to a human. The trajectories of the 'hander' and the 'receiver', and the handing-over point in the motion of passing an object from one human to another is analyzed. We propose an application of the obtained human characteristics for robot motion with regard to the velocity pattern and the handing-over point. The effectiveness of the proposed applications is confirmed by the psychological evaluations.
Author (AIAA)
Robot Dynamics; Man Machine Systems; End Effectors; Human Factors Engineering

19980065350

Human factor versus the computer factor

Altayeb, Saleh A.; Cost Engineering (Morgantown, West Virginia); Nov, 1997; ISSN 0274-9696; Volume 39, no. 11, pp. 15-16; In English; Copyright; Avail: Issuing Activity

The use of computers is essential in the construction industry, especially in medium- and large-sized companies. However, while computer proficiency is a great tool, it is not an objective or a goal. Getting good and accurate estimators, and making informed and intelligent decisions, are the real objectives and goals. This article discussed extensively these two factors - the human factor and the computer factor - in cost estimation.

EI

Cost Estimates; Costs; Human Factors Engineering; Computer Techniques; Personnel; Decision Making

19980065430

Adaptive simulated pilot

Stroud, Phillip D., Los Alamos National Lab., USA; Journal of Guidance, Control, and Dynamics; Apr. 1998; ISSN 0731-5090; Volume 21, no. 2, pp. 352-354; In English; Copyright; Avail: Aeroplus Dispatch

The present adaptive pilot model for an airborne laser theater missile defense system is constructed with a three-part Darwinian cognitive architecture. It is shown that the implementation of pilot behavior with a parameterized set of rules is an effective way to represent a vast array of alternative behaviors; it can easily be set to mimic the behavior of human operators over a limited time domain.

AIAA

Aircraft Pilots; Aviation Psychology; Cognitive Psychology; Antimissile Defense; Adaptive Control

19980066161 CHI Systems, Inc., Lower Gwynedd, PA USA

Project: SH-60R Operator Machine Interface Enhancement (SHOMIE) ***Monthly Report, 1 Aug. - 30 Sep. 1997***

Glenn, Floyd, CHI Systems, Inc., USA; Oct. 1997; 3p; In English

Contract(s)/Grant(s): N00421-97-C-1133

Report No.(s): AD-A330891; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Work during this period consisted primarily of developing a concept of an adaptive, intelligent interface aid for the SENSO and discussing that concept with Government representatives. Meetings attended included a project review meeting with Ms. Becky Morgan and Mr. John Suarez on 28 August 1997 and an M&S HSI meeting on 5 September 1997.

DTIC

Augmentation; Man Machine Systems

19980066686

The perception of distance in simulated visual displays - A comparison of the effectiveness and accuracy of multiple depth cues across viewing distances

Surdick, R. T., Georgia Inst. of Technology, Atlanta, USA; Davis, Elizabeth T., Georgia Inst. of Technology, Atlanta; King, Robert A., Georgia Inst. of Technology, Atlanta; Hodges, Larry F., Georgia Inst. of Technology, Atlanta; Presence: Teleoperators and Virtual Environments; Oct. 1997; ISSN 1054-7460; Volume 6,, no. 5, pp. 513-531; In English; Copyright; Avail: Aeroplus Dispatch

The ability effectively and accurately to simulate distance in virtual and augmented reality systems is a challenge currently facing R&D. to examine this issue, we separately tested each of seven visual depth cues (relative brightness, relative size, relative height, linear perspective, foreshortening, texture gradient, and stereopsis) as well as the condition in which all seven of these cues were present and simultaneously providing distance information in a simulated display. Ten college-aged subjects were tested with each depth-cue condition at two viewing distances. They were tested using a method of constant stimuli procedure and a modified Wheatstone stereoscopic display. The perspective cues (linear perspective, foreshortening, and texture gradient) were found to be more effective than other depth cues, while effectiveness of relative brightness was vastly inferior. Moreover, relative brightness, relative height, and relative size all significantly decreased in effectiveness with an increase in viewing distance. We conclude that the use of perspective cues in simulated displays may be more important than the other depth cues tested because these cues are the most effective and accurate cues at both viewing distances, can be easily perceived by all subjects, and can be readily incorporated into simpler, less complex displays or more complex ones.

Author (AIAA)

Display Devices; Visual Perception; Virtual Reality; Distance

19980066687

Magnetic tracker calibration for improved augmented reality registration

Livingston, Mark A., North Carolina, Univ., Chapel Hill, USA; State, Andrei, North Carolina, Univ., Chapel Hill; Presence: Teleoperators and Virtual Environments; Oct. 1997; ISSN 1054-7460; Volume 6,, no. 5, pp. 532-546; In English; Copyright; Avail: Aeroplus Dispatch

We apply a look-up table technique to calibrate both position and orientation readings from a magnetic tracker for use in virtual environments within a defined working volume. In a test volume of 2.4 cu m, the method reduced the tracker's average position error by 79 percent and its average orientation error by 40 percent. We test the correction table against the tracker's performance outdoors (a metal-poor environment) and show that readings taken in our lab and corrected by our method exhibit less error than uncorrected readings taken outdoors. We demonstrate that such reduction in position error visibly improves registration in an augmented reality system, whereas the (lesser) reduction in orientation error does not visibly improve registration. We show that the model we used for the orientation error function was incorrect, preventing our method from achieving better correction of orientation error. We discuss future directions for correction of orientation error.

Author (AIAA)

Magnetic Fields; Virtual Reality; Tracking (Position); Error Correcting Devices

19980066688

Humans in large-scale, networked virtual environments

Pratt, David R., U.S. Naval Postgraduate School, USA; Pratt, Shirley M., U.S. Naval Postgraduate School, USA; Barham, Paul T., U.S. Naval Postgraduate School, USA; Barker, Randall E., U.S. Naval Postgraduate School, USA; Waldrop, Marianne S., U.S. Naval Postgraduate School, USA; Ehlert, James F., U.S. Naval Postgraduate School, USA; Chrislip, Christopher A., U.S. Naval Postgraduate School, USA; Presence: Teleoperators and Virtual Environments; Oct. 1997; ISSN 1054-7460; Volume 6,, no. 5, pp. 547-564; In English; Copyright; Avail: Aeroplus Dispatch

This paper examines the representation of humans in large-scale, networked virtual environments. Previous work done in this field is summarized, and existing problems with rendering, articulating, and networking numerous human figures in real time are explained. We have developed a system that integrates together some well-known solutions along with new ideas. Models with multiple level of details, body-tracking technology and animation libraries to specify joint angles, efficient group representations to describe multiple humans, and hierarchical network protocols have been successfully employed to increase the number of humans represented, system performance, and user interactivity. The resulting system immerses participants effectively and has numerous useful applications.

Author (AIAA)

Virtual Reality; Human Performance; Biological Models (Mathematics); Computer Animation; Human-Computer Interface

19980066689

EEG measurements in a virtual reality headset

Strickland, Dorothy, Stetson Univ., USA; Chartier, Dan, North Carolina State Univ., Raleigh; Presence: Teleoperators and Virtual Environments; Oct. 1997; ISSN 1054-7460; Volume 6,, no. 5, pp. 581-589; In English; Copyright; Avail: Aeroplus Dispatch

We demonstrate that verifiable EEG measurements of mental activity can be obtained while subjects are immersed in a virtual reality headset. Using standard commercial EEG measuring equipment, we recorded EEG activity in similar virtual and real scenes for 14 people encountering four different test conditions. We discuss the systematic exploration of the recording problems and the steps taken to verify the data. These data are further analyzed to conclude that differences do exist between real and virtual image processing, with variations affected more by subject and task than by which area of the brain is processing the image. We discuss some possible reasons for these findings.

Author (AIAA)

Virtual Reality; Mental Performance; Head (Anatomy); Image Processing; Brain Circulation; Electroencephalography

19980066815

Effects of fore-and-aft, lateral and vertical whole-body vibration on a head-positioning task

Griffin, M. J., Southampton, Univ., UK; Brett, M. W., Southampton, Univ., UK; Aviation, Space, and Environmental Medicine; Dec. 1997; ISSN 0095-6562; Volume 68,, no. 12, pp. 1115-1122; In English; Copyright; Avail: Aeroplus Dispatch

The performance of tasks in which the head must be positioned close to objects in a moving vehicle may be impeded by vibration. The extent to which a head positioning task would be impeded by whole-body vibration could depend on the frequency, direction and waveform of the vibration and the posture of the body. Twelve subjects participated in a laboratory experiment in which they judged the difficulty of looking through a pair of sights while exposed to LF vibration. We investigated four variables: vibra-

tion axis (fore-and-aft, lateral, vertical), vibration frequency (11 frequencies, 0.5-5.0 Hz) and waveform (sinusoidal, 1/3 octave bands of random vibration), seating condition (4-point harness, sitting without back support). All variables affected the perceived task difficulty. Frequencies of horizontal vibration in the range 1-4 Hz caused most difficulty. Task difficulty was greatest with random vibration, especially with LF vibration in the horizontal axes. Wearing a 4-point harness greatly reduced the perceived task difficulty during exposure to LF fore-and-aft vibration but increased task difficulty with higher frequencies of lateral vibration. Increased motion predictability and the provision of suitable support to the upper body (a harness, back support, front support) can reduce the difficulty of head positioning tasks during exposure to some types of oscillatory motion.
Author (AIAA)
Human Body; Vibration Perception; Head (Anatomy); Vertical Flight; Posture; Motion Stability

19980067154
Towards the error free cockpit
Courteney, Hazel, Civil Aviation Authority, Safety Regulation Group, UK; Aerospace International; Dec. 1997; ISSN 0305-0831; Volume 24,, no. 12, pp. 24-26; In English; Copyright; Avail: Aeroplus Dispatch

The CAA's Safety Regulation Group has proposed regulatory extensions that will help certification teams to ensure that new or modified flight deck designs meet goals aimed at zero-pilot-errors. Means toward these ends encompass adequate feedback to pilot actions, positive challenges for potentially hazardous actions, and a structured analysis of error effects.
AIAA
Cockpits; Research and Development; Aircraft Design; Flight Safety; Pilot Error; Flight Crews

19980067195
Absolute accuracy of the Cyberware WB4 whole body scanner
Daanen, Hein, TNO Human Factors Research Inst., Netherlands; Taylor, Stacie E., Sytronics, Inc., USA; Brunsman, Matthew A., Sytronics, Inc., USA; Nurre, Joseph H., Ohio Univ., Athens; 1997, pp. 6-12; In English; Copyright; Avail: Aeroplus Dispatch

The Cyberware WB4 whole body scanner is one of the first scanning systems in the world that generates a high resolution data set of the outer surface of the human body. The Computerized Anthropometric Research and Design (CARD) Laboratory of Wright-Patterson AFB intends to use the scanner to enable quick and reliable acquisition of anthropometric data. For this purpose, a validation study was initiated to check the accuracy, reliability, and errors of the system. A calibration object consisting of two boxes and a cylinder was scanned in several locations in the scanning space. The object dimensions in the resulting scans compared favorably to the actual dimensions of the calibration object.
Author (AIAA)
Optical Scanners; Human Body; Accuracy; Anthropometry; Imaging Techniques

19980067196
Three-dimensional anthropometric techniques applied to the fabrication of burn masks and the quantification of wound healing
Whitestone, Jennifer J., USAF, CARD Lab., USA; Geisen, Glen R., Sytronics, Inc., USA; McQuiston, Barbara K., Sytronics, Inc., USA; 1997, pp. 76-86; In English; Copyright; Avail: Aeroplus Dispatch

Anthropometric surveys conducted by the military provide comprehensive human body measurement data that are human interface requirements for successful mission performance of weapon systems, including cockpits, protective equipment, and clothing. The application of human body dimensions to model humans and human-machine performance begins with engineering anthropometry. Recently, Air Force technology transfer allowed researchers at the Computerized Anthropometric Research and Design (CARD) Laboratory at Wright-Patterson Air Force Base to work with the Dayton, Ohio, area medical community in assessing the rate of wound healing and improving the fit of total contact burn masks. This paper describes the successful application of CARD Lab engineering anthropometry to two medically oriented human interface problems.
Author (AIAA)
Anthropometry; Wound Healing; Human Body; Masks; Burns (Injuries); Imaging Techniques

19980067281
Helmet-mounted uncooled FPA camera for buried object detection
Miller, John L., FLIR Systems, Inc., USA; Duvoisin, Herbert, III, Coleman Research Corp., USA; Wiltsey, George, Vista Controls, USA; 1997, pp. 224-235; In English; Copyright; Avail: Aeroplus Dispatch

Software neural nets hosted on a parallel processor can analyze input from an IR imager to evaluate the likelihood of a buried object. However, it is only recently that low weight, staring LWIR sensors have become available in uncooled formats at sensitivi-

ties that provide enough information for useful man-portable helmet mounted applications. The images from the IR are presented to a human user through a see-through display after processing and highlighting by a neural net housed in a fanny-pack. This paper describes the phenomenology of buried object detection in the infrared, the neural net-based image processing, the helmet-mounted IR sensor, and the ergonomics of mounting a sensor to head gear. The maturing and commercialization of uncooled focal plane arrays and high density electronics enables lightweight, low cost, small camera packages that can be integrated with hard hats and military helmets. The head gear described has an noise equivalent delta temperature (NEDT) of less than 50 milliKelvin, consumes less than 10 watts, and weighs about 1.5 kilograms.
Author (AIAA)
Focal Plane Devices; Helmet Mounted Displays; Room Temperature; Cameras; Underground Structures; Infrared Detectors

19980067564
A survey of augmented reality
Azuma, Ronald T., Hughes Research Labs., USA; Presence: Teleoperators and Virtual Environments; Aug. 1997; ISSN 1054-7460; Volume 6,, no. 4, pp. 355-385; In English; Copyright; Avail: Aeroplus Dispatch

This paper surveys the field of augmented reality (AR), in which 3D virtual objects are integrated into a 3D real environment in real time. The medical, manufacturing, visualization, path planning, entertainment, and military applications that have been explored are described, and a detailed discussion is presented of the tradeoffs between optical and video blending approaches. Registration and sensing errors are two of the biggest problems in building effective augmented reality systems; this paper accordingly summarizes current efforts to overcome these problems. Future directions and areas requiring further research are discussed. This survey provides a starting point for anyone interested in researching or using augmented reality.
Author (AIAA)
Three Dimensional Models; Medical Science; Task Planning (Robotics); Teleoperators; Military Aircraft

19980067565
Augmented reality through wearable computing
Starner, Thad, MIT, USA; Mann, Steve, MIT, USA; Rhodes, Bradley, MIT, USA; Levine, Jeffrey, MIT, USA; Healey, Jennifer, MIT, USA; Kirsch, Dana, MIT, USA; Picard, Rosalind W., MIT, USA; Pentland, Alex, MIT, USA; Presence: Teleoperators and Virtual Environments; Aug. 1997; ISSN 1054-7460; Volume 6,, no. 4, pp. 386-398; In English; Copyright; Avail: Aeroplus Dispatch

Wearable computing moves computation from the desktop to the user. We are forming a community of networked, wearable-computer users to explore, over a long period, the augmented realities that these systems can provide. by adapting its behavior to the user's changing environment, a body-worn computer can assist the user more intelligently, consistently, and continuously than a desktop system. A text-based augmented reality, the Remembrance Agent, is presented to illustrate this approach. Video cameras are used both to warp the visual input (mediated reality) and to sense the user's world for graphical overlay. With a camera, the computer could track the user's finger to act as the system's mouse, perform face recognition, and detect passive objects to overlay, 2.5D and 3D graphics onto the real world. Additional apparatus such as audio systems, IR beacons for sensing location, and biosensors for learning about the wearer's affect, are described. With the use of input from these interface devices and sensors, a long-term goat of this project is to model the user's actions, anticipate his or her needs, and perform a seamless interaction between the virtual and physical environments.
Author (AIAA)
Computer Graphics

19980067566
NaviCam - A magnifying glass approach to augmented reality
Rekimoto, Jun, Sony Computer Science Lab., Inc., Japan; Presence: Teleoperators and Virtual Environments; Aug. 1997; ISSN 1054-7460; Volume 6,, no. 4, pp. 399-412; In English; Copyright; Avail: Aeroplus Dispatch

A way to realize augmented reality (AR) is proposed that can be used in an open environment by introducing the concept of identification (ID) awareness and a hand-held video see-through display. Unlike other AR systems that use head-mounted or head-up displays, our approach employs the combination of a palmtop-sized display and a small video camera. A user sees the real world through the display device, with added computer-augmented information. In this configuration, the 'magnifying-glass' approach, the user is not required to wear any cumbersome headgear and can easily move the display device around like a magnifying glass to compare real and augmented images. The video camera also obtains information related to real-world situations. The

system recognizes real-world objects using the video images by reading ID tags. Based on the recognized tag, the system retrieves and displays information about the real-world object to the user. We describe several potential applications.
Author (AIAA)
Magnification

19980067567
Registration error analysis for augmented reality
Holloway, Richard L., North Carolina, Univ., Chapel Hill, USA; Presence: Teleoperators and Virtual Environments; Aug. 1997; ISSN 1054-7460; Volume 6,, no. 4, pp. 413-432; In English
Contract(s)/Grant(s): DABT63-94-C-0048; NSF 89-20219; N00014-86-K-0680; Copyright; Avail: Aeroplus Dispatch

Augmented reality (AR) systems typically use see-through head-mounted displays (STHMDs) to superimpose images of computer-generated objects onto the user's view of the real environment in order to augment it with additional information. The main failing of current AR systems is that the visual objects displayed in the STHMD appear in the wrong position relative to the real environment. This paper presents the results of an end-to-end error analysis of an optical STHMD-based tool for surgery planning. The analysis was done with a mathematical model of the system and the main results were checked by taking measurements on a real system under controlled circumstances. The model makes it possible to analyze the sensitivity of the system-registration error to errors in each part of the system. Even for moderate head velocities, system delay causes more registration error than all other sources combined. Tracker error is a significant problem both in head tracking and in system calibration. Computational correction of optical distortion may introduce more delay-induced registration error than the distorsion error it corrects. Although this model was developed for optical STHMDs for surgical planning, many of the results apply to other HMDs as well.
Author (AIAA)
Error Analysis; Head-Up Displays

19980067568
Confluence of computer vision and interactive graphics for augmented reality
Klinker, Gudrun J., European Computer-Industry Research Centre, Germany; Ahlers, Klaus H., European Computer-Industry Research Centre, Germany; Breen, David E., European Computer-Industry Research Centre, Germany; Chevalier, Pierre-Yves, European Computer-Industry Research Centre, Germany; Crampton, Chris, European Computer-Industry Research Centre, Germany; Greer, Douglas S., European Computer-Industry Research Centre, Germany; Koller, Dieter, European Computer-Industry Research Centre, Germany; Kramer, Andre, European Computer-Industry Research Centre, Germany; Rose, Eric, European Computer-Industry Research Centre, Germany; Tuceryan, Mihran, European Computer-Industry Research Centre, Germany; Presence: Teleoperators and Virtual Environments; Aug. 1997; ISSN 1054-7460; Volume 6,, no. 4, pp. 433-451; In English; Copyright; Avail: Aeroplus Dispatch

Augmented reality (AR) is a technology in which a user's view of the real world is enhanced or augmented with additional information generated from a computer model. Use of AR technology requires that it fulfill very strong requirements including precise calibration, registration and tracking of sensors and objects in the scene, as well as detailed overall understanding of the scene. We see computer-vision and image-processing technology playing an increasing role in acquiring appropriate sensor and scene models. to balance robustness with automation, we integrate automatic image analysis with both interactive user assistance and input from magnetic trackers and CAD models. Also, in order to meet the requirements of the emerging global information society, future human-computer interaction will be highly collaborative and distributed. We thus conduct research pertaining to distributed and collaborative use of AR technology. We have demonstrated our work in several prototype applications, such as collaborative interior design and collaborative mechanical repair.
Author (AIAA)
Computer Vision; Computer Graphics; Computer Aided Design

19980067569
Judgments of the distance to nearby virtual objects - Interaction of viewing conditions and accommodative demand
Ellis, Stephen R., NASA Ames Research Center, USA; Menges, Brian M., NASA Ames Research Center, USA; Presence: Teleoperators and Virtual Environments; Aug. 1997; ISSN 1054-7460; Volume 6,, no. 4, pp. 452-460; In English; Copyright; Avail: Aeroplus Dispatch

Ten subjects adjusted a real-object probe to match the distance of nearby virtual objects optically presented via a see-through, helmet-mounted display. Monocular, biocular, and stereoscopic viewing conditions were used with two levels of required focus.

Observed errors may be related to changes in the subjects' binocular convergence. The results suggest ways in which virtual objects may be presented with improved spatial fidelity.
Author (AIAA)
Head-Up Displays; Virtual Reality

19980067735
Airborne Tactical Information Management System synthetic environment demonstration
Reibling, Lyle, GDE Systems, Inc., USA; Logan, Roger, U.S. Navy, USA; Churchman, Dave, Boeing Defense & Space Group, USA; Storer, Mark, GDE Systems, Inc., USA; 1997, pp. 5.4-9 to 5.4-15; In English; Copyright; Avail: Aeroplus Dispatch

The Airborne Tactical Information Management System (ATIMS) project has previously demonstrated the potential benefits of exploiting advance onboard processing capabilities and the sharing of data and imagery between command and control elements and shooter aircraft. Capabilities to digitize the battle space and send data to the cockpit raised interest in the aircrew's ability to effectively use the available information. The ATIMS Phase IIIa Advanced Information Flow Demonstration performed a preliminary assessement of the benefits of synthetic environments, enhanced tactical display and expanded Real-time Information Into the Cockpit information to improve mission effectiveness, particularly in degraded environments. A Synthetic Vision (SV) concept was designed and implemented in a high fidelity cockpit dome. Pilots flew the SV system in the dome to assess the potential of the SV system concept to improve tactical capabilities and the merit of continuing to refine the SV concept.
Author (AIAA)
Management Systems; Airborne Equipment; Real Time Operation; Computer Vision; Pilot Training; AWACS Aircraft

19980067748
Integrated human centered systems approach to the development of advanced cockpit and air traffic management systems
Hansman, R. J., MIT, USA; Kuchar, James K., MIT, USA; Clarke, John-Paul, MIT, USA; Vakil, Sanjay, MIT, USA; Barhydt, Richard, MIT, USA; Pritchett, Amy, Georgia Inst. of Technology, Atlanta; 1997, pp. 6.3-1 to 6.3-9; In English; Copyright; Avail: Aeroplus Dispatch

Human performance considerations are expected to be central to the performance of advanced cockpit and air traffic management (ATM) systems. The development of information systems and decision aids in these advanced systems will be simultaneously driven by technical and human capabilities coupled with operational requirements. An integrated human centered systems approach is suggested which considers the human controller as a functional component of the closed loop information system. Recent research activities which illustrate different aspects of human performance issues are discussed.
Author (AIAA)
Systems Integration; Man Machine Systems; Cockpits; Human Performance

19980067749
Harmonisation of human machine interface - The intuitive approach
Graham, R. V., EUROCONTROL, Experimental Centre, France; 1997, pp. 6.3-10 to 6.3-17; In English; Copyright; Avail: Aeroplus Dispatch

EUROCONTROL, in cooperation with European Aviation Administrations (and recently the FAA), has conducted experiments involving the use of advanced HMI (Human Machine Interface) for Controller Working Positions. From ODID (Operational Display and Input Development) through to PHARE (Program for Harmonized ATM Research in EUROCONTROL) and EATCHIP III (European ATC Harmonization and Integration Program), a baseline of HMI and use of color has evolved. This involves the use of dynamic graphical interaction and display, together with a logical use of system functions which are approaching 'in service' maturity (trajectory and conflict probe, conflict monitoring and resolution, and system assisted coordination). Participants in the experiments have commented that the HMI is intuitive. Most data input relate to clearance instructions passed to the pilot, coordination effected with an adjacent sector/center, or planning tasks such as traffic integration and conflict calculation.
Author (AIAA)
Man Machine Systems; Controllers; Air Traffic Control

19980067750
A study of commercial flight crew self-separation
Cashion, Patricia, San Jose State Univ., USA; Macintosh, Margaret-Anne, San Jose State Univ., USA; McGann, Alison, San Jose State Univ., USA; Lozito, Sandra, NASA Ames Research Center, USA; 1997, pp. 6.3-18 to 6.3-25; In English; Copyright; Avail: Aeroplus Dispatch

The concept of 'free flight' is intended to emphasize more flexibility for the operators in NAS by providing more opportunities for aircraft self-separation. The purpose of this simulation was to begin examining some of the communication and procedural issues associated with self-separation in the enroute environment. A simulation demonstration was conducted in the Boeing 747-400 simulator at NASA/Ames. Commercial U.S. pilots current on the B747-400 aircraft were the participants. Ten flight crews flew in the Denver enroute airspace. A new alerting logic designed to allow for airborne self-separation was created for this demonstration. New flight deck display features were designed and incorporated into the existing navigational display in the simulator to allow for increased traffic and maneuvering information to the flight crew. Each of the flight crews flew eight different scenarios representing different conflict types. The effects of traffic density (high and low) and the introduction of an 'almost intruder' (AI) aircraft were assessed. Loss of separation was assessed as a safety metric. Timing variables and maneuver strategies were examined to determine potential differences in efficiency of navigation in free flight based on scenario and conflict type. The impact of these findings on free flight procedural definitions are discussed.
Author (AIAA)
Free Flight; National Airspace System; Flight Crews; Flight Simulators; Boeing 777 Aircraft; Aircraft Approach Spacing

19980067751
Experimental study of helmet-mounted display attitude and flow cues on rotorcraft hover performance
Bachelder, E. N., MIT, USA; Hansman, R. J., Jr., MIT, USA; 1997, pp. 6.3-26 to 6.3-32; In English; Copyright; Avail: Aeroplus Dispatch

A study was conducted to investigate the use of visual flow and attitude cues as an aid to lateral drift awareness during helicopter flight while using night vision goggles (NVGs). Four displays were compared: NVG display: the baseline display simulating an NVG image of the cockpit and external environment; NVG/attitude display: NVG image with an overlay of an attitude symbol and a surrounding Earth-referenced wire-frame globe; rate display: NVG image with an overlay of a flow cue field; and rate/attitude display: NVG image with the rate and NVG/attitude display overlays. The task objective was to null out lateral rates in the presence of lateral gusts while in a hover. This task was conducted in a fixed-based helicopter simulator using a helmet-mounted virtual reality device. Three pilots were used in this preliminary study. The mean rms drift rate error associated with the baseline NVG display was approximately 6 ft/s. The introduction of rate cues reduced this error by a factor of three. Mean rms position error using the NVG display was 90 feet, which was decreased by an order of magnitude when rate cues were overlaid on the NVG image. The addition of attitude in the rate/attitude display substantially improved lateral rate control stability where gain margin for the rate display had degraded.
Author (AIAA)
Helmet Mounted Displays; Hovering

19980067752
Crew interfaces for future ATM
Huisman, H., National Aerospace Lab., Netherlands; Verhoeven, R. P. M., National Aerospace Lab., Netherlands; van Houten, Y. A., National Aerospace Lab., Netherlands; Flohr, E. R., National Aerospace Lab., Netherlands; 1997, pp. 6.3-33 to 6.3-40; In English; Copyright; Avail: Aeroplus Dispatch

Two flight simulator evaluations were conducted at NLR with a 4-DOF moving base simulator. A navigation display (ND) and a primary flight display (PFD) for application in a future air traffic management environment were evaluated. A total of 22 airline pilots participated. It is concluded that flight execution by using a perspective PFD resulted in more accurate flight performance, faster recovery after the occurrence of an aircraft failure, and less visual workload. Interactive graphical user interfaces for flight planning and monitoring based on the ND are well accepted by pilots.
Author (AIAA)
Flight Simulators; Display Devices; Flight Management Systems

19980067790
Pilot non-conformance to altering system commands during closely spaced parallel approaches
Pritchett, Amy R., Georgia Inst. of Technology, Atlanta, USA; Hansman, R. J., MIT, USA; 1997, pp. 9.1-1 to 9.1-8; In English Contract(s)/Grant(s): NAG2-716; Copyright; Avail: Aeroplus Dispatch

Pilot nonconformance to alerting system commands has been noted in general and to a TCAS-like collision avoidance system in a previous experiment. This paper details two experiments studying collision avoidance during closely-spaced parallel

approaches in instrument meteorological conditions, and specifically examining possible causal factors of, and design solutions to, pilot nonconformance.
Author (AIAA)
Collision Avoidance; Aircraft Approach Spacing; Flight Simulators

19980067917
The 'Space Cycle' Self Powered Human Centrifuge - A proposed countermeasure for prolonged human spaceflight
Kreitenberg, Arthur, California, Univ., Irvine, USA; Baldwin, Kenneth M., California, Univ., Irvine; Bagian, James P., California, Univ., Irvine; Cotten, Sam, California, Univ., Irvine; Witmer, Jack, California, Univ., Irvine; Caiozzo, Vincent J., California, Univ., Irvine; Aviation, Space, and Environmental Medicine; Jan. 1998; ISSN 0095-6562; Volume 69, no. 1, pp. 66-72; In English; Copyright; Avail: Aeroplus Dispatch

The Self Powered Human Centrifuge, or Space Cycle, is a countermeasure to the adverse physiologic effects of prolonged human exposure to spaceflight microgravity. This unique device simultaneously provides exercise, impact loading, and gravity analogous acceleration to emulate conditions on Earth. One or two crewmembers pedal themselves about a shaft mounted to the space craft located 'above' their heads. This creates a short arm centrifuge with a head-to-toe acceleration orientation. The potential advantages of the Space Cycle include: reversal of cephalad fluid shift, minimizing postflight orthostatic intolerance; pedaling to maintain muscular and cardiovascular fitness; and enhancement of skeletal homeostasis by impact loading with a pedal-crank-mounted cam and frame-mounted resistive device. Other anticipated advantages include generation of usable electricity, physiologic monitoring, and a means of mass measurement. Motion sickness is controlled with restraints and virtual reality headsets. The device is compatible with International Space Station dimensional constraints.
Author (AIAA)
Human Centrifuges; Manned Space Flight; Long Duration Space Flight; Physiological Effects; Bioastronautics; Microgravity; Mechanical Devices; Spacecraft Equipment

19980068284
Flight technology and the human factor *Flugtechnik und Faktor Mensch*
DLR-Nachrichten; Nov. 1997; ISSN 0937-0420, no. 87, pp. 14-19; In German; Copyright; Avail: Aeroplus Dispatch

Computerized simulations, wind tunnel tests, and flight tests being conducted on helicopters and fixed-wing aircraft at the Institute for Flight Mechanics at Braunschweig are examined. Special attention is given to the interface between man and machine.
AIAA
X-31 Aircraft; Man Machine Systems; Human Factors Engineering; Computerized Simulation; Helicopters; Wind Tunnel Tests

19980068482
FELIX - A volumetric 3D imaging technique
Bahr, Detlef, Braunschweig, Technical Univ., Germany; Kanghans, Knut, Vincent-Luebeck High School, Germany; Bezecny, Daniel, Vincent-Luebeck High School, Germany; Homann, Dennis, Vincent-Luebeck High School, Germany; Vogt, Carsten, Vincent-Luebeck High School, Germany; 1997, pp. 202-210; In English; Copyright; Avail: Aeroplus Dispatch

FELIX is a physical volume 3D display. A modulated colored laser beam is directed via mirrors and a computer controlled x-y scanning unit towards a transparent enclosure containing a helical shaped projection screen. to describe a physical space this screen is rotated about its vertical axis so that it occupies a cylindrical volume over time. Due to the translucent property of the screen, the hitting laser beam will be scattered and visible to the observer. The position of each voxel (volume pixel) is determined by the momentary location of the laser beam's intersection with the rotating helix, thus providing a volumetric display medium through which scanned laser pulses are projected. The receptors in the human eye have a temporal persistence because of a mental processing delay, and this causes the eyes to fuse the light scattered from the moving 2D element into a 3D image. Since the images are generated within a given display space rather than on a stationary surface, they are intrinsically 3D and may be observed directly from any position. This image generation technique ensures that human factors regarding depth sensation are satisfied without special viewing glasses being worn by the observer. Potential applications are in air traffic control, medicine, entertainment, and educational visualization, as well as engineering, computer-aided design and rapid prototyping.
Author (AIAA)
Imaging Techniques; Scientific Visualization; Laser Applications

19980068655
Fusion of visible and thermal imagery improves situational awareness
Toet, A., TNO Human Factors Research Inst., Netherlands; Ijspeert, J. K., TNO Human Factors Research Inst., Netherlands; Wax-

man, A. M., MIT, USA; Aguilar, M., MIT, USA; 1997, pp. 177-188; In English; Copyright; Avail: Aeroplus Dispatch

Two recently developed color image fusion techniques, the TNO fusion scheme and the MIT fusion scheme, are applied to visible and thermal images of military scenarios. An observer experiment is performed to test if the increased amount of detail in the fused images can yield an improved observer performance in a task that requires situational awareness. The task that is devised involves the detection and localization of a person in the displayed scene relative to some characteristic details that provide the spatial context. It is shown that color-fused imagery leads to improved target detection over all other modalities (visible, thermal, and gray fused). Results show that observers can indeed determine the relative location of a person in a scene with a significantly higher accuracy when they perform with fused images (either gray or color-fused), compared to the original image modalities. The MIT color-fusion scheme yields the best overall performance (i.e. an accuracy that is significantly higher than that obtained with images fused according to the TNO scheme and with the original images). Even the most simple (TNO) fusion scheme yields an observer performance that is better than that obtained for the individual (thermal and visible) images.
Author (AIAA)
Infrared Imagery; Multisensor Fusion

19980068656
Development of a night driving simulator concept for night vision image intensification device training
Ruffner, John W., DCS Corp., USA; Piccione, Dino, DCS Corp., USA; Woodward, Kim, DCS Corp., USA; 1997, pp. 190-197; In English; Copyright; Avail: Aeroplus Dispatch

The use of night vision devices (NVDs) by U.S. Army foot soldiers, aviators, and drivers of combat and tactical wheeled vehicles has enhanced operations at night by allowing increased mobility and potentially safer operations. With this increased capability in the night environment has come an increased exposure to the hazards of that environment and the risks that the command structure must manage and balance with mission requirements. Numerous vehicular accidents have occurred during night field exercises involving drivers wearing image intensification (II) systems. These accidents can be frequently be attributed to perceptual problems experienced by the drivers. Performance with NVDs generally increases with practice and experience. However, there is little formal training provided in night driving skills, and few opportunities to practice these skills under realistic conditions. This paper reports the approach and preliminary results of an effort to define and demonstrate a low-cost Night Driving Simulator concept for training night driving skills with II devices and to identify and evaluate the techniques and resources that are available for implementing this approach.
Author (AIAA)
Night Vision; Military Vehicles; Simulators; Display Devices; Image Enhancement; Training Devices

19980068657
Head-steered sensor solution for enhanced situational awareness
Stuart, Kenneth, Kaiser Electronics, USA; Tompkins, Richard D., Kaiser Electronics, USA; 1997, pp. 198-204; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes a modification to an Army Driver's Vision Enhancement (DVE) system. The FLIR turret gimbals are instrumented with resolvers to enable a feedback-control loop. The FLIR video is displayed on a head-mounted binocular display system which has an integrated head tracker for pointing the FLIR turret. The paper describes and compares several candidate head tracker technologies. An acoustic head tracker was selected as a baseline to demonstrate the concept in a simple and quick manner. Additionally, a hybrid optical/inertial tracker implementation is discussed which also has the ability to minimize effects of vibration on the DVE system.
Author (AIAA)
Helmet Mounted Displays; Head Movement; Military Technology

19980068738
The application of the avionics to the lifesaving system
Shen, Weizhong, Air Force, First Aeronautical Inst., China; Xu, Guoqiang, Air Force, First Aeronautical Inst., China; Cha, Guoyun, Air Force, First Aeronautical Inst., China; Zen, Zhenhua, Air Force, First Aeronautical Inst., China; 1997, pp. 463-469; In English; Copyright; Avail: Aeroplus Dispatch

The role of avionics in the development of lifesaving systems aboard aircraft is discussed. The role of avionics in danger estimation, propulsive force control, and flight control in lifesaving systems is addressed. Data processing in an avionics lifesaving system is discussed.
AIAA
Avionics; Aircraft Survivability; Aircraft Control; Electronic Control; Flight Control

19980068976

Monitoring and detection of indoor air contamination

Skliar, Mikhail, Utah, Univ., Salt Lake City, USA; Ramirez, W. F., Colorado, Univ., Boulder; 1997, pp. 319-323; In English; Copyright; Avail: Aeroplus Dispatch

We report on the development of the air quality monitoring and early detection system for an enclosed environment with specific emphasis on manned spacecraft. The proposed monitoring approach is based on the distributed parameter model of contaminant dispersion and real-time contaminant concentration measurements. The implicit Kalman filtering (IKF) algorithm is used to generate on-line estimations of the spatial contamination profile, which are used for the air quality monitoring and early detection of an air contamination event.

Author (AIAA)

Indoor Air Pollution; Pollution Monitoring; Kalman Filters; Pollution Control; Distributed Parameter Systems

19980069267

New results on human operator modelling during nonlinear behavior in the control loop

Innocenti, Mario, Pisa, Univ., Italy; Balluchi, Andrea, Pisa, Univ., Italy; Balestrino, Aldo, Pisa, Univ., Italy; 1997, pp. 2567-2570; In English; Copyright; Avail: Aeroplus Dispatch

The human operator behavior in the control loop is analyzed, when plant dynamics and/or input require a clear nonlinear strategy for performance as well as stability. A novel model structure that uses switching surfaces followed by a relay with variable amplitude with delay is proposed. The model is used to validate experimental data, and to separate the performance of different individuals, showing interesting properties for further development.

AIAA

Human Performance; Operators (Personnel); Manual Control

19980069311

An optimal control model of human balance - Can it provide theoretical insight to neural control of movement?

Kuo, Arthur D., Michigan, Univ., Ann Arbor, USA; 1997, pp. 2856-2860; In English

Contract(s)/Grant(s): NSF IBN-95-11814; NIH-P60DC02072; NIH-R29DC02312-01; Copyright; Avail: Aeroplus Dispatch

A physiologically plausible model for control of human postural balance, combining optimal state estimation and control, is proposed. The linear dynamics of three sensory modalities are modeled: joint proprioception, vestibular organs in the inner ear, and vision. These sensors are mated with a two-degree-of-freedom model of planar body dynamics. Linear quadratic optimal control theory is used to design the state feedback and estimation gains. Free parameters for the overall system set the form of the control objective and the sensory precision of the sensors. The model predicts statistical properties of human sway in terms of covariance of ankle and hip motion. These predictions are compared with human responses to alterations in sensory conditions. For a single set of parameters, the model successfully reproduces the general nature of postural motion as a function of sensory environment. Sensitivity studies demonstrate that the model is robust to parameter variations, consistent with observed behavior. A physiological structure is proposed for learning and implementing the necessary computations. The model may be useful as a diagnostic tool for detecting contributing factors to poor balance.

Author (AIAA)

Optimal Control; Posture; State Estimation; Feedback Control; Body Kinematics; Linear Quadratic Gaussian Control

19980069721 NERAC, Inc., Tolland, CT USA

Respirators (Latest citations from the US Patent Bibliographic File with Exemplary Claims)

Mar. 1998; In English; Page count unavailable

Report No.(s): PB98-853880; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The bibliography contains citations of selected patents concerning respirator designs and systems. Citations cover the design of respirator filters, masks, pumps, valves, oxygen supply systems, gas mixing systems, and liquefied-gas type respirators. Respirator systems for in-flight use, the treatment of sleep apnea, protective helmets, and medical emergency are included. Contains 50-250 citations and includes a subject term index and title list.

NTIS

Bibliographies; Respirators; Life Support Systems

19980069925

F-22 ECS/TMS qualification test program overview

Sprouse, Jim, Lockheed Martin Aeronautical Systems Co., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972261; Copyright; Avail: Aeroplus Dispatch

Qualification testing is performed to verify that component and system designs will operate successfully in their intended environment. The F-22 ECS/TMS is currently well into its component and system qualification testing. This paper addresses a summary of the test program efforts to date, focusing on lessons learned generally applicable to any product development effort. Specific areas to be discussed include: an overview of the system functions and components; a summary of the qualification test program goals and structure at component and system level; discussion of the basic test environments required; importance of a good closed loop failure reporting and corrective action system (FRACAS); key elements of an effective test program; summary of test failures experienced to date, with corresponding corrective actions/lessons learned; and an overview of system and flight qualification tests yet to be performed.

Author (AIAA)

F-22 Aircraft; Environmental Control; Aircraft Reliability

19980069927

Environmental control system for an experimental crew return vehicle

Dingell, Charles W., Jr., NASA Johnson Space Center, USA; Hurlbert, Kathryn M., NASA Johnson Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972263; Copyright; Avail: Aeroplus Dispatch

A small team of NASA engineers has been assembled at the Johnson Space Center with the goal of developing an inexpensive space-capable vehicle. The basic shape of the X-24A experimental lilting body was chosen for several reasons, and in the case of ECLS, the de-orbit cross-range capability of this shape provides for a minimal on-orbit time while waiting for landing opportunities, which in turn simplifies the ECLS. The X-38 vehicle body shape is shown. In keeping with the goal of rapidly developing an inexpensive and reliable vehicle, the ECLS was developed using simple, passive systems where practical. This paper provides an overview of the ECLS mission requirements and design, with emphasis on the philosophy used in its development. In addition, some initial testing and analysis results are presented to support the validation of the operational concept.

Author (AIAA)

Environmental Control; Life Support Systems

19980069928

Orbiter regenerable CO2 sorbent life characterization

Boehm, Albert M., Hamilton Standard Space Systems International, Inc., USA; Allen, Gordon F., Hamilton Standard Space Systems International, Inc., USA; Chen, P. J., Boeing North American-Space Systems Div., USA; Sandersfeld, Donald L., Boeing North American-Space Systems Div., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972264; Copyright; Avail: Aeroplus Dispatch

The Regenerable Carbon Dioxide Removal System (RCRS) has been flying on Extended Duration Orbiter (EDO) versions of the Shuttle since 1992. Life characteristics of an enhanced sorbent were evaluated after five years of service life on two Orbiter vehicles. Performance data are presented showing excellent carbon dioxide removal. Limited data forces a range of life predictions for the useful life of the sorbent.

Author (AIAA)

Carbon Dioxide Removal; Sorbents; Space Shuttle Orbiters; Regeneration (Physiology)

19980069929

The Water Membrane Evaporator - An advanced heat rejection technology for the Space Shuttle

Ungar, Eugene K., NASA Johnson Space Center, USA; Almlie, Jay C., Hernandez Engineering, Inc., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972266; Copyright; Avail: Aeroplus Dispatch

The U.S. Space Shuttle on-orbit waste heat rejection is currently accomplished through a combination of radiators and a Flash Evaporator System (FES). Three of the FES units have been rebuilt to date owing to corrosion problems. In addition, the FES has experienced freeze-ups on-orbit. As part of NASA's Orbiter Upgrade Program, a water membrane evaporator (WME) is being developed as a replacement for the FES. The WME will be installed on the Space Shuttle starting in the fall of 2001. It will use hydrophobic micropore membrane technology to passively control a water liquid/vapor interface. Waste heat that will be acquired from the Orbiter Freon-21 coolant loops will evaporate water at the interface. The water vapor will pass through the membrane and be vented to space. The WME program takes advantage of the recent advances in hydrophobic micropore membrane technol-

ogy to provide a simpler and more robust heat rejection device than the current FES. In the present work, the WME concept is described in detail, and its development program is discussed. The results of the WME hydrophobic membrane tests performed to date are presented, and a snapshot of the WME preliminary design is provided.
Author (AIAA)
Evaporators; Space Shuttles; Heat Transfer; Waste Heat; Flashing (Vaporizing); Membranes

19980069933
Steam gasification and reformation of spacecraft wastes
Couch, H. T., Hamilton Standard Space Systems International, Inc., USA; Birbara, Philip J., Hamilton Standard Space Systems International, Inc., USA; Grin, Walter, Hamilton Standard Space Systems International, Inc., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972273; Copyright; Avail: Aeroplus Dispatch
A two-stage steam gasification and reforming process was evaluated for converting wastes generated within enclosed habitable environments into synthesis gas (CO and H2) and other recyclable inorganic species, i.e., water, CO2 and inorganic salts. Waste compounds used in the experimentation included: cellulose, urea, methionine, sucrose, butyric acid, Igepon TC-42 - a particularly (chemically) stable soap selected by NASA for use in space life support systems, wheat straw, and a high density polyethylene. The compounds were tested individually and in combination to simulate the wastes anticipated within enclosed habitat environments.
Author (AIAA)
Steam; Gasification; Waste Treatment; Life Support Systems

19980069934
Converting NASA space colony wastes into energy with steam-reforming
Galloway, Terry R., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972274; Copyright; Avail: Aeroplus Dispatch
The Steam Reformer System (SRS) converts organic wastes into hydrogen-rich synthetic gas which can supply chemical energy to a fuel-cell for converting this syngas into recoverable electric power, CO2 for plant growth, and potable water. In the radwaste market area Westinghouse-SEG operates this SRS system on commercial radwaste routinely, and this system is presented. NASA-projected space colony waste was successfully processed in an SRS, and data are presented. A conceptual design of the SSR-Fuel Cell system that can support a small community in a harsh environment or in space is presented.
Author (AIAA)
Space Colonies; Waste Treatment; Fuel Cells; Steam; Organic Materials; Potable Water

19980069935
Membrane-based humidity control in microgravity - A comparison of membrane materials and design equations
Scovazzo, Paul, Colorado, Univ., Boulder, USA; Todd, Paul, Colorado, Univ., Boulder; Burgos, Jedrick, Colorado, Univ., Boulder; Lattarulo, Nina, Colorado, Univ., Boulder; Hoehn, Alex, Colorado, Univ., Boulder; Jul. 1997; In English
Contract(s)/Grant(s): NAGW-1197
Report No.(s): SAE Paper 972275; Copyright; Avail: Aeroplus Dispatch
A microgravity dehumidification system for plant growth experiments requires the generation of no free-liquid condensate and the recovery of water for reuse. In membrane dehumidification, the membrane is a barrier between the humid air phase and a liquid coolant water. The coolant water temperature combined with a transmembrane pressure differential establishes a water flux from the humid air into the coolant water. Building on the work of others, we directly compared hydrophilic and hydrophobic membranes for humidity control. Hydrophobic membranes did not meet the required operational parameters. In a direct comparison of the hydrophilic membranes, cellulose ester membranes were superior to metal and ceramic membranes in the categories of condensation flux per surface area, ease of start-up, and stability. However, cellulose ester membranes were inferior to metal membranes in one significant category, longevity/durability. Cellulose ester membranes broke down with operational lifetimes of hours to days. Our work established that surface science principles control the relative performances of membrane materials.
Author (AIAA)
Membranes; Humidity; Microgravity; Crop Growth; Water Reclamation; Dehumidification

19980069936
A study of a new type of metabolic simulator
Meng, Yunyu, Inst. of Space Medico-Engineering, China; Wang, Lidong, Inst. of Space Medico-Engineering, China; Sun, Jinbiao, Inst. of Space Medico-Engineering, China; Hu, Keyuan, Chinese Academy of Sciences, China; Wang, Rongrong, Chinese Acad-

emy of Sciences, China; Peng, Meisheng, Chinese Academy of Sciences, China; Zhao, Ruilan, Chinese Academy of Sciences, China; Jul. 1997; In English
Report No.(s): SAE Paper 972276; Copyright; Avail: Aeroplus Dispatch

We present a new type of metabolic simulator and its operating principles, composition, and structure. This simulator can exactly simulate the human body's main metabolic parameters, i.e., oxygen consumption, carbon dioxide production, and heat and water vapor production.
Author (AIAA)
Metabolism; Simulators

19980069937
Environmental design considerations for STARDUST
Vellinga, Joseph M., Lockheed Martin Astronautics, USA; Craig, Calvin L., Lockheed Martin Astronautics, USA; Giellis, Roger T., Lockheed Martin Astronautics, USA; Rasbach, Charles E., Lockheed Martin Astronautics, USA; Rogers, Jeffrey J., Lockheed Martin Astronautics, USA; Thornton, Michael G., Lockheed Martin Astronautics, USA; Willcockson, William H., Lockheed Martin Astronautics, USA; Brownlee, Donald E., Washington, Univ., Seattle; Atkins, Kenneth L., JPL, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972278; Copyright; Avail: Aeroplus Dispatch

To accomplish the STARDUST mission several unique environments must be coped with in the design of the spacecraft and the mission. The most challenging is passing through a cloud of dust at a relative speed many times that of rifle bullets. A second challenging environment is entering the Earth's atmosphere at a higher velocity than has ever been done by a scientific mission. Another challenge is the operation of solar cells farther from the sun than has been done on prior missions. The orbit also presents thermal environments ranging from near Earth to 2.7 AU. These environments and the design solutions to accommodate them are described in this paper.
Author (AIAA)
Spacecraft Design; Dust; Atmospheric Entry; Earth Atmosphere; Spacecraft Temperature

19980069939
Medical and aerospace applications of high fidelity three-dimensional simulations and virtual reality
Folio, Les, California, Univ., Davis; USAF, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972283; Copyright; Avail: Aeroplus Dispatch

Application of virtual reality (VR) infiltrates into every aspect of spacecraft development and astronaut training. A background in 3D simulation is presented, with an overview of recent technical developments that have helped make VR what it is today. A foundation on human perception of static and dynamic 3-D environments in real life and simulation is described to help understand needed fidelity improvements on existing VR systems. Works in progress with dynamic educational applications of VR and AI are introduced. A large, multi-institutional study by the Human Systems Center at Brooks AFB may prove the educational benefits expected with the virtual classroom of the future. Basic terminology is defined and integrated with simple, yet technologically advanced, examples. Available VR equipment for home, office, industrial, and university applications is briefly discussed.
Author (AIAA)
Computerized Simulation; Virtual Reality; Three Dimensional Models; Spacecraft Design; Medical Science

19980069940
Human Research Facility for the International Space Station
Holler, Patricia A., Krug Life Sciences, Inc., USA; Fortney, Suzanne M., NASA Johnson Space Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972284; Copyright; Avail: Aeroplus Dispatch

Understanding the physiological and psychological changes that occur during space flight is critical as crews live and work in space for prolonged periods. These changes could adversely affect the health and performance of crew members inflight. The Human Research Facility (HRF), a crucial component of the life sciences program for the International Space Station (ISS), will provide basic human research capabilities and facilitate transfer of knowledge and technology for Earth-based applications. Critical issues such as bone density deterioration, renal stone risk, effect of gravity on vestibular and visual systems, and others are investigated using the generic hardware currently being developed for the HRF.
Author (AIAA)
Human Factors Engineering; International Space Station; Physiological Factors; Psychological Factors; Spacecrews; Health

19980069941

3-D ultrasound for medical imaging in space

Littlefield, Richard J., Pacific Northwest National Lab., USA; Macedonia, Christian R., U.S. Army, Medical Corps, USA; Jul. 1997; In English

Contract(s)/Grant(s): DAMD17-94-C-4127; DE-AC06-76RL-01830

Report No.(s): SAE Paper 972286; Copyright; Avail: Aeroplus Dispatch

Ultrasound is attractive for medical imaging in space because scanners can be small, lightweight, low-power, and have minimal EM emissions. In addition, unlike conventional 2-D ultrasound, 3-D ultrasound allows an operator with no diagnostic skills to collect high-quality scans that can be interpreted by a remote expert. This allows 3-D ultrasound to be used effectively in remote locations. These capabilities are illustrated by the MUSTPAC-1, a portable 3-D ultrasound telemedicine system recently developed for the U.S. military. Design, implementation, and field experiences with the MUSTPAC-1 are discussed, and extensions for use in space are proposed.

Author (AIAA)

Ultrasonics; Medical Science; Imaging Techniques; Aerospace Medicine

19980069942

Critical medical technologies for human space exploration

Simmons, Scott C., Krug Life Sciences, Inc., USA; Butler, Douglas J., Krug Life Sciences, Inc., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972288; Copyright; Avail: Aeroplus Dispatch

Exploration of the solar system has captured the imagination of scientists and artists for centuries. The U.S. and other space-faring nations now plan to take the first step by examining the requirements for a human mission to Mars. A three-year journey to Mars will test the limits of our technical and human experience. Maintenance of crew mental and physical health is of utmost importance to mission success. Several critical technologies must be developed to enable healthy and productive crews during Mars missions. The technology development process must begin now, by identifying technology and research requirements, so that the necessary systems are ready when the decision is made to leave Earth and travel to Mars.

Author (AIAA)

Aerospace Medicine; Space Exploration; Manned Space Flight

19980069945

OCAM-2 - A second generation bioregenerative life support system model

Drysdale, Alan, McDonnell Douglas Space and Defense Systems, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972291; Copyright; Avail: Aeroplus Dispatch

A second-generation system model has been developed to account for the movement of carbon, hydrogen, and oxygen through the various life support system components. It accounts for edible and inedible biomass and the water content of plant materials, and models various crops based on growth and transpiration rate tables, including multiple overlapping crops of the same or different species. It also calculates mass, volume, energy use, heat rejection, and manpower required for each component, including varying power use, heat rejection, and manpower as a function of the crop, and equivalent mass (EM) for each cost factor and for the system. Results are displayed graphically. The model was developed using G2, a commercially available modeling package. Enhancements are under consideration to improve the modeling of waste management and to account for minerals and variations in crew metabolism. The ability to use data directly from the NASA KSC ABF to drive this model is currently being implemented, with the intent to investigate model-based control.

Author (AIAA)

Regeneration (Physiology); Life Support Systems; Crop Growth; Waste Treatment

19980069946

Waste processing for advanced life support - Influences on operational strategies and design

Drysdale, Alan E., McDonnell Douglas Space and Defense Systems, USA; Finger, Barry W., Dynamac Corp., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972292; Copyright; Avail: Aeroplus Dispatch

This paper addresses the effect of waste processing on advanced life support system design. Waste processing is a critical component of an advanced life support system. It must take all life support system wastes and either convert them into useful products or into a form in which they can be discarded. Waste can be treated as soon as it is produced, stored as is, or processed into

an intermediate form for further treatment. The decisions made will affect the cost-effectiveness of the system. Strategies must be developed to meet waste processing requirements for specific mission scenarios.
Author (AIAA)
Waste Treatment; Life Support Systems; Long Duration Space Flight

19980069949
Material circulation analysis of CEEF through simulation
Miyajima, Hiroyuki, Chiba Polytechnic College, Japan; Ishikawa, Yoshio, Nihon Univ., Japan; Nitta, Keiji, Inst. for Environmental Sciences, Japan; Jul. 1997; In English
Report No.(s): SAE Paper 972297; Copyright; Avail: Aeroplus Dispatch

The closed ecology experiment facilities (CEEF) are comprised of an animal breeding and habitation module, plant module, and a geohydrosphere module (currently being established), which are composed of physicochemical devices to allow almost all the material to be circulated. Partial test operations are now in progress with these kinds of equipment, and cooperative operations between an animal breeding and habitation module and plant module are expected to be started in the near future. Balance of the material and equipment performance as the whole of the system are being tested, and material circulation in a variety of operation modes is being examined. Keeping such a situation in mind, an analysis is made of material circulation in the plant module by itself, for operations based on the equipment design data.
Author (AIAA)
Closed Ecological Systems; Computerized Simulation; Animals; Breeding (Reproduction); Water Circulation

19980069950
The development of work on life support systems and strategies of space mastering
Bartsev, S. I., Russian Academy of Sciences, Inst. of Biophysics, Russia; Mezhevikin, V. V., Russian Academy of Sciences, Inst. of Biophysics, Russia; Okhonin, V. A., Russian Academy of Sciences, Inst. of Biophysics, Russia; Jul. 1997; In English
Report No.(s): SAE Paper 972298; Copyright; Avail: Aeroplus Dispatch

Needs in life support systems (LSS) depend on the degree of human participation in spaceflight. On the other hand, the decision for human participation in long-term space missions depends on an ability to provide for the safety of the crew. As a mission type which can provide satisfactory safety, a 'space rover' mission would be a fully reusable spacecraft with ionic thrust and solar panels or nuclear reactor as power source. It would contain a highly autonomous (closed), reliable and comfortable LSS (including both higher plants and some backup systems). Planet exploration and exploitation are conducted with robots which are controlled via radio waves without time delay. Arguments pro and contra the space rover, and the traditionally discussed mission scenarios, are considered.
Author (AIAA)
Life Support Systems; Long Duration Space Flight; Microgravity; Extraterrestrial Radiation

19980069951
Life support system power supply optimization
Bartsev, Sergey I., Russian Academy of Sciences, Inst. of Biophysics, Russia; Jul. 1997; In English
Report No.(s): SAE Paper 972299; Copyright; Avail: Aeroplus Dispatch

Evaluation of life support system (LSS) mass has to take into account not only the mass of components and the stock of expendable substances but also the mass of the power supply and heat rejection systems. The productivity of biological regeneration processes grows with power supply, but at a high level of power supply the efficiency of these processes is decreased. On the other hand, increasing power supply causes a growth of system mass. The optimization process for the intensity of regeneration processes is thereby defined. It is shown that the value of power supplied providing minimal total mass of the LSS does not depend on the level of closure and mission duration.
Author (AIAA)
Life Support Systems; Long Duration Space Flight; Regeneration (Physiology); Power Supplies

19980069957
MPLM - Environmental control system design evolution
D'Auria, R., Alenia Aerospazio, Div. Spazio, Italy; Antonacci, M., Alenia Aerospazio, Div. Spazio, Italy; Moscatelli, A., Alenia Aerospazio, Div. Spazio, Italy; Jul. 1997; In English
Report No.(s): SAE Paper 972313; Copyright; Avail: Aeroplus Dispatch

The Mini Pressurised Logistics Module (MPLM) has the important job of servicing the Space Station via the National Space Transportation System (NSTS). Alenia has optimized MPLM performance characteristics toward mass reduction. This paper documents recent configuration changes and activities of the last couple of years. The two subsystems involved in this evolution are the Thermal Control System and the Environmental Control System (ECS). Most of the MPLM equipment has already passed the Critical Design Review step and the update situation for each piece of equipment is listed in this paper. Intensive test activities have been accomplished to support the actual MPLM ECS configuration. A general overview of the tests performed is presented in this paper.
Author (AIAA)
Pressurizing; Logistics; Spacecraft Modules; Space Stations; Space Transportation System; Environmental Control

19980069958
Thermal and environmental control of the Crew Transport Vehicle
Bottacini, M., Alenia Aerospazio, Div. Spazio, Italy; Fenoglio, F., Alenia Aerospazio, Div. Spazio, Italy; Ferro, C., Alenia Aerospazio, Div. Spazio, Italy; Loddoni, G., Alenia Aerospazio, Div. Spazio, Italy; Jul. 1997; In English
Report No.(s): SAE Paper 972314; Copyright; Avail: Aeroplus Dispatch

European Space Agency has supported studies concerning a Crew Transport Vehicle (CTV) based on the Ariane 5 launcher. This vehicle is designed to transport a maximum crew of four members to/from the International Space Station, with a limited amount of payloads. It is mainly composed of a Crew Module (CM), capable of withstanding the severe environmental conditions of atmospheric reentry, offering an adequate habitable environment for the crew throughout the mission; a Resource Module (RM), where most of provisions and electrical equipment (e.g. batteries) supporting the vehicle's orbital life is stored (the truncated cone shape external surface of RM is entirely exploited for mounting dedicated fluid radiators); a Transfer Vehicle (TV), a propulsion module designed to supply means and resources for vehicle orbital maneuvers and attitude control from launcher separation up to deorbitat, when the RM + TV composite is jettisoned. The thermal control of the CTV requires the adoption of technical solutions compatible with extremely different environmental conditions and various operational modes. Temperature and humidity in the habitable compartment are controlled by a dedicated section of the Environmental Control and Life Support Subsystem.
Author (AIAA)
Temperature Control; Environmental Control; Life Support Systems

19980069961
Hypobaric atmosphere as a prophylactic measure against decompression sickness during repetitive EVA
Chadov, V. I., All-Russia Center for Disaster Medicine 'Zashchita', Russia; Filipenkov, S. N., All-Russia Center for Disaster Medicine 'Zashchita', Russia; Isseev, L. R., All-Russia Center for Disaster Medicine 'Zashchita', Russia; Jul. 1997; In English
Report No.(s): SAE Paper 972317; Copyright; Avail: Aeroplus Dispatch

The risk of decompression sickness (DCS) inherent in EVA is reduced through the use of hypobaric normoxic atmosphere. The safety of decompression protocols was evaluated during EVA simulation in the PCC-270 pressure chamber complex according to DCS frequency and tissue supersaturation ratio. The test program included 15 man-rated test runs with 123 test subjects aged 19-54. The aim of the test program was to select decompression-safe protocols for transfer from hypobaric environment to a reduced pressure mode in the Russian space suit. These experiments displayed the ratio of operative pressure mode in the extravehicular space suit to the duration of a preliminary exposure in normoxic hypobaric conditions as a nomogram. Two other nomograms allowed to estimate variants of the compatible atmosphere parameters (total pressure, nitrogen partial pressure, oxygen content) and allowable value of the space suit pressure for denitrogenation-free egress without oxygen prebreathing. We present experimental data from the orbital space stations.
Author (AIAA)
Decompression Sickness; Extravehicular Activity; Hypobaric Atmospheres

19980069962
Forced and directed heat exchange for providing human body comfort in extreme environments
Koscheyev, Victor S., Minnesota, Univ., Minneapolis, USA; Leon, Gloria R., Minnesota, Univ., Minneapolis; Tranchida, Donna, Minnesota, Univ., Minneapolis; Taylor, Timothy J., Minnesota, Univ., Minneapolis; Jul. 1997; In English
Contract(s)/Grant(s): NAG5-3533
Report No.(s): SAE Paper 972318; Copyright; Avail: Aeroplus Dispatch

A new methodological tool was developed consisting of a patchwork thermal cool/warm grid with great flexibility to manipulate the temperature on different areas of the body. Through conflicting temperatures on the body surface, it is possible to direct

heat current to different distal or proximal areas. The effectiveness of the use of a cooled hood, gloves, socks on the overheated body was evaluated as countermeasures for balancing heat exchange. Temperature in the magistral vessels was the main source of information for understanding the mechanism of the relationship between core and shell, and shell and distal parts of the limb.
Author (AIAA)
Heat Exchangers; Heat Transfer; Human Body; Comfort; Physiological Effects

19980069963

Human thermoregulation model for space suit - Mathematical model for human thermal regulation in a suited mode with ventilation and liquid cooling capabilities provided

Zaratuichenko, I. K., All-Russia Center for Disaster Medicine 'Zashchita', Russia; Kuznetz, E. I., All-Russia Center for Disaster Medicine 'Zashchita', Russia; Filipenkov, S. N., All-Russia Center for Disaster Medicine 'Zashchita', Russia; Jul. 1997; In English
Report No.(s): SAE Paper 972319; Copyright; Avail: Aeroplus Dispatch

The purpose of this study on human thermal regulation during space operation is to scientifically justify an automatic thermal control system (ATCS). The primary goal of the ATCS is to maintain the thermal comfort during all possible types of human activities. ATCS development has identified physiologically valuable requirements and validation of optimal laws used to control human thermal status in the suited mode. One needs an assessment of interrelationships between thermal status, activities and disturbances. A model of human thermal regulation and metabolism in a space suit with a ventilation loop and a water cooling loop is a theoretical basis for ATCS experimental tests. Our model has two interdependent parts: (1) an anatomical/physiological component and (2) technical component. The first is presented by a cylindrical human body simulator that has a core and skin layers divided into two ventilated areas, with cooling tubes or without them. The physiological compartment includes such mechanisms as perspiration, vasomotor reactions and heat production, and the technical compartment includes a liquid cooling garment, a gas ventilation loop and a space enclosure.
Author (AIAA)
Thermoregulation; Space Suits; Mathematical Models; Ventilation; Liquid Cooling; Convective Heat Transfer

19980069964

Parameter values and assumptions in human thermal modeling for EVA applications

French, Jonathan D., Missouri-Columbia, Univ., Columbia, USA; Viswanath, Arvind D., Missouri-Columbia, Univ., Columbia; Nair, Satish S., Missouri-Columbia, Univ., Columbia; Miles, John B., Missouri-Columbia, Univ., Columbia; Lin, Chin, NASA Johnson Space Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972320; Copyright; Avail: Aeroplus Dispatch

The prospect of using automatic control for astronaut thermal comfort regulation during EVA requires an investigation of issues concerning the state of the art of human thermal models. The analysis presented includes, but is not limited to, the discussion of assumptions and the accuracy, range and relative significance of parameters (e.g., thermal properties, physical dimensions, etc.) of transient human thermal models. The Wissler (1964) 1D model attracts primary consideration; however, there exists a '41-Node Man' model for additional reflection and study.
Author (AIAA)
Thermal Comfort; Automatic Control; Astronauts; Extravehicular Activity; Body Temperature

19980069965

Analysis of LCG thermal performance and control

Nyberg, Karen L., Texas, Univ., Austin, USA; Diller, Kenneth R., Texas, Univ., Austin; Wissler, Eugene H., Texas, Univ., Austin; Jul. 1997; In English
Contract(s)/Grant(s): NAS9-841
Report No.(s): SAE Paper 972321; Copyright; Avail: Aeroplus Dispatch

The use of the Wissler (1985) human thermoregulation model has been demonstrated for various aspects of the design of liquid cooling garment (LCG) temperature control. Thermal performance of the LCG under various conditions and the simulation of control schemes have been studied. The benefits of the study emerge in the design of an automatic control scheme for the LCG, where numerous control algorithms and scenarios can be evaluated without costly and time-consuming experimentation.
Author (AIAA)
Thermoregulation; Liquid Cooling; Space Suits; Extravehicular Activity; Thermal Comfort

19980069966

Quantification of muscle fatigue and joint position of the hand during EVA simulation operations

Ranniger, C. U., Maryland, Univ., College Park, USA; Akin, D. L., Maryland, Univ., College Park; Jul. 1997; In English

Report No.(s): SAE Paper 972322; Copyright; Avail: Aeroplus Dispatch

Task-based intensity and fatigue metrics were developed and applied to neutral buoyancy simulations of EVA. Surface electromyographic (EMG) signals from hand flexor and extensor musculature were recorded during neutral buoyancy EVA simulations at NASA-Marshall in August-September 1996. A task intensity index, based on the cumulative histogram of EMG amplitude, was developed and used to determine relative physical difficulty of hand-gripping, knob-turning, bolt-manipulation, and j-hook release tasks. A fatigue index, based on the task intensity metric and task duration, was used to provide a measure of task-related fatigue.

Author (AIAA)

Muscular Fatigue; Hand (Anatomy); Extravehicular Activity; Buoyancy

19980069974

International Space Station Environmental Control and Life Support System design overview update

Reuter, James L., NASA Johnson Space Center, USA; Reysa, Richard P., Boeing Missile and Space Div., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972333; Copyright; Avail: Aeroplus Dispatch

The International Space Station (ISS) program consists of three distinct phases. Phase 1 consists of the joint Shuttle-Mir missions. Phase 2 establishes the ISS initial research capability with a three-person crew permanent presence. Phase 3 completes the assembly, establishing a six-person crew permanent presence with multiple International Partner (IP) research facilities. Phase 1 is nearing completion, while Phase 2 is in the subsystem delivery and element integration stage. This paper provides a status of the U.S. Environmental Control and Life Support (ECLS) system for Phases 2 and 3 of the ISS program, focusing on updates and changes in the past year.

Author (AIAA)

International Space Station; Environmental Control; Life Support Systems; Mir Space Station

19980069977

KSC Advanced Life Support Breadboard - Facility description and testing objectives

Sager, John C., NASA Kennedy Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972341; Copyright; Avail: Aeroplus Dispatch

The Breadboard Project at Kennedy Space Center has focused on the development of the bioregenerative life support components, crop plants for water, air, and food production, and bioreactors for recycling of waste. The keystone of the Breadboard Project has been the Biomass Production Chamber (BPC), which is supported by 15 environmentally controlled chambers and 2150 sq m of laboratory facilities. The Project objectives, in support of the ALS Program, utilize these facilities for large-scale testing of components and development of required technologies for the human testbeds at JSC, flight experiments, and ALS research to enable a Mars mission.

Author (AIAA)

Cape Kennedy Launch Complex; Life Support Systems; Biomass

19980069982

Development of a Liquid Carry Over Sensor for monitoring the performance of condensing heat exchangers

McConville, Kristina, AlliedSignal Aerospace, USA; Lavenir, Marianne, AlliedSignal Aerospace, USA; Seurig, Roland, AlliedSignal Aerospace, USA; Barnes, John, AlliedSignal Aerospace, USA; Inkpen, Stuart, Instrumar, Ltd., Canada; Spearns, Heather, Instrumar, Ltd., Canada; Jul. 1997; In English

Report No.(s): SAE Paper 972350; Copyright; Avail: Aeroplus Dispatch

This paper describes the development and testing of a Liquid Carry Over Sensor (LCOS) designed for use in the Columbus Orbital Facility (COF), the European Laboratory Module of the ISS. The LCOS is a capacitive-type sensor which has been designed to fit into the ducting wall, providing no intrusion into the airflow. The sensor surface has a fused glass finish with extremely low porosity and near-zero water retention and is able to detect extremely small levels of moisture.

Author (AIAA)

Heat Exchangers; Condensing; Performance Tests; Life Support Systems; Spacecraft Temperature; Gas Flow

19980069989

Development of a Mostly Liquid Separator for use on the International Space Station

Lanzarone, Anthony W., Hamilton Standard Space Systems International, Inc., USA; Dean, W. C., Hamilton Standard Space Systems International, Inc., USA; Holder, Donald W., NASA Marshall Space Flight Center, USA; Howard, Stanley G., Boeing Defense & Space Group, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972374; Copyright; Avail: Aeroplus Dispatch

A liquid/gas separator called the Mostly Liquid Separator (MLS) has been devised to provide liquid/gas separation with soapy fluids in a microgravity environment, and is an integral component of the International Space Station Water Processor. Now in its third generation of development, this paper describes the evolution of the MLS design, and presents a discussion of the development test data and results.

Author (AIAA)

International Space Station; Separators; Water Treatment

19980069990

Phase III integrated water recovery testing at MSFC - International Space Station recipient mode test results and lessons learned

Carter, D. L., NASA Marshall Space Flight Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972375; Copyright; Avail: Aeroplus Dispatch

A test has been completed at NASA/Marshall to evaluate the Water Recovery and Management (WRM) system and Waste Management (WM) urinal design for the USA On-Orbit Segment (USOS) of the International Space Station (ISS). Potable and urine reclamation processors were integrated with waste water generation equipment and successfully operated for a total of 128 d in recipient mode configuration to evaluate the accumulation of contaminants in the water system and to assess the performance of various modifications to the WRM and WM hardware. No accumulation of contaminants was detected in the product water over the course of the recipient mode test. An additional 18 d were conducted in donor mode to assess the ability of the system to remove viral contaminants, to monitor the breakthrough of organic contaminants through the multifiltration bed, and to resolve anomalies that occurred during the test. This paper summarizes the test objectives, system design, test activities and protocols, significant results, anomalies and major lessons learned.

Author (AIAA)

Water Reclamation; International Space Station; Waste Treatment

19980069991

Solid polymer electrolyte oxygen generator assembly life testing at MSFC - The first year

Erickson, Robert J., NASA Marshall Space Flight Center, USA; Roy, Robert J., United Technologies Corp., USA; Mason, Richard K., Hamilton Standard Space Systems International, Inc., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972376; Copyright; Avail: Aeroplus Dispatch

A two-year test program has been initiated to evaluate the effects of extended duration operation on a solid polymer electrolyte oxygen generator assembly (OGA), in particular the cell stack and membrane phase separators. As part of this test program, the OGA was integrated into the Marshall Space Flight Center Water Recovery Test (WRT) Stage 10, a six-month test, to use reclaimed water directly from the water processor product water storage tanks. This paper documents results encountered and evaluated thus far in the life-testing program.

Author (AIAA)

Solid Electrolytes; Oxygen Production; Gas Generators; Conducting Polymers; Service Life

19980069992

VRA flight experiment sample stability study

Steele, John W., Hamilton Standard Space Systems International, Inc., USA; Grabowski, Norman, Hamilton Standard Space Systems International, Inc., USA; Parker, David, Hamilton Standard Space Systems International, Inc., USA; Holder, Don, NASA Marshall Space Flight Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972377; Copyright; Avail: Aeroplus Dispatch

Design concepts for the International Space Station Water Processor (WP) will be validated as discrete flight experiments on-board the Space Shuttle Spacehab. This paper summarizes the results of a study into sample stability within a modified Teflon cell culture bag assembly to support an upcoming Spacehab evaluation of the WP Volatile Removal Assembly (VRA). Results indicate that a lack of adequate preservation results in significant sample analyte degradation over the course of 2-3 wk due to

increased microbial activity. Results were utilized for the definition of an optimal preservation approach based on the anticipated VRA Flight Experiment samples.
Author (AIAA)
International Space Station; Water Treatment; Flight Tests; Life Support Systems

19980069993
Cost/benefit analyses for high pressure oxygen generation and carbon dioxide reduction capabilities on ISS
Erickson, Robert J., NASA Marshall Space Flight Center, USA; Carrasquillo, Robyn L., NASA Marshall Space Flight Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972379; Copyright; Avail: Aeroplus Dispatch
Advanced life support flight experiments have been conceptualized for the International Space Station (ISS). Two of the experiments, a high pressure oxygen generator and a carbon dioxide reduction subsystem, offer high payback potential to the ISS program. This paper documents the cost-benefit analyses for these two experiments.
Author (AIAA)
Cost Analysis; High Pressure; Gas Pressure; Oxygen Production; Carbon Dioxide Removal; International Space Station

19980069994
International Space Station ECLSS Major Constituent Analyzer protoflight test results
Torres, Diego, Orbital Sciences Corp., USA; Bedard, Terri, Boeing Co., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972380; Copyright; Avail: Aeroplus Dispatch
The ECLSS on the International Space Station (ISS) utilizes the Major Constituent Analyzer (MCA) for monitoring major atmospheric constituents from sampling locations within the station. This paper describes the results of the protoflight testing of the first MCA unit. The MCA monitors six major constituents: oxygen, nitrogen, carbon dioxide, hydrogen, water vapor, and methane. In order to monitor these gases, the MCA uses a permanent-magnet, single focusing mass spectrometer. Protofiight testing consisted of a sequence of qualification tests performed on the first system to be used for flight. The test levels were reduced from qualification levels in order to minimize stress on the unit. The testing performed on the MCA consisted of an initial performance test, software validation tests, environmental test, and a final performance test. The initial performance test demonstrated that the MCA met all of its requirements. The environmental tests performed were EMI, Acoustic, Thermal, Humidity, Depress/Repress, 1553 Remote Terminal Validation and Waveform Testing, and Vibration. The test results show that the MCA met all of its performance and environmental requirements.
Author (AIAA)
International Space Station; Environmental Control; Life Support Systems; Atmospheric Chemistry

19980070000
Detection and diagnosis of air contaminants in spacecraft
Ramirez, W. F., Colorado, Univ., Boulder, USA; Skliar, Mikhail, Colorado, Univ., Boulder; Jul. 1997; In English
Report No.(s): SAE Paper 972390; Copyright; Avail: Aeroplus Dispatch
We report on the development of the air quality monitoring and early detection system for an enclosed environment with specific emphasis on manned spacecraft. The proposed monitoring approach is based on the distributed parameter model of contaminant dispersion and real-time contaminant concentration measurements. The Implicit Kalman Filtering (IKF) algorithm is used to generate on-line estimations of the spatial contamination profile, which are used for the air quality monitoring and early detection of an air contamination event. We also solve the problem of the pointwise source identification of the convection-diffusion transport processes. This is done by converting the identification problem into an optimization problem of finding a spatial location and the capacity of a point source, which results in the best match of the model-predicted measurements to the observed measurements.
Author (AIAA)
Spacecraft Cabin Atmospheres; Air Pollution; Contaminants; Kalman Filters; Pollution Monitoring

19980070003
Performance variation in Hopcalite catalysts
Pasternack, Louise, U.S. Navy, Naval Research Lab., USA; Rice, Jane K., U.S. Navy, Naval Research Lab., USA; McCarrick, Alan D., U.S. Navy, Naval Surface Warfare Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972394; Copyright; Avail: Aeroplus Dispatch

U.S. Navy submarines have used Hopcalite catalyst (MnO2, CuO) for over 30 years to oxidize carbon monoxide, hydrogen, and many trace organic species. During that time, the material has been manufactured by the same company, and the performance of fresh Hopcalite has never shown significant variation. Recently, a new lot of Hopcalite was tested and found to be 300 percent more active toward one specific refrigerant than measured in previous lots. In life support applications, unexpectedly high activity can generate hazardous products that endanger crew and equipment. This paper describes and interprets the tests performed by the Naval Research Laboratory and the Naval Surface Warfare Center to investigate different Hopcalite samples.
Author (AIAA)
Catalysts; Manganese Oxides; Copper Oxides; Submarines; Air Purification

19980070004
The impact of CFC conversion on nuclear powered submarines
Wyatt, Jeffrey R., U.S. Navy, Naval Research Lab., USA; Wright, Kenneth A., U.S. Navy, Naval Surface Warfare Center, USA; Daley, Thomas J., U.S. Navy, Naval Surface Warfare Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972395; Copyright; Avail: Aeroplus Dispatch

The replacement of refrigerant CFC-12 (dichlorodifluoromethane) with ozone-friendly HFC-134a (1,1,1,2 tetrafluoroethane) in submarines has not only required changes in the refrigeration system but the life support equipment as well. Modifications to the refrigeration systems, the catalytic oxidizer used for air purification, and the atmosphere analyzer were required to implement the conversion. Each of these modifications required careful laboratory and full-scale testing to assure no adverse impact on the submarine equipment or crew.
Author (AIAA)
Refrigerants; Chlorofluoromethane; Fluoro Compounds; Submarines; Nuclear Powered Ships

19980070005
High differential pressure, solid polymer electrolysis
Colling, Arthur K., Hamilton Standard, USA; Roy, Robert J., Hamilton Standard, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972398; Copyright; Avail: Aeroplus Dispatch

Submarines, aircraft, and manned space vehicles require oxygen for human respiration. Onboard generation through the electrolysis of water is a practical means of obtaining this oxygen. Recent technical advances allow high differential pressure cell stacks, which permit direct discharge of one gas at low or ambient pressure while supplying the other gas at high pressure. This capability simplifies system and component designs and results in improved reliability, safety, and operability. This paper updates the development status of high differential pressure electrolysis cells and describes systems for applying this technology to submarine and aircraft applications.
Author (AIAA)
High Pressure; Solid Electrolytes; Polymers; Electrolysis; Oxygen Production; Submarines

19980070007
Human engineering applied to International Space Station design
Novak, Jennifer B., Lockheed Martin Space Mission Systems & Services Co., USA; Liddell, Gregory, Lockheed Martin Space Mission Systems & Services Co., USA; Sampaio, Carlos, Lockheed Martin Space Mission Systems & Services Co., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972400; Copyright; Avail: Aeroplus Dispatch

Living and working aboard International Space Station will present the on-orbit crew with many challenges. A team from the Flight Crew Support Division at NASA/Johnson addresses human engineering and human interface concerns. These concerns are either low-level, such as how to best distinguish push buttons from indicators, or high-level, such as the delineation of habitability requirements for the Space Station's Habitation Module. Because the human engineering solutions provided by this team typically result in robust designs that enhance the flight crew's likelihood of success, crewmembers can be confident that the Space Station will be habitable and usable.
Author (AIAA)
Human Factors Engineering; International Space Station; Spacecraft Design; Spacecraft Cabin Atmospheres

19980070008
A comparison of remote operations training methods
Whitmore, Mihriban, Lockheed Martin Engineering & Science Services, USA; Berman, Andrea, Lockheed Martin Engineering & Science Services, USA; Chmielewski, Cynthia, Lockheed Martin Engineering & Science Services, USA; Woolford, Barbara,

NASA Johnson Space Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972403; Copyright; Avail: Aeroplus Dispatch

The purpose of this study was to evaluate and identify the most effective techniques for self-guided remote training. Nine subjects were trained on the use of a personal videoconferencing system and the use of a Web-based multimedia program. Each subject performed two tasks with both training techniques: one assembly task and one instrumentation task. It was found that task times using the multimedia application were greater than task times using videoconferencing. However, for complex tasks, participants preferred multimedia training. With multimedia, participants preferred to use video clips over diagrams and photos during assembly tasks. However, no preference was found during instrumentation tasks.
Author (AIAA)
Remote Control; Education; Teleconferencing; Long Duration Space Flight; International Space Station

19980070010
Development of a Fluid Systems Servicer (FSS) for the International Space Station
Miernik, Janie H., Boeing Defense & Space Group, USA; Schubert, Franz H., Life Systems, Inc., USA; Chang, B. J., Life Systems, Inc., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972407; Copyright; Avail: Aeroplus Dispatch

The Fluid Systems Servicer (FSS) is designed to drain, purge, fill, and recirculate fluids while performing on-orbit start-up, scheduled, and unscheduled maintenance for fluid lines on the International Space Station (ISS). The FSS will utilize space vacuum for purging operations, thus providing essentially unpowered vacuum back-filling capability. There is also a fluids pump in the FSS which is used for draining and recirculating water. The recirculation mode fulfills an additional design requirement of removing gas bubbles by directing water through a static membrane separator. Several flex-lines and adapters which interface various ISS lines via self-sealing quick disconnects (QDs), are part of the FSS assembly. The FSS has its own power cord, which enables excellent transportability. This feature, as well as the QD adapters, allows the FSS to be used anywhere on station for numerous servicing tasks.
Author (AIAA)
International Space Station; Recirculative Fluid Flow; Temperature Control; Environmental Control; Life Support Systems; Water Reclamation

19980070011
Development of a hydrophilic, antimicrobial coating for condensing heat exchangers
Pickup, Helen, AlliedSignal Aerospace, USA; Zhou, S. J., AlliedSignal Aerospace, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972408; Copyright; Avail: Aeroplus Dispatch

A hydrophilic, antimicrobial coating has been developed for the condensing heat exchanger and filter assembly (CHFXA) for the Columbus Orbital Facility of the International Space Station. The coating is a single-phase, alumina-based, ceramic coating containing silver oxide as a biocide. It can be applied to complex shaped components using conventional coating processes. A significant amount of biocide can be included in such single-phase coatings without apparent detriment to physical properties. The development and characterization of this coating are described here.
Author (AIAA)
Condensing; Heat Exchangers; International Space Station; Prophylaxis; Life Support Systems; Temperature Control

19980070012
Columbus Orbital Facility condensing heat exchanger and filter assembly
Fourquet, Helene, SECAN, France; Carpentier, Pierre, SECAN, France; Rolland, Andre, SECAN, France; Martin, Claude, SECAN, France; Pickup, Helen, AlliedSignal Aerospace, USA; Rose, Susan, AlliedSignal Aerospace, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972409; Copyright; Avail: Aeroplus Dispatch

A condensing heat exchanger and filter assembly (CHXFA) is being developed and manufactured by SECAN/AlliedSignal as part of an ESA program. The CHXFA is part of the environmental control system of the Columbus Orbital Facility (COF), the European laboratory module of the International Space Station (ISS). The CHXFA contains a filter to remove particulates from the air stream, and a differential pressure sensor to monitor filter pressure drop. The condensing heat exchanger reduces the air temperature and the humidity level. Efficient air-water separation is achieved by a combination of a hydrophilic coating on the heat exchanger air flow passages and a water removal section. A thermal control valve regulates the temperature of the outlet air.

A sensor is incorporated in the outlet line to detect liquid carryover in the air stream. This paper gives an overview of the condensing heat exchanger assembly developed for the Columbus Orbital Facility.
Author (AIAA)
Columbus Space Station; Heat Exchangers; Condensing; Air Filters; Spacecraft Cabin Atmospheres; Environmental Control

19980070013

A thermal control system dual-membrane gas trap for the International Space Station

Humphrey, Joseph T., AlliedSignal Aerospace, USA; Supra, Laura N., AlliedSignal Aerospace, USA; Faust, Michael B., AlliedSignal Aerospace, USA; Jul. 1997; In English
Contract(s)/Grant(s): NAS8-50000
Report No.(s): SAE Paper 972410; Copyright; Avail: Aeroplus Dispatch

The dual membrane gas trap filter is utilized in the internal thermal control system (ITCS) as part of the pump package assembly to remove non-condensed gases from the ITCS coolant. This improves pump performance and prevents pump cavitation. The gas trap also provides the capability to vent air that is ingested into the ITCS during routine maintenance and replacement of the International Space Station (ISS) system orbital replacement units. This paper describes the principles involved in the gas trap design and the development of the current mature design that will be utilized on the ISS. The performance capabilities and the operational lifetime of the unit are also discussed. Test data validating gas trap performance are presented to demonstrate gas removal capability vs time, maximum gas removal capacity, and the sensitivity of the ITCS gas trap to water contamination when it is exposed to an ethanol/water mixture.
Author (AIAA)
Temperature Control; International Space Station; Air Filters; Liquid-Vapor Interfaces

19980070014

Overview of the International Space Station, Mini-Pressurized Logistics Module, environmental control system

Holladay, Jon B., NASA Marshall Space Flight Center, USA; D'Auria, Renato, Alenia Aerospazio, Div. Spazio, Italy; Jul. 1997; In English
Report No.(s): SAE Paper 972412; Copyright; Avail: Aeroplus Dispatch

Consideration is given to the Mini-Pressurized Logistics Module (MPLM), the primary vehicle for the transportation of equipment, scientific payloads, and supplies for use inside of the International Space Station. The MPLM active thermal control system, water pump backage, metal bellows expander, water modulating valve, passive thermal control system, ECLSS, cabin air system, fire detection system, and atmosphere control system are examined.
AIAA
International Space Station; Environmental Control; Logistics; Spacecraft Modules; Pressurizing; Temperature Control

19980070015

Viral challenge of an advanced life support water treatment system

Bouma, J. E., NASA Johnson Space Center, USA; Pierson, D. L., NASA Johnson Space Center, USA; Koenig, D. W., Krug Life Sciences, Inc., USA; Bell-Robinson, D. M., Krug Life Sciences, Inc., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972413; Copyright; Avail: Aeroplus Dispatch

The ability of the water recovery system (WRS) designed for Phase II of the Lunar-Mars Life Support Test Project to remove viral contaminants was tested by challenging the system with bacteriophages MS-2 and PRD-1. Urine-pretreatment and ultrafiltration/reverse osmosis (UF/RO) steps each reduced the combined density of both bacteriophages from greater than 10 exp 9 to less than 1 plaque-forming units (PFU)/100 mL. UF/RO also reduced the bacterial density from 10 exp 8 to 10 exp 7 colony-forming units (CFU)/100 mL. Before UF/RO, the predominant species of bacteria in the water were Acinetobacter calcoacetious and Klebsiella pneumoniae; afterward, the predominant species were Burkholderia cepacia and B. picketti. The removal of the bacteriophages and the difference in predominant bacteria across the UF/RO step suggest that the Burkholderia had been established downstream of the UF/RO membranes before the test began. An aqueous-phase catalytic oxidation system (APCOS) and iodination further reduced the bacterial density from 10 exp 7 to less than 1 CFU/100 mL. Neither bacteria nor bacteriophages were detected in the final product water. This WRS successfully removed viral and bacterial contaminants from wastewater.
Author (AIAA)
Life Support Systems; Water Treatment; Water Reclamation; Viruses; International Space Station; Lunar Exploration

19980070016

Microbial colonization of closed life support chambers

Koenig, D. W., Krug Life Sciences, Inc., USA; Bell-Robinson, D. M., Krug Life Sciences, Inc., USA; Valadez, V. A., Krug Life Sciences, Inc., USA; Pierson, D. L., NASA Johnson Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972414; Copyright; Avail: Aeroplus Dispatch

The first two phases of the Lunar-Mars Life Support Test Project (LMLSTP) involved housing human volunteers in closed chambers that mimic future extraterrestrial life support systems. The Phase I test involved one person living for 15 days in a chamber with wheat as the primary means of air revitalization. The Phase II test involved four people living for 30 d in a chamber with physical/chemical air revitalization and waste water recycling. The consequences of closure on microbial ecology and the influence that microbes had on these closed environmental life support systems were determined during both tests. The air, water, and surfaces of each chamber were sampled for microbial content before, during, and after each test. The numbers of microbes on the Phase I habitation chamber surfaces increased with length of occupation. However, the numbers of microbes on the surfaces of the Phase II chamber did not increase, a finding that contrasts with past results from other closed chamber studies and from Space Shuttle missions. The types of microbes found in the air and on the surfaces from both tests were similar. Results from Phase I and II tests imply that human flora may ultimately dominate the ecology of a closed life support system.

Author (AIAA)

Bacteria; Life Support Systems; Lunar Exploration; Closed Ecological Systems

19980070017

Lunar-Mars Life Support Test Project, Phase II - Human factors and crew interactions

Ming, D. W., NASA Johnson Space Center, USA; Hurlbert, K. M., NASA Johnson Space Center, USA; Kirby, G., Lockheed Martin Engineering & Sciences, USA; Lewis, J. F., Lockheed Martin Engineering & Sciences, USA; O'Rear, P., Lockheed Martin Engineering & Sciences, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972415; Copyright; Avail: Aeroplus Dispatch

Phase II of the Lunar-Mars Life Support Test Project was conducted in June and July of 1996 at NASA/Johnson. The primary objective for Phase II was to develop and test an integrated human life support system capable of sustaining a crew of four for 30 days in a closed chamber. The crew was continuously present inside a chamber throughout the 30-d test. The objective of this paper is to describe crew interactions and human factors for the test. Crew preparations for the test included training and familiarization of chamber systems and accommodations, and medical and psychological evaluations. During the test, crew members provided metabolic loads for the life support systems, performed maintenance on chamber systems, and evaluated human factors inside the chamber. Overall, the four crew members found the chamber to be comfortable for the 30-day test. The crew parformed well together, and this was attributed in part to team dynamics, skill mix (one commander, two system experts, and one logistics lead), and a complementary mix of personalities. Communication with and support by family, friends, and colleagues were identified as important contributors to the high morale of the crew during the test. Lessons learned and recommendations for future testing are presented.

Author (AIAA)

Lunar Exploration; Life Support Systems; Crew Procedures (Inflight); Human Factors Engineering; International Space Station

19980070018

Performance of the water recovery system during Phase II of the Lunar-Mars Life Support Test Project

Verostko, Charles, NASA Johnson Space Center, USA; Pickering, Karen, NASA Johnson Space Center, USA; Smith, Fred, NASA Johnson Space Center, USA; Packham, Nigel, Lockheed Martin Engineering & Sciences, USA; Lewis, John, Lockheed Martin Engineering & Sciences, USA; Stonesifer, Greg, Lockheed Martin Engineering & Sciences, USA; Staat, Dave, Lockheed Martin Engineering & Sciences, USA; Rosenbaum, Melissa, Hamilton Standard, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972417; Copyright; Avail: Aeroplus Dispatch

The Lunar-Mars Life Support Test Project (LMLSTP) Phase II test was performed to validate candidate technologies to support long-duration space missions. The test was conducted in the Crew and Thermal Systems Division (CTSD) Life Support Systems Integration Facility (LSSIF) at Johnson Space Center (JSC). Discussed in this paper are the water recovery system (WRS) results of this test. A crew of four participated in the test and lived in the LSSIF chamber for a duration of 30 days from June 12 to July 12, 1996. The crew had accommodations for personal hygiene, the air was regenerated for reuse, and the waste water was processed to potable and hygiene quality for reuse by the crew during this period. The waste water consisted of shower, laundry, handwash, urine and humidity condensate. The subsystems, the performance of the subsystems, and the quality of water produced

are discussed in detail. The anomalies associated with the postprocessing subsystem leading up to the 30-d test and the changes made to the post-processing subsystem to obtain potable water after the first day of the test are presented.
Author (AIAA)
Water Reclamation; Life Support Systems; Lunar Exploration; Potable Water; Waste Water

19980070019
Performance of the Atmosphere Revitalization System During Phase II of the Lunar-Mars Life Support Test Project
Brasseaux, Sandra, NASA Johnson Space Center, USA; Rosenbaum, Melissa, Hamilton Standard Management Services, Inc., USA; Supra, Laura, AlliedSignal Aerospace, USA; El Sherif, Dina, AlliedSignal Aerospace, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972418; Copyright; Avail: Aeroplus Dispatch

The Lunar-Mars Life Support Test Project (LMLSTP) was established to perform the necessary research, technology development, integration, and verification of regenerative life support systems to provide safe, reliable, and self-sufficient human life support systems. The primary objective of the Phase II test was to demonstrate an integrated regenerative life support system capable of sustaining a human crew of four for 30 d in a closed chamber. The LMLSTP Phase II test was conducted June 12-July 12, 1996, in the Life Support Systems Integration Facility (LSSIF) at Johnson Space Center. The Phase II Atmosphere Revitalization System (ARS) maintained an acceptable atmosphere for the four-person test crew for the entire 30-d test. This paper describes the Phase II ARS in more detail, and discusses the performance of the system during the 30-day test.
Author (AIAA)
Life Support Systems; Lunar Exploration; Regeneration (Physiology); International Space Station; Spacecraft Cabin Atmospheres

19980070020
Molecular sieve CO2 removal systems - International Space Station and Lunar-Mars Life Support Test Project
Supra, Laura N., AlliedSignal Aerospace, USA; Brasseaux, Sandra F., NASA Johnson Space Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972419; Copyright; Avail: Aeroplus Dispatch

Molecular sieve CO2 removal systems are a proven and reliable method for the control of CO2 in a closed environment. CO2 control was provided by a molecular sieve unit for Skylab. Currently, the CO2 removal assembly (CDRA) is being manufactured by AlliedSignal for Boeing and will be utilized for CO2 removal on the International Space Station (ISS). Development testing has been performed on CDRA, and different power saving operation modes have been investigated. Also as part of the Lunar-Mars Life Support Test Project (LMLSTP) initiative, a research four-bed molecular sieve (4BMS) system has been tested at NASA/Johnson. The most recent test was Phase IIA, which was a 60-d test that focused on integration testing of representative ISS hardware with four humans living inside a closed chamber. The purpose of this paper is to discuss results from development testing of ISS CDRA and the 4BMS results from the LMLSTP 60-d test, and to describe the differences between the ISS CDRA and the LMLSTP 4BMS.
Author (AIAA)
Carbon Dioxide Removal; Sieves; International Space Station; Life Support Systems; Lunar Exploration

19980070022
Rapid detection of bacteria in spacecraft water systems
Pyle, Barry H., Montana State Univ., Bozeman, USA; Lisle, John T., Montana State Univ., Bozeman; Broadaway, Susan C., Montana State Univ., Bozeman; McFeters, Gordon A., Montana State Univ., Bozeman; Jul. 1997; In English
Report No.(s): SAE Paper 972421; Copyright; Avail: Aeroplus Dispatch

Rapid methods are needed for monitoring water, both pre-flight and on orbit. We are developing techniques to enumerate specific, metabolically active bacteria that may threaten crew health or lead to water system deterioration. Our methods are directed at the detection of individual bacteria, rather than populations of bacteria, and we aim to determine the identity of the organism as well as its physiological state concurrently. Our objectives are to determine, in a single test, the total number of bacteria present in a water sample, if a specific strain of bacteria is present within the total population and if these bacteria are viable or dead. We report on the combination of methods into highly sensitive, rapid technologies for detecting specific target bacteria and assessing their viability in spacecraft water.
Author (AIAA)
Bacteria; Water Reclamation; Spacecrews; Spacecraft Environments

19980070026

Aqueous Phase Ammonia Removal and Destruction System (APARDS)

Akse, James R., Umpqua Research Co., USA; Thompson, John O., Umpqua Research Co., USA; Jul. 1997; In English

Contract(s)/Grant(s): NAS2-14353

Report No.(s): SAE Paper 972425; Copyright; Avail: Aeroplus Dispatch

In order to meet NASA potable water standards using biological processing, additional purification is needed. Elimination of ammonia species is a significant post-treatment step to achieve this goal. New technology, combining membrane transport and electro-oxidation of ammonia, was developed to solve this problem without the use of expendables. The APARDS Phase I Program rigorously demonstrated the feasibility of each sub-process, and an integrated system was developed that removed and destroyed ammonia from a simulated bioreactor effluent. Membranes and process conditions suitable for ammonia removal have been determined. An ammonia removal module (ARM) was designed for the efficient transfer of ammonia to a secondary electro-oxidation stream where the ammonia was destroyed. The electrolysis cell's electrodes, operational voltage, and flow characteristics were optimized to rapidly destroy ammonia. The theory of operation, basis for selection of membranes and electro-oxidation cell materials, design of the ARM and destruction loop, determination of permeation conditions, and experimental results from each unit process and the integrated process are presented.

Author (AIAA)

Aqueous Solutions; Ammonia; Potable Water; Removal

19980070027

An ozone-based laundry and laundry wash water recovery system

Denvir, Adrian, Lynntech, Inc., USA; Rogers, Tom, Lynntech, Inc., USA; Hitchens, G. D., Lynntech, Inc., USA; Jeng, King-Tsai, Lynntech, Inc., USA; Jul. 1997; In English

Contract(s)/Grant(s): NAS9-19447

Report No.(s): SAE Paper 972426; Copyright; Avail: Aeroplus Dispatch

The impact on the water recovery and reclamation system resulting from laundry operations has been the primary obstacle to the implementation of a laundry capable for long duration space missions. Such an onboard system can provide improved housekeeping effectiveness and crew health maintenance aspects. Electrochemically generated ozone was used as a laundry (cleaning) agent under simulated washing conditions and compared with Tide and dodecynlbenzoicsuccinic acid (DBSA). Three aspects were studied: cleaning ability, disinfection potential, and impact on the resulting laundry water. In most instances, ozone provided a detergentlike cleaning ability that was as good as, or better than, Tide or DBSA. Ozone was a superior disinfectant and, more importantly, had a low impact on the laundry wash water in terms of its potential for recycling. Ozone does not contribute to the organic or inorganic load of the waste water stream (as do typical detergents), and tests clearly showed that ozone could be used to oxidize organics in the waste water stream, thereby enabling a feasible pathway toward the development of a closed-loop recycle system for laundry wash water.

Author (AIAA)

Ozone; Water Reclamation; Cleaning; Long Duration Space Flight; Gas Generators

19980070028

Electrochemical deionization of waste water using a new polymer membrane cell

Archer, Shivaun D., Lynntech, Inc., USA; Hitchens, G. D., Lynntech, Inc., USA; Tennakoon, Charles L. K., Lynntech, Inc., USA; Pickering, Karen, NASA Johnson Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972427; Copyright; Avail: Aeroplus Dispatch

The removal of dissolved ions from waste water is essential to regenerative water reclamation technology for life support systems. The aim of this project was to demonstrate a novel electrochemically driven purification method using tubulated bipolar ion exchange membranes for the separation of dissolved ionic impurities from spacecraft waste water. The new method uses a membrane composed of bilayers of oppositely charged ionically conducting polymers. This membrane makes it practical to treat all types of waste water, independently of the water's conductivity. Electricity is the only additional consumable required for this method. Greater than 90 percent water recovery is possible, depending on the concentration of contaminants in the feed stream. This paper describes performance tests showing that both inorganic and organic ion impurities in Ersatz solutions could be reduced to 1 part per million or below. The size, weight, and power requirements, as well as the operation of a continuous flow system, are discussed. The test results provide a technical foundation for further development and scale up for applications in advanced life support systems.

Author (AIAA)

Electrochemistry; Deionization; Waste Water; Polymer Chemistry

19980070029

Waste incineration for resource recovery in a bioregenerative life support system

Lighty, JoAnn S., Utah, Univ., Salt Lake City, USA; Burton, Bill, Utah, Univ., Salt Lake City; Sirdeshpande, Avinash, Utah, Univ., Salt Lake City; Inkley, Dale, Utah, Univ., Salt Lake City; Pershing, David, Utah, Univ., Salt Lake City; Brouwer, Jacob, Reaction Engineering International, USA; Kemp, Gary, Reaction Engineering International, USA; Heap, Michael P., Reaction Engineering International, USA; Fisher, John, NASA Ames Research Center, USA; Pisharody, Suresh, NASA Ames Research Center, USA;
Jul. 1997; In English
Report No.(s): SAE Paper 972429; Copyright; Avail: Aeroplus Dispatch

For the last two years, the University of Utah and Reaction Engineering International, in cooperation with NASA/Ames, have been developing a waste incineration system for regenerative life support systems. The system is designed to burn inedible plant biomass and human waste. The goal is to obtain an exhaust gas clean enough to recycle to either the plant or human habitats. The incineration system, a fluidized bed reactor, has been designed for a four-person mission. This paper details the design of the units. In addition, results are presented from testing at the University of Utah. Presently, the unit has been shipped to Ames Research Center for more tests prior to delivery to Johnson Space Center for testing in a 90-d, four-person test.
Author (AIAA)

Waste Treatment; Incinerators; Regeneration (Physiology); Life Support Systems; Biomass; Human Wastes

19980070030

Microwave-powered thermal regeneration of sorbents for CO2, water vapor and trace organic contaminants

Atwater, James E., Umpqua Research Co., USA; Holtsnider, John T., Umpqua Research Co., USA; Wheeler, Richard R., Jr., Umpqua Research Co., USA; Luna, Bernadette, NASA Ames Research Center, USA; Jul. 1997; In English
Contract(s)/Grant(s): NAS2-14374
Report No.(s): SAE Paper 972430; Copyright; Avail: Aeroplus Dispatch

Feasibility of the use of microwave heating to achieve fast and efficient thermal regeneration of sorbents for the removal of carbon dioxide, water vapor, and trace organics from contaminated air streams has been conclusively demonstrated. During the initial research, the sorption and microwave-powered thermal desorption of acetone, trichloroethylene (TCE), CO2, and water vapor was studied at 2.45 GHz using a rectangular waveguide based test apparatus. Both activated carbon and Carbosieve S-III were identified as excellent microwave regenerable sorbents for use in the removal of airborne organics. Water loaded silica gel, Molecular Sieve 13X, and Molecular Sieve 5A were also effectively regenerated under microwave irradiation at this frequency. Molecular Sieve 5A and a carbogenic molecular sieve prepared at JPL were identified as viable microwave regenerable CO2 sorbents. A sorbent bed containing multiple media was challenged with air containing 0.5 percent CO2, 300 parts per million (ppm) acetone, 50 ppm TCE, and saturated with water vapor. The layered media bed was shown to effectively purify the contaminated air stream and to be completely regenerated by microwave induced heating. Spectral studies of the reflection, transmission, and phase shifts of microwaves for a variety of sorbents over the frequency range between 1.3-2.7 GHz were performed.
Author (AIAA)

Sorbents; Carbon Dioxide; Water Vapor; Trace Contaminants; Radio Frequency Heating

19980070031

CO2 removal with enhanced molecular sieves

Rose, Susan K., AlliedSignal Aerospace, USA; MacKnight, Allen K., AlliedSignal Aerospace, USA; El Sherif, Dina, AlliedSignal Aerospace, USA; Jul. 1997; In English
Contract(s)/Grant(s): NAS9-19607; NASW-5033
Report No.(s): SAE Paper 972431; Copyright; Avail: Aeroplus Dispatch

Two-bed CO2 adsorption systems that can remove CO2 from humid spacecraft air and be regenerated using pressure-swing desorption offer mass, volume, and power advantages when compared with the other methods. Two classes of sorbent materials show particular promise for this application: zeolite sorbents, similar to those in the International Space Station (ISS) CO2 removal assembly, and functionalized carbon molecular sieves (FCMS), which adsorb CO2 independent of the humidity in the airstream. Pressure-swing testing of these two different sorbents under both space station and space suit conditions are currently underway. Results obtained to date, from zeolites under space station conditions and FCMS under suit conditions, indicate that a pressure-swing CO2 removal system is a competitive solution for both life-support applications.
Author (AIAA)

Carbon Dioxide Removal; Sieves; Water Vapor; Spacecrews; Extravehicular Activity

19980070032

Unique metal monolith catalytic reactor for destruction of airborne trace contaminants

Carter, R. N., Precision Combustion, Inc., USA; Bianchi, J. F., Precision Combustion, Inc., USA; Pfefferle, W. C., Precision Combustion, Inc., USA; Roychoudhury, S., Precision Combustion, Inc., USA; Perry, J. L., NASA Marshall Space Flight Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972432; Copyright; Avail: Aeroplus Dispatch

The Trace Contaminant Control Subassembly (TCCS) to be used onboard the International Space Station (ISS) uses expendable adsorption beds and a conventional high temperature catalytic oxidizer to control trace chemical contaminants in the cabin air. Although effective, the current design has a high life cycle operating cost associated with maintaining the expendable beds and heating the catalytic oxidizer. In order to improve the TCCS's process economics, a retrofit to its primary design which utilizes an advanced technology lightweight, long-life Microlith catalytic converter (MCC) is being studied. Development and testing of MCC prototypes for application to the TCCS have been conducted on a bench scale. Results from these studies are presented that show the converter's destruction performance for representative trace chemical contaminants found in a spacecraft cabin atmosphere.

Author (AIAA)

Catalysts; Trace Contaminants; International Space Station; Prophylaxis

19980070033

Development and testing of a non-expendable contaminant control system

Wright, J. D., TDA Research, Inc., USA; Bahr, J., TDA Research, Inc., USA; Bai, C., TDA Research, Inc., USA; Chen, B., TDA Research, Inc., USA; Wang, C., TDA Research, Inc., USA; Goss, J., NASA Johnson Space Center, USA; Graf, J., NASA Johnson Space Center, USA; Jul. 1997; In English

Contract(s)/Grant(s): NAS9-19369

Report No.(s): SAE Paper 972433; Copyright; Avail: Aeroplus Dispatch

TDA Research Inc. (TDA) has designed, built, and tested an all-catalytic trace contaminant control system (TCCS) to be used in Phase III of the Early Human Testing Program. The TCCS does not have a charcoal bed; it consists of a blower, a high flow moderate temperature catalyst bed, a low flow high temperature catalyst bed, a high efficiency regenerative heat exchanger, and an acid gas removal bed. The system has only one moving part (the blower), effectively controls hydrocarbons including methane, CFCs and CHCs, and effectively oxidizes ammonia (NH3) to N2 and water without generating NO(x). The catalysts are not poisoned by CFCs or CHCs, and oxidation products are acid gases rather than chlorine or fluorine gas.

Author (AIAA)

Trace Contaminants; International Space Station; Prophylaxis; Activated Carbon

19980070047

U.S./Russian EVA status

Fullerton, Richard K., NASA Johnson Space Center, USA; Tsygankov, Oleg S., Rocket Space Corp. 'Ehnergiya', Russia; Yuzov, Nikolai, Gagarin Cosmonaut Training Center, Russia; Abramov, Isaac P., JSC RD&PE Zvezda, Russia; Jul. 1997; In English

Report No.(s): SAE Paper 972455; Copyright; Avail: Aeroplus Dispatch

U.S. and Russian cooperation in the International Space Station (ISS) has been ongoing since the end of 1993. Joint agreements related to EVA involve the full scope of hardware and operations used on-orbit and on the ground. Technical requirement studies, common hardware development, ground tests, and flight experience are all combining to aid joint progress. The Shuttle-Mir missions are directly contributing to the level of hands-on experience which is so crucial to current and future ISS activities. Common goals and practical methods are aiding in overcoming minor technical differences to create real opportunities for mutual success. With shared vision, dedicated leadership and adequate resources, the future is bright.

Author (AIAA)

Extravehicular Activity; International Space Station; International Cooperation; NASA Space Programs; Russian Space Program

19980070048

Enhanced extra-vehicular activity operations through custom human modeling analysis

Anderson, David E., McDonnell Douglas Aerospace, USA; Price, Larry R., McDonnell Douglas Aerospace, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972457; Copyright; Avail: Aeroplus Dispatch

To sustain the EVA rate required to assemble and maintain the International Space Station (ISS), we must enhance our ability to plan, train for, and execute EVAs. An underlying analysis capability must be in place to ensure EVA access to all external worksites either as a starting point for ground training, to generate information needed for on-orbit training, or to react quickly to develop contingency EVA plans, techniques, and procedures. This paper describes a potential flight experiment for application of custom human modeling analysis to plan and train for EVAs to enhance space station functionality and usability through assembly and operation.
Author (AIAA)
Extravehicular Activity; International Space Station; Human Factors Engineering

19980070049
Antarctica/Mars analog field report - EVA engineer's experience and lessons learned
Trevino, Robert C., NASA Johnson Space Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972459; Copyright; Avail: Aeroplus Dispatch

This paper describes the experiences and lessons learned by a NASA EVA engineer as a team member of an aerogeophysical research team based in a remote and isolated field camp, very similar to a Mars exploration base. Design of the tools, equipment, and techniques for scientific research that could be related to future EVA systems were studied. Logistics and maintenance strategies as they apply to EVA orbital replaceable unit designs and EVA maintenance were also studied. Antarctic operations were also studied due to the similarity with Mars EVA operations and the need to perform safe and sustainable operations for extended periods of time, such as from a Mars habitat or a pressurized rover. Experiences and lessons learned from this Antarctic expedition will be beneficial during planning and design of future EVA systems and operations for human space exploration.
Author (AIAA)
Extravehicular Activity; Antarctic Regions; Space Exploration

19980070050
EVA advanced research and development road map
Rouen, Michael, NASA Johnson Space Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972460; Copyright; Avail: Aeroplus Dispatch

The purpose of this paper is to introduce those interested in EVA technology to the technology development road map which the NASA EVA Project Office is following to prepare the technology needed for future missions. The origin, purpose, and content of the road map are described. An outline of the processes that will be used to keep the road map current, as well as how to access the current road map, is described.
Author (AIAA)
Extravehicular Activity; Research and Development; Maps

19980070051
Potable water treatment and transfer from Shuttle to Mir
Mudgett, Paul D., Krug Life Sciences, Inc., USA; Schultz, John R., Krug Life Sciences, Inc., USA; Packham, Nigel J., Lockheed Martin Corp., USA; Veselka, Dennis J., Boeing North America, Inc., USA; Brasseaux, Hubert J., Jr., NASA Johnson Space Center, USA; Rotter, Henry A., NASA Johnson Space Center, USA; Sauer, Richard L., NASA Johnson Space Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972461; Copyright; Avail: Aeroplus Dispatch

To satisfy a requirement to supply water to Mir station, a process for treating iodinated water on the Shuttle was developed and implemented. The treatment system consists of packed columns for removing iodine and a syringe-based injection system for adding ionic silver, the biocide used in Mir water. Technical and potable grade water is produced and transferred in batches using collapsible 44-liter contingency water containers (CWCs). Silver is added to the water via injection of a solution from preloaded syringes. Minerals are also added to water destined for drinking. During the previous four Shuttle-Mir docking missions, a total of 2781 liters of water produced by the Shuttle fuel cells was processed using this method and transferred to Mir. to verify the quality of the processed water, samples were collected during flight and returned for chemical analysis. Results show that iodine and related species were removed effectively by the activated carbon and ion exchange treatment system. Target concentrations of silver, fluoride, calcium, and magnesium were reproducibly obtained. A discussion of problems encountered during the first flight of the treatment system, and the changes made for subsequent flights are presented.
Author (AIAA)
Potable Water; Water Treatment; Mir Space Station; Space Shuttles; Mass Transfer

19980070052

Chemical analysis of potable water and humidity condensate collected during the Mir-21 mission

Pierre, Lizanna M., Krug Life Sciences, Inc., USA; Schultz, John R., Krug Life Sciences, Inc., USA; Sauer, Richard L., NASA Johnson Space Center, USA; Sinyak, Yuri E., Inst. of Biomedical Problems, Russia; Skuratov, Vladimir M., Inst. of Biomedical Problems, Russia; Protasov, Nikolai N., RSC-Energia, Russia; Jul. 1997; In English

Report No.(s): SAE Paper 972462; Copyright; Avail: Aeroplus Dispatch

The primary source of potable water planned for the International Space Station will be generated from the reclamation of humidity condensate, urine, and hygiene waters. It is vital to crew health and performance that this reclaimed water be safe for human consumption, and that health risks associated with recycled water consumption be identified and quantified. Only recently has data been available on the chemical constituents in reclaimed waters generated in microgravity. Results for samples collected during Mir-21 reveal that both the reclaimed water and stored water are of potable quality, although the samples did not meet U.S. standards for total organic carbon, total phenols, and turbidity.

Author (AIAA)

Chemical Analysis; Potable Water; Humidity; Condensates; Mir Space Station; International Space Station

19980070053

Risk mitigation water quality monitor

Straub, John E., II, Krug Life Sciences, Inc., USA; Shimamoto, Susan M., Krug Life Sciences, Inc., USA; Schultz, John R., Krug Life Sciences, Inc., USA; Davenport, Ronald J., Sievers Instruments, Inc., USA; Sauer, Richard L., NASA Johnson Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972463; Copyright; Avail: Aeroplus Dispatch

Space station requirements include an on-orbit capability for real-time monitoring of key water quality parameters, such as total organic carbon, total inorganic carbon, total carbon, pH, and conductivity, to ensure that crew health is protected for consumption of reclaimed water. The Crew Health Care System for ISS includes a total organic carbon (TOC) analyzer that is currently being designed to meet this requirement. As part of the effort, a spacecraft TOC analyzer was developed to demonstrate the technology in microgravity and mitigate risks associated with its use on station. This analyzer was successfully tested on Shuttle during the STS-81 mission as a risk mitigation experiment. A total of six ground-prepared test samples and two Mir potable water samples were analyzed in flight during the 10-d mission. Duplicate test samples were analyzed on the ground concurrent with on-orbit analyses. Archived Mir water samples were returned and analyzed for comparison to in-flight results. Analytical performance of the analyzer during STS-81 was very good. All test sample results except for a few pH values were within the prescribed analytical acceptance limits for the experiment.

Author (AIAA)

Water Quality; Quality Control; International Space Station; Condensates; Water Treatment

19980070054

Capillary electrophoresis for spacecraft drinking water analysis - Methods and breadboard development

Orta, David R., Krug Life Sciences, Inc., USA; Levy, R. J., Krug Life Sciences, Inc., USA; Mudgett, Paul D., Krug Life Sciences, Inc., USA; Homan, Mark E., Krug Life Sciences, Inc., USA; Schultz, John R., Krug Life Sciences, Inc., USA; Sauer, Richard L., NASA Johnson Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972464; Copyright; Avail: Aeroplus Dispatch

This report describes the first two parts of a three-phase project to develop and test a spacecraft-compatible capillary electrophoresis (CE) instrument. This instrument is designed to monitor the quality of recycled potable water aboard spacecraft such as the International Space Station. Phase I involved selecting and validating methods for low mass-to-charge ratio (m/z) cations and anions by using a slightly modified commercial CE instrument as a model. The analytical performance of several published CE methods was assessed for their ability to detect targeted anions and cations listed in a NASA water quality standard. Phase II focused on building a breadboard CE instrument and flight-testing it on NASA's KC-135 parabolic aircraft. Phase I results showed that 91 percent of the target ions can be separated and detected, and the required minimum detection limits for 52 percent of NASA's target ions can be met by using a 75-cm x 50-micron bubble-cell capillary and three different separation schemes. Phase II results verified that the instrument can function in parabolic flight but that further tests are needed to optimize separation and to confirm detection limits in microgravity.

Author (AIAA)

Electrophoresis; Potable Water; Water Quality; Water Treatment

19980070055

Solid phase extraction of polar compounds in water

Rutz, Jeffrey A., Krug Life Sciences, Inc., USA; Schultz, John R., Krug Life Sciences, Inc., USA; Sauer, Richard L., NASA Johnson Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972465; Copyright; Avail: Aeroplus Dispatch

The Water and Food Analytical Laboratory at the Johnson Space Center is developing an alternative to EPA Method 625 for analyzing semivolatile organic compounds in water. The current EPA method uses liquid-liquid extraction. The alternative method being developed differs in the sample preparation phase by replacing gravity-dependent liquid-liquid extraction with solid phase extraction (SPE). The ultimate goal is to incorporate the optimum SPE conditions into an automated sample preparation process. The method shows promise with regard to anticipated polar compounds. Fourteen SPE resins and nine elution solvents were compared. For typical analytes encountered by our laboratory, a styrene-divinylbenzene SPE resin and an elution solvent mixture of methylene chloride and ethyl ether were found to give the highest extraction recoveries. A study is in progress to remove water from the extracts before GC/MS analysis.

Author (AIAA)

Solid Phases; Organic Compounds; Waste Water; Water Treatment; Aerospace Environments

19980070075

Plant growth model using artificial neural networks

Zee, Frank, JPL, USA; Bubenheim, David, NASA Ames Research Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972494; Copyright; Avail: Aeroplus Dispatch

We have developed a plant growth (physiology) model using artificial neural networks. Neural networks are suitable for both steady-state and dynamic modeling and identification tasks, since they can be trained to approximate arbitrary nonlinear input-output mappings from a collection of input and output examples. In addition, they can be expanded to incorporate a large number of inputs and outputs as required, which makes it simple to model multivariable systems. In this paper, we describe our motivation and approach to developing these models and the neural network architecture. Initial use of the artificial neural network for modeling the single plant process of transpiration is presented. The approach is to develop and validate neural network submodels describing the individual plant-based functions (assimilation, biomass allocation, and accumulation and resource demands) and to integrate them for full control of plant-based life support functions. With the use of neural networks, these complex nonlinear dynamic multimodal multivariable plant growth models will be able to better interpolate between various environmental conditions and parameters and be able to simulate responses and the performance of various plants.

Author (AIAA)

Plants (Botany); Neural Nets; Life Support Systems; Crop Growth; Spacecrews

19980070078

Extravehicular Activity metabolic profile development based on Apollo, Skylab, and Shuttle missions

Thomas, Gretchen A., NASA Johnson Space Center, USA; Trevino, Luis A., NASA Johnson Space Center, USA; Jul. 1997; In English

Report No.(s): SAE Paper 972502; Copyright; Avail: Aeroplus Dispatch

The importance of being able to determine the usage rate of life support subsystem consumables was recognized well before the first Apollo Extravehicular Activity (EVA). Since that time, metabolic activity levels have been evaluated and recorded for each EVA crew member. Throughout the history of the U.S. space program, EVA metabolic rates have been shown to be variable depending upon the mission scenario and the equipment used. Knowing this historic information is invaluable for current EVA planning activities, as well as for the design of future Extravehicular Mobility Unit (EMU) systems. This paper presents an overview of historic metabolic expenditures for Apollo, Skylab, and Shuttle missions, along with a discussion of the types of EVA crew member activities which lead to various metabolic rate levels, and a discussion on how this data is being used to develop advanced EMU systems.

Author (AIAA)

Extravehicular Activity; Metabolism; Apollo Flights; Space Shuttle Missions; Carbon Dioxide Removal

19980070079

Venting membrane for EVA CO2 and H2O removal

Murdoch, Karen E., Hamilton Standard Space Systems International, Inc., USA; Thomas, Gretchen A., NASA Johnson Space Center, USA; Duffield, Bruce, Lockheed Martin Corp., USA; Jul. 1997; In English

Report No.(s): SAE Paper 972504; Copyright; Avail: Aeroplus Dispatch

The device described in this paper is a flat sheet membrane module that removes humidity from the space suit breathing loop by venting it to the vacuum of space. The module consists of alternating vacuum layer assemblies and vent layer assemblies separated by solid polymer membrane sheets. The module is designed to optimize volume and pressure drop at a given vent flow rate and water removal rate. Both Hamilton Standard and the NASA Johnson Space Center tested the module under varying EMU flow and humidity conditions; the results of the testing are presented in the paper. The module met or exceeded all of the design goals set forth in the program statement of work, including volume, pressure drop, and water removal rate.
Author (AIAA)
Extravehicular Activity; Carbon Dioxide Removal; Water; Membranes; Extravehicular Mobility Units; Venting

19980070080
Development status of the metal oxide regenerable CO2 removal system for the NASA EMU
Butler, LeRoy B., Jr., Hamilton Standard Space Systems International, Inc., USA; Faszcza, Jeffrey J., Hamilton Standard Space Systems International, Inc., USA; Thomas, Gretchen A., NASA Johnson Space Center, USA; Jul. 1997; In English
Contract(s)/Grant(s): NAS9-19520
Report No.(s): SAE Paper 972505; Copyright; Avail: Aeroplus Dispatch

Hamilton Standard Space Systems International, Inc., is currently under contract to NASA for the development and certification of an advanced technology regenerable carbon dioxide removal system for the International Space Station Extravehicular Mobility Unit (EMU), or 'space suit'. This new metal-oxide-based system ('Metox') will replace the existing nonregenerable lithium hydroxide (LiOH) carbon dioxide (CO2) removal system located in the EMU's Primary Life Support System (PLSS). The Metox canister is designed to replace the current LiOH Contamination Control Canister (CCC) with no modification to existing EMU interfaces. The metal oxide sorbent is 'regenerable' and can be restored to its original condition permitting the Metox canisters to be used over and over again on-orbit. Once a Metox canister becomes 'loaded' with CO2, it will be placed in the 'Regenerator', where the system will circulate hot air through the canister to drive off, or desorb, the CO2. The regenerated canister is then replaced in the PLSS for the next EVA.
Author (AIAA)
Extravehicular Mobility Units; Metal Oxides; Carbon Dioxide Removal; NASA Space Programs; Lithium Hydroxides; Pollution Control

19980070081
PLSS thermal model requirements for control
Campbell, Anthony B., Missouri-Columbia, Univ., USA; Mays, Craig, Missouri-Columbia, Univ., USA; Nair, Satish S., Missouri-Columbia, Univ., USA; Miles, John B., Missouri-Columbia, Univ., USA; Iovine, John V., Lockheed Martin Engineering & Science Services, USA; Lin, Chin H., NASA Johnson Space Center, USA; Jul. 1997; In English
Contract(s)/Grant(s): NAG9-915
Report No.(s): SAE Paper 972506; Copyright; Avail: Aeroplus Dispatch

This paper discusses several issues related to the PLSS thermal model requirements for a planned generalized EVA Simulation Test Bed. The existing models of the extravehicular mobility unit (EMU) are briefly discussed. The paper then focuses specifically on the NASA JSC Shuttle EMU model (referred to as SINDA EMU). After the SINDA EMU model review, the PLSS thermal model requirements for the EVA Simulation Test Bed are discussed in detail.
Author (AIAA)
Portable Life Support Systems; Temperature Control; Extravehicular Activity; Extravehicular Mobility Units

19980070082
Cryogen-based breathing gas system
Hamill, Doris, Oceaneering Space Systems, USA; Sprick, Cyle, Oceaneering Space Systems, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972507; Copyright; Avail: Aeroplus Dispatch

Storing breathing gas as a cryogenic liquid rather than a compressed gas has advantages in profile, weight, and safety. The disadvantage of the extremely cold temperature can be turned into an advantage by cooling the user while vaporizing and warming the cryogen. A cryogenic breathing apparatus capable of providing up to two hours of breathing and cooling and operating in any orientation will be available to commercial users in 1998. The same technology can be easily extended to use with liquid oxygen on the moon and Mars, and can be adapted to a zero-gravity environment.
Author (AIAA)
Cryogenic Fluids; Breathing Apparatus; Oxygen Breathing; Liquid Oxygen; Mars Environment; Lunar Environment

19980070083

Human functions in a biological life support system

Gitelson, J. I., Russian Academy of Sciences, Inst. of Biophysics, Russia; Okladnikov, Yu. N., Russian Academy of Sciences, Inst. of Biophysics, Russia; Jul. 1997; In English

Report No.(s): SAE Paper 972513; Copyright; Avail: Aeroplus Dispatch

The Institute of Biophysics at the Siberian branch of the Russian Academy of Sciences has developed and studied a life support system, called the Bios-3 facility, capable of self-sustained operation based on human habitat regeneration by photosynthetic processes. The system matter turnover involves humans not only as objects to be sustained, but also as components whose metabolism provides for reliable and steady operation of the entire system. This paper gives a description of the facility's construction and describes results of experiments conducted over a period of several months in the facility. Bios-3 demonstrated its feasibility at completely regenerating the atmosphere, water, and 93 percent of the plant portion of the human diet. Self-sustained operation of the system requires human control of all processes running within the system.

AIAA

Life Support Systems; Manned Space Flight; Photosynthesis; Plants (Botany); Carbon Dioxide Concentration

19980070084

Numerical analysis for the small positive pressure control system of CEEF

Nakano, Susumu, Hitachi, Japan; Uchida, Tsuyoshi, Hitachi, Japan; Ishigamori, Isao, Hitachi, Japan; Sugarwara, Satoshi, Hitachi, Japan; Nitta, Keiji, Inst. for Environmental Sciences, Japan; Jul. 1997; In English

Report No.(s): SAE Paper 972516; Copyright; Avail: Aeroplus Dispatch

It is necessary to develop a small positive pressure control system for the closed ecology experiment facility (CEEF) to protect against over-differential pressure loading. In the present study, a numerical method was developed to calculate the quantity of state of the closed module, which is fitted with rubber buffers, for the small positive pressure control system. Experiments to examine the pressure change of the closed module were carried out at the CEEF. Comparison of calculated and experimental results showed that the present dynamic simulation is suited to estimating the quantity of state of the closed module.

Author (AIAA)

Closed Ecological Systems; Pressure Regulators; Vegetation Growth; Control Systems Design; Temperature Control

19980070085

Waste management system for the habitant module for CEEF

Nitta, K., Inst. for Environmental Sciences, Japan; Hattori, I., JGC Corp., Japan; Hayashi, K., JGC Corp., Japan; Tora, T., Nikken Corp., Japan; Jul. 1997; In English

Report No.(s): SAE Paper 972519; Copyright; Avail: Aeroplus Dispatch

A waste management system for an animal breeding/habitant module in CEEF is proposed. The waste management system consists of two subsystems, the urine treatment subsystem and the feces and daily waste treatment subsystem. Wet oxidation processes and a drying toilet process are used in those subsystems. The urine and the feces excreted from human beings and animals in the module are separately treated in order to collect NaCl from the urine. The urine is stored in the tank until the volume reaches a fixed level. It is then sent to a wet oxidation process in the urine treatment subsystem. The liquid oxidized in the process is sent to a salinity recovery process to recover NaCl, and the produced gas is sent to a gas adjustment process. The salinity recovery process and the gas adjustment process are in another process. The feces are treated in a wet oxidation process in the feces and daily waste treatment subsystem, and the waste oxidized in the process is moreover treated in the catalytic wet oxidation process of the plant cultivation module in order to decompose organic components completely. Processes and major specifications of the waste management system are described.

Author (AIAA)

Closed Ecological Systems; Space Habitats; Urine; Waste Treatment; Oxidation; Drying

19980070086

An ideal design concept for Bioregenerative Life Support Systems

Takashima, Yas, Ichidai Nursery, Japan; Jul. 1997; In English

Report No.(s): SAE Paper 972522; Copyright; Avail: Aeroplus Dispatch

The implementation of Advanced Life Support Systems (ALSS) for missions of long duration is inevitable. Many research works have been conducted on systems which would eventually become part of an ALSS. However, when the actual integration takes place, compatibility of different systems may become another issue and require further research, redesign, and modifications to the hardware, controls, and its programs. An uncoordinated design process will result in a costly integration effort later. If a

main system with all possible integrations were adopted now, it would greatly reduce development costs and time. In the design of the subsystems, known parameters provided by researchers should be regarded. These subsystems can produce fermented foods, mushrooms, bean sprouts, escargot, radish, and vinegar. Ecologically balanced subsystems include heat and water recirculation systems and biofilters with microbes and other biomedical material. These systems should be ascertained and interfaced to the degree now possible. Most of these can share part of the environment given to the main vegetable production system, which will undoubtedly have a major role in regeneration, gas exchange via photosynthesis, and biofiltering through transpiration. The total system design must have a harmonious balance among all the subsystems while providing economical and technical advantages. The main focus of this paper is the feasibility of integrating many compatible systems with plant-growing machines which will most likely occupy the largest space and contribute most for the life support system. At the same time, we investigate adoptabilities of our Gravity Independent Fluid Transfer System (GIFTS) in operating other subsystems, as they all involve liquid transfer which is affected by gravitational changes.
Author (AIAA)
Closed Ecological Systems; Long Duration Space Flight; Systems Integration; Design to Cost; Vegetation Growth

19980070089
Thermal control design of the European Robotic Arm (ERA)
Boillot, Y., Fokker Space, Netherlands; Beere, G. I. M., ESTEC, Netherlands; Jul. 1997; In English
Report No.(s): SAE Paper 972526; Copyright; Avail: Aeroplus Dispatch

As part of the European contribution to the Russian segment of the International Space Station (ISS), the European Robotic Arm (ERA) is designed under contract from the European Space Agency by Fokker Space as the prime contractor. After the launch in 1999, ERA operations will first begin with the assembly of the Russian segment and then later continue with the routine tasks such as inspection, maintenance, freight handling, etc. The particularly challenging aspect of the ERA thermal design is to enable the ERA to operate under all possible, but wide, in-orbit thermal environmental conditions which are to be experienced throughout its 10-year life. These can be between the extreme cold conditions without sunlight for hibernation to the extreme hot conditions with the ERA operating in full sunlight in close vicinity to a large station item, for instance, the solar arrays. First, a short description of the ERA system is given; then, the thermal requirements and the main thermal design features are presented. Also, an overview of the thermal control design cases analysis is given. The design case definition is the outcome of a comprehensive analysis involving both the natural and the induced thermal environmental parameters. Attention is also drawn to the analysis tools which had to account for the fact that the thermal design was performed under the responsibility of different subcontractors. Finally, the ongoing verification and qualification program is briefly addressed.
Author (AIAA)
International Space Station; Robot Arms; Temperature Control; Control Systems Design

19980070096
Analysis procedure of heat modes for the Oxygen Generation System
Samsonov, Nicolay M., NIIKHIMMASH, Russia; Kurmazenko, Edward A., NIIKHIMMASH, Russia; Farafonov, Nicolay S., NIIKHIMMASH, Russia; Dokunin, Ivan V., NIIKHIMMASH, Russia; Gavrilov, Lev I., NIIKHIMMASH, Russia; Korolev, Vitaly P., NIIKHIMMASH, Russia; Proshkin, Vladimir Yu., NIIKHIMMASH, Russia; Sachkov, Roman Ju., NIIKHIMMASH, Russia; Jul. 1997; In English
Report No.(s): SAE Paper 972536; Copyright; Avail: Aeroplus Dispatch

This paper reviews one of the possible approaches to developing an analysis technique of the Oxygen Generation System (OGS) thermal conditions. The OGS, which is based on water electrolysis with forced KOH electrolyte circulation followed by separation of a gas/liquid mixture using hydrophobic porous membranes, has been in operation aboard Russia's Mir Space Station since 1986. The simulation consists of a 30-percent KOH water electrolysis system with forced electrolyte circulation through both electrolyzer chambers followed by separation of a gas/liqiud mixture using hydrophobic porous membranes. A formalized description of the key system components (an electrolyzer, set of coolers, separator, and canister) is presented. A mathematical model simulating the stationary and non-stationary thermal conditions of the system is constructed, and its computer programming is reviewed. Some results of computational and operational experiments obtained for checking the model adequacy are presented.
AIAA
Oxygen Production; Heat Transfer; Potassium Hydroxides; Electrolysis; Liquid-Gas Mixtures; Mir Space Station

19980070102
Stability and reliability of biological reactors
Strayer, Richard F., Dynamac Corp., USA; Finger, Barry W., Dynamac Corp., USA; Alazraki, Michael P., Dynamac Corp., USA;

Jul. 1997; In English
Report No.(s): SAE Paper 972549; Copyright; Avail: Aeroplus Dispatch

Bioregenerative resource recovery components for Advanced Life Support systems will need to be reliable and stable for long duration space travel. Since 1989, bioregenerative life support research at the ALS Breadboard Project has examined processing of inedible crop residues in bioreactors for recovery of nutrients for replenishment of crop hydroponic solutions. Bioreactor operation has been reliable, as demonstrated by continuous operation for up to 418 d with long periods of steady state conditions. Bioreactors have demonstrated stability following unplanned, nonlethal perturbations in pH, temperature, dissolved oxygen, and inedible residue supply. In each instance, a rapid return to steady state conditions was observed.
Author (AIAA)
Regeneration (Physiology); Life Support Systems; Biodegradation

19980070103
Regenerative water recovery system testing and model correlation
Supra, Laura N., AlliedSignal Aerospace, USA; Reddig, Mike, AlliedSignal Aerospace, USA; Edeen, Marybeth A., NASA Johnson Space Center, USA; Pickering, Karen D., NASA Johnson Space Center, USA; Packham, Nigel J. C., Lockheed Martin Corp., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972550; Copyright; Avail: Aeroplus Dispatch

Biological wastewater processing has been under investigation by AlliedSignal Aerospace and NASA/Johnson for future use in space. Testing in the Hybrid Regenerative Water Recovery System (HRWRS) in preparation for future closed human testing has been performed. Computer models have been developed to aid in the design of a new four-person immobilized cell bioreactor. The design of the reactor and validation of the computer model is presented. In addition, the total organic carbon (TOC) computer model has been expanded to begin investigation of nitrification. This model is being developed to identify the key parameters of the nitrification process, and to improve the design and operating conditions of nitrifying bioreactors. In addition, the model can be used as a design tool to rapidly predict the effects of changes in operational conditions and reactor design, significantly reducing the number and duration of experiments required.
Author (AIAA)
Regeneration (Physiology); Water Reclamation; Waste Water; Bioreactors

19980070104
Design and operation of laboratory-scale aerobic composters
Atkinson, Cheryl F., NRC, USA; Alazraki, Michael P., Dynamac Corp., USA; Loader, Colleen A., Dynamac Corp., USA; Sager, John C., NASA Kennedy Space Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972551; Copyright; Avail: Aeroplus Dispatch

Regenerative life support systems are under development to reduce the need for resupply of essential commodities during long duration space missions. If higher plants are used to supply food, oxygen, and potable water, composters could be used to stabilize solid wastes, provide CO2 and nutrients to the plants, and achieve pathogen reduction. Small-scale aerobic composting was used successfully to degrade organic compounds in inedible potato biomass. Soluble nutrients were extracted from the compost at concentrations that supported seed germination. Further work is indicated to understand the inhibitory effects of some leachates. Future composter designs should allow improved performance through better instrumentation and process control.
Author (AIAA)
Regeneration (Physiology); Life Support Systems; Solid Wastes

19980070105
Water analysis results from Phase II of the NASA Early Human Testing Initiative 30-day closed chamber test
Homan, Mark E., Krug Life Sciences, Inc., USA; Schultz, John R., Krug Life Sciences, Inc., USA; Sauer, Richard L., NASA Johnson Space Center, USA; Jul. 1997; In English
Report No.(s): SAE Paper 972555; Copyright; Avail: Aeroplus Dispatch

An important milestone in the ongoing effort by NASA to develop and refine closed-loop water recycling systems for human space flight was reached during the summer of 1996 with the successful completion of Phase II of the Lunar Mars Life Support Testing Program at Johnson Space Center. Part of Phase II involved testing a water-recycling system in a closed test chamber continuously occupied by four human subjects for 30 d. The Phase II crew began the test with a supply of water that had been processed and certified for human use. As the test progressed, humidity condensate, urine, and wastewater from personal hygiene and housekeeping activities were reclaimed and reused several times. Samples were collected from various points in the reclamation process during the 30-d test. The data verified the water-processing hardware can reliably remove wastewater contaminants and produce

reclaimed water that meets NASA standards for hygiene- and potable-quality water. This paper describes the methods used to analyze these samples, and the water-quality results.
Author (AIAA)
Water Treatment; Manned Space Flight; Manned Mars Missions

19980070106

Development status of the Mini Pressurized Logistics Module environmental control and life support subsystem and equipment

Mueller, R., Daimler-Benz Aerospace AG, Germany; Herber, N., Daimler-Benz Aerospace AG, Germany; Lucas, J., Daimler-Benz Aerospace AG, Germany; Laurini, D., ESTEC, Netherlands; Jul. 1997; In English
Report No.(s): SAE Paper 972556; Copyright; Avail: Aeroplus Dispatch

The Mini Pressurized Logistics Module (MPLM) is being developed as the Italian contribution to the International Space Station (ISS) Program. To improve the efficiency of European space programs, the Italian Space Agency (ASI) and ESA have decided to increase the commonality between the MPLM and the Columbus Orbital Facility (COF), the European laboratory contribution to the ISS. As a result, ASI will provide ESA a primary structure of the MPLM to be used as the primary structure for COF; in return ESA will provide to ASI the ECLS subsystem for the MPLM, which is a subset of the COF ECLS subsystem. This paper describes the functions of the MPLM ECLS subsystem, the analytical and developmental activities performed by the ECLS contractor, Daimler-Benz Aerospace Dornier GmbH, and the development status of the ECLS equipment.
Author (AIAA)
Pressurizing; Life Support Systems; International Space Station; Spacecraft Modules

19980070107

Hydraulic analysis of the MPLM cabin loop using the software tool ECOSIM

Forster, R., Daimler-Benz Aerospace AG, Germany; Eicher, L., Daimler-Benz Aerospace AG, Germany; Lucas, J., Daimler-Benz Aerospace AG, Germany; Mueller, R., Daimler-Benz Aerospace AG, Germany; Perez Vara, R., Empressarios Agrupados, Spain; Jul. 1997; In English
Report No.(s): SAE Paper 972557; Copyright; Avail: Aeroplus Dispatch

The Mini Pressurized Logistic Module (MPLM) of the International Space Station (ISS) is foreseen for the transport of service equipment, experiment racks, and service racks to the station. For the orbital operational phase it needs an ECLSS to make it commissionable for the astronauts. The Temperature and Humidity Control (THC) is supported by the Space Station via an Inter Module Ventilation Interface (IMV I/F). The MPLM ECLS has the requirement to suck revitalized air through the IMV I/F and mix it up with the recirculated air in order to provide a comfortable atmosphere in the MPLM habitable area. The fulfillment of the hydraulic and thermal requirements is verified by test and analysis. In this paper we provide the hydraulic analysis performed with ECOSIM, an ESA approved software tool. It is a software tool for steady state and transient simulations of complex thermo-hydraulic systems. From a library of ECLSS components like ducts, valves, fans, etc., a hydraulic network can be built up by connecting the components with each other. We present the application of the ECOSIM SNV tool for the simulation of the MPLM ECLS. The results of the simulation are verified with partly available test results.
Author (AIAA)
Pressurizing; Spacecraft Modules; International Space Station; Closed Ecological Systems; Environmental Control; Temperature Control

19980070108

Anaylsis of the MPLM pressure control function

Theurer, G., Daimler-Benz Aerospace AG, Germany; Eicher, L., Daimler-Benz Aerospace AG, Germany; Lucas, J., Daimler-Benz Aerospace AG, Germany; Jul. 1997; In English
Report No.(s): SAE Paper 972558; Copyright; Avail: Aeroplus Dispatch

The ECLSS for both the Mini Pressurized Logistics Module (MPLM) and the Attached Pressurized Module (APM) is being developed by Dornier. One of the main ECLSS functions to be realized is the atmosphere pressure control of the module. It includes the Cabin Depressurization, the Positive Pressure Relief, and the Negative Pressure Relief. In order to verify the functionality of the atmosphere pressure control system (ACS), analyses of different scenarios have to be performed. The analysis method, including the governing equations of the three ACS functions, is described. The analyses are performed with a Dornier-developed

software program that solves the set of equations numerically. The results of the analyses in terms of pressure and temperature transients are presented and discussed with respect to the boundary conditions and the influence of humidity.
Author (AIAA)
Pressurizing; Environmental Control; Life Support Systems; Atmospheric Pressure

19980070109
Updated systems for water recovery from humidity condensate and urine for the International Space Station
Samsonov, N. M., AO NIIKHIMMASH, Russia; Bobe, L. S., AO NIIKHIMMASH, Russia; Novikov, V. M., AO NIIKHIMMASH, Russia; Farafonov, N. S., AO NIIKHIMMASH, Russia; Pinsky, B. Ya., AO NIIKHIMMASH, Russia; Abramov, G. Kh., AO NIIKHIMMASH, Russia; Berezkin, S. V., AO NIIKHIMMASH, Russia; Grigorov, E. I., RSC Energia, Russia; Zaitsev, E. N., RSC Energia, Russia; Protasov, N. N., RSC Energia, Russia; Jul. 1997; In English
Report No.(s): SAE Paper 972559; Copyright; Avail: Aeroplus Dispatch

At the initial phase of the construction of the International Space Station (ISS) water supply will be provided by the systems located in the Russian segment. The paper reviews the systems for water recovery from humidity condensate and urine to be incorporated in the Russian segment of the ISS. The similar systems have been successfully operated on the Mir space station. The updates aim at enhancing system cost-effectiveness and reliability. The system for water recovery from humidity condensate (WRS-C) features an added assembly for the removal of organic contaminants to be catalytically oxidized in an air/liquid flow at ambient temperature and pressure. The system for water reclamation from urine (WRS-U) incorporates a new distillation subsystem based on vacuum distillation with a multistage rotary distiller and a vapor compression or thermoelectric heat pump. The updating of the WRS-C system will enable an increase in the multifiltration bed's life at least twofold. As regards the updating of the WRS-U system, its production rate will be increased by a factor of 10, and energy demand reduced by a factor of 10 as well.
Author (AIAA)
Water Reclamation; Humidity; Condensates; Urine; International Space Station

19980070110
Integrated CO2 and humidity control by membrane gas absorption
Jacobs, P., Stork Engineering Consultancy, Netherlands; Paul, P. G., Stork Engineering Consultancy, Netherlands; Feron, P. H. M., TNO-MEP, Netherlands; Savage, C. J., ESTEC, Netherlands; Witt, J., ESTEC, Netherlands; Jul. 1997; In English
Report No.(s): SAE Paper 972560; Copyright; Avail: Aeroplus Dispatch

In a harmonized ESA/NIVR project, the performance of membrane gas absorption for the simultaneous removal of CO2 and moisture has been determined experimentally at CO2 and humidity concentration levels representative for spacecraft conditions. Performance data at several experimental conditions have been collected. Removal of moisture can be controlled by the temperature of the absorption liquid. Removal of CO2 is slightly affected by the temperature of the absorption liquid. Based on these measurements, a conceptual design for a CO2 and humidity control system for the Crew Transport Vehicle (CTV) is made. For the regeneration step in this design a number of assumptions have been made. The multifunctionality of membrane gas absorption makes it possible to combine a number of functions in one compact system. This advantage is demonstrated by comparing the total mass and volume demands of the present CTV ECLSS system design, respectively 522 kg and 1747 l, with the MGA conceptual design. NIGA replaces the Condensing Heat Exchanger, LiOH cartridges, the Water Evaporator Assembly and several water storage tanks. Therefore, volume and mass reductions of respectively 28 and 25 percent can be obtained.
Author (AIAA)
Humidity; Carbon Dioxide Removal; Absorbers (Equipment)

19980070111
O2 generation - A key system for extended manned space missions
Funke, Helmut, Daimler-Benz Aerospace AG, Germany; Tan, Gijsbert, ESTEC, Netherlands; Friedrichs, Dietmar, DARA, Germany; Jung, Karl O., DARA, Germany; Jul. 1997; In English
Report No.(s): SAE Paper 972561; Copyright; Avail: Aeroplus Dispatch

The on-board production of oxygen is demanded for future long-term missions such as International Space Station, lunar base, and missions to Mars. The needed oxygen can be recovered by electrolyzing the water produced by the carbon dioxide processing system or other on-board water sources like water condensate. This way the oxygen loop will be closed. Since 1985 in a harmonized program sponsored by ESA and the German Space Agency (DARA), the required technology for an air revitalization system (ARS) is being developed. The system is based on carbon dioxide concentration using solid amine water steam desorption,

carbon dioxide hydrogenation (Sabatier) and fixed alkaline electrolysis. This paper reports on the manufacturing and testing of the fixed alkaline electrolyser system designed for a three-person capability, and it discusses the current status of the ARS.
Author (AIAA)
Oxygen Production; Long Duration Space Flight

19980070113
Temperature control analysis for the U.S. Lab, Node 1, and elements attached to Node 1
von Jouanne, Roger G., Boeing Co., USA; Barker, Robert S., Boeing Co., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972564; Copyright; Avail: Aeroplus Dispatch

The International Space Station (ISS) Temperature and Humidity Control (THC) system has been designed with the intent of supplying the air cooling needs of various elements from the U.S. Lab heat exchanger assembly. Elements without independent air cooling capability are known as 'parasitic' elements; these are Node 1, the Cupola, and the Mini Pressurized Logistics Module (MPLM). Analysis results are presented which show expected temperatures in the MPLM, and Node 1, as various heat loads are present in the respective elements. Analyses within this paper are coordinated with the results obtained from the Development Test of the complex USL/Node 1 integrated ducting system. The test results indicate that when one USL heat exchanger assembly is operating, the air flow rates provided to the parasitic environments are lower than necessary to accomplish satisfactory cooling under high parasitic heat load conditions. Operating in the 'Enhanced Mode', wherein the second cabin air fan is also activated, is shown to result in acceptable cooling for the parasitic elements under all conditions.
Author (AIAA)
Temperature Control; International Space Station; Humidity; Pressurizing; Spacecraft Modules; Logistics

19980070114
Space Station THC/IMV development test/analysis correlations and flight predictions
Barker, Robert S., Boeing Co., USA; von Jouanne, Roger G., Boeing Co., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972565; Copyright; Avail: Aeroplus Dispatch

The International Space Station (ISS) Temperature and Humidity Control/Intermodule Ventilation (THC/IMV) system for the U.S. Lab provides required cooling air for the U.S. Lab and also provides 'parasitic' cooling air for Node 1 and its attached elements. This scheme provides cooled air from the Lab THC directly to Node 1 and also to elements attached to Node 1, at different stages of Space Station assembly. An analytical model has been developed, which has been used to predict flow and pressure drop performance of the system for several potential and actual changes from the Development Test configuration. Flight configuration versions of the model have been prepared. This paper presents correlations of test data and predictions of flight performance incorporating changes in hardware and changes in operating conditions. The Development Test results and further analytic evaluations have revealed that there is a need for more cooling air flow to the Cupola than was provided by the tested development THC/IMV system. It has been determined that by isolating the port and starboard THC supply air duct strings from each other and operating both common cabin air asemblies, this deficit in cooling air for the Cupola can be overcome.
Author (AIAA)
International Space Station; Temperature Control; Humidity; Ventilation; Flight Tests

19980070115
Comparison of Mated Air Interchange System performance model results and Mir missions flight data
Tsai, Ching-Fen, Boeing North America, Inc., USA; Duong, Kenneth N., Boeing North America, Inc., USA; Jul. 1997; In English
Report No.(s): SAE Paper 972567; Copyright; Avail: Aeroplus Dispatch

A multi-element fixed control volume air interchange system performance computer model was developed and upgraded for the evaluation of atmospheric characteristics inside each habitable volume on the mated Orbiter/Mir Station. The results from this computer model has been utilized to assess and determine the Orbiter airflow supply capabilities, and to develop mated air interchange system design limitations and requirements. The results from this performance model were also used to predict possible air interchange system operating constraints, such as occupancy limitations in each chamber, during the Orbiter/Mir-Station docking mission. In order to verify the validity of the simulated computer model results, several post-Mir missions flight data were obtained and compared. Based on the results of comparison between model results and post flight data, it is concluded that this model can provide an acceptable and reasonable atmosphere prediction and evaluation for assessing all the habitable volumes inside the mated Orbiter/Mir-Station.
Author (AIAA)
Mir Space Station; Air Flow; Spacecraft Docking; Computer Techniques; Space Shuttle Orbiters

19980070285

Analysing pilot error

Howard, Ron, UK; Aerospace International; Oct. 1997; ISSN 0305-0831; Volume 24,, no. 10, pp. 28-30; In English; Copyright; Avail: Aeroplus Dispatch

An evaluation is conducted of the possibility that air transport safety requirements have outstripped human flight deck-management capabilities, or that, alternatively, the traditional reliability-with-redundancy means of achieving high safety levels are not being satisfactorily applied. It is noted that investigations frequently put more weight on the discovery of an accident's prime causes than why they were not prevented by provisions already incorporated.

AIAA

Flight Safety; Mtbf; Pilot Error; Error Analysis

19980070769

Measuring helmet and helmet mounted display displacement under sustained acceleration

Esken, Robert L., Jr., USAF, Armstrong Lab., USA; SAFE Journal; Aug. 1997; ISSN 0191-6319; Volume 27, no. 3, pp. 192-195; In English; Copyright; Avail: Aeroplus Dispatch

Selection and development of a reliable motion capture system and procedure that can be used under high G exposure within the Dynamic Environment Simulator centrifuge has been a challenge. Current helmet mounted display (HMD) testing at high G uses a novel motion capture procedure and shows helmet displacement relative to the pilot's eye. This helmet platform displacement can now be measured to within +/-0.5 mm during high G exposure. This measurement system has also provided test results that have influenced helmet liner selection and design to stabilize the helmet, reduce helmet slippage, and assure HMD stability during high G air-to-air combat maneuvers.

Author (AIAA)

Helmet Mounted Displays; Helmets; Displacement Measurement; High Gravity Environments; Environment Simulation; Systems Stability

19980070807

SAFE Association, Annual Symposium, 35th, Phoenix, AZ, Sept. 8-10, 1997, Proceedings

1997; In English; Copyright; Avail: Aeroplus Dispatch

The present conference discusses B-2 aircrew seat cushion development, potential brain pathologies from repeated +Gz exposure, safe disposal of energetic materials, the features of the 16SL high performance ejection seat, inflatable aerostabilizers for ejection seats, laser-initiated ordnance systems for crew escape, a spinal-related criterion for ejection-seat design, helmet-mounted display stability during +Gz exposure, force-dependent parachute inflation control, and anthropometry in naval aviation. Also discussed are the modeling of human neck response to vertical impact, rocket motor quality assessment for aircrew escape applications, anthropometric accommodation in training aircraft, occupant safety simulations for interior design, a virtual horizon altitude warning system, extended exposure capability after rapid decompression at 60,000 ft altitude, oxygen mask construction using CAD/CAM, and a mishap data evaluation for naval aircraft in the 1987-1996 period.

AIAA

Conferences; Aerospace Safety; Flight Safety

19980070813

Report on the Optimized Mach Number Immune sequencer

Peck, Walter R., LME, Inc., USA; 1997, pp. 46-53; In English; Copyright; Avail: Aeroplus Dispatch

The Optimized Mach Number Immune (OMNI) sequencer has several unique features which have been investigated using pitot pressures and base/beam pressures recorded during several ejection seat flight and track tests. The OMNI sequencer provides optimum timing of parachute deployment for all airspeeds, for all ejectee weights, and for all ambient temperatures at any altitude and Mach number, based upon actual recovery parachute system test data. It also provides protection against blockage of either or both of the Pitot tubes. It can be tied into the host aircraft air data computer via the 1553 data bus for an automatic ejection signal, for a low or moderate ejection risk signal, and for a Mach number signal to back up the Mach number sensing of the sequencer. A test prototype unit has been built that is suitable for testing in flight or in track-ejection seat tests.

Author (AIAA)

Immune Systems; Aircraft Pilots; Ejection Seats; Recovery Parachutes; Mach Number

19980070816

The effects of aircraft transparencies on night vision goggle-mediated visual acuity

Pinkus, Alan, USAF, Armstrong Lab., USA; Task, H. L., USAF, Armstrong Lab., USA; 1997, pp. 93-104; In English; Copyright; Avail: Aeroplus Dispatch

Night vision goggles (NVGs) are currently used in a wide variety of military aircraft that were not originally designed for NVGs. Likewise, the windscreens and canopies on these aircraft were not designed with NVGs in mind. Present day windscreens and canopies typically have one or more specialized coatings applied to them. These may be reasonably transparent for visible wavelengths but not so transparent for near-IR light to which the NVGs are sensitive. The major mechanism by which aircraft transparencies affect the operation of NVGs is through reduced light levels; transmission coefficients should be calculated using the spectral sensitivity of the NVGs. This hypothesis was tested by investigating visual acuity performance of trained observers viewing through NVGs for three levels of ambient illumination and three levels of NVG-weighted windscreen transmissivities. In addition, two levels of contrast were included in the study. A luminance-based model was developed to smoothly combine the effects of illumination level and transmission level for each contrast, thus supporting the hypothesis. The results demonstrate the significant difference between individual observer's performance level and the increased difficulty (higher variability) of performance at lower contrast levels.

Author (AIAA)

Military Aircraft; Night Vision; Goggles; Visual Acuity; Illumination

19980070819

Methodology for accurate flow measurement at sub-atmospheric pressures

Siskowski, Bruce E., Carleton Technologies, USA; Maloney, David C., Carleton Technologies, USA; 1997, pp. 123-129; In English; Copyright; Avail: Aeroplus Dispatch

The life support community regularly tests components such as pressure regulators and various types of valves for performance at subatmospheric pressures to simulate actual use at altitude. More specifically, flow performance is a key test parameter typically because the devices are required to satisfy a wide range of steady state and dynamic flow demands. We have investigated a diversified group of flow measurement techniques to support our hardware production. We present empirical data showing that past assumptions and test methods associated with the use of laminar flow sensing devices at various ambient pressures are flawed. An attempt is made to explain the underlying physical phenomenon, and the methods that users of laminar flow elements must observe to ensure accurate, repeatable flow measurement.

Author (AIAA)

Laminar Flow; Flow Measurement; Pressure Regulators; Flowmeters; Pressure Drop

19980070820

Laser initiated ordnance systems for crew escape - A cooperative approach

Blachowski, Tom, U.S. Navy, Naval Surface Warfare Center, USA; Porter, Stephen, Ensign-Bickford Co., USA; 1997, pp. 130-138; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents the status of a Cooperative Research and Development Agreement (CRADA), an ongoing effort to promote and enhance the laser-initiated ordnance (LIO) technology database available to the aircraft crew escape community. LIO systems offer potential size and weight advantages over current signal transfer systems, in addition to inherent immunity to EMI. Presently, this CRADA is focused on the environmental testing of the fiber optic transmission line portion of a LIO system. Follow-on efforts proposed include investigation of the optical initiators and detonators required to function the escape system CAD/PAD work-performing devices. The Indian Head Division, Naval Surface Warfare Center has been active in laser ignitability studies, design, development, and testing of the Laser Initiated Transfer Energy Subsystem. This subsystem comprises a laser signal generator, fiber optic transmission lines, and optical initiators and detonators required for use by the aircrew emergency escape system.

Author (AIAA)

Flight Crews; Fuses (Ordnance); Escape Systems; Semiconductor Lasers; Fiber Optics; Performance Tests

19980070822

Establishing a spinal injury criterion for military seats

Rapaport, Martin, U.S. Navy, Naval Air Warfare Center, USA; Forster, Estrella, U.S. Navy, Naval Air Warfare Center, USA; Schoenbeck, Ann, U.S. Navy, Naval Air Warfare Center, USA; Domzalski, Leon, ARCCA, Inc., USA; 1997, pp. 156-164; In English; Copyright; Avail: Aeroplus Dispatch

Currently, military specifications require use of an acceleration-time criterion to assess the physiological acceptability of crash resistant seats and restraint systems. With the evolution of crash test dummies which now exhibit greater biofidelic performance, military researchers are considering 'direct force' measurements taken within the Hybrid III anthropomorphic test device as an alternative evaluation criterion. The FAA recently established such a criterion as part of a new dynamic test requirement for the certification of airline passenger seats. Prior to military triservice implementation of a similar requirement, validation of the methodolgy with the 'aerospace' model of the Hybrid III manikin was necessary. This paper describes the test program conducted with Hybrid III crash test dummies to establish a lumbar spinal load injury criterion for military crash resistant seat compliance testing. Dynamic testing was conducted on the Horizontal Accelerator Facility at the Naval Air Warfare Center. Sufficient data was acquired to conduct a statistical analysis of the Hybrid III's lumbar spine response to compressive loading (i.e., +Gz headward direction). The analysis supports the recommendation to employ lumbar force as a primary physiological criterion for military crash resistant seat compliance.
Author (AIAA)
Spinal Cord; Ejection Injuries; Ejection Seats; Military Technology; Crash Injuries; Test Facilities

19980070823
Priority one: Survival. II - Navy state-of-the-art survival item update
Jaffee, Michael, U.S. Navy, Naval Air Warfare Center, USA; Coughlin, Rich, U.S. Navy, Naval Air Warfare Center, USA; Moore, Brev, LME, Inc., USA; 1997, pp. 165-175; In English; Copyright; Avail: Aeroplus Dispatch

The 'state-of-the-art' program at the Naval Air Warfare Center (Patuxent River) is an R&D effort that identifies the requirements for a mission through fleet-generated deficiencies. The result is replacement of survival items that are usually nondevelopmental items in nature and that are introduced after fleet assessment. We address findings now that the database has matured, and attempt to broaden the discussion regarding this important issue. Military as well as civilian usage of survival items are addressed, as well as the priority items for different aircraft, environments, military services and countries. Military and civilian survival handbooks and other literature are included in the presentation.
Author (AIAA)
Military Aircraft; Survival; Technology Assessment; Research and Development; Data Bases

19980070826
Interaction between computer models of face and mask
Shams, T., GESAC, Inc., USA; Zhao, Y., GESAC, Inc., USA; Fullerton, J., GESAC, Inc., USA; Rangarajan, N., GESAC, Inc., USA; Cohen, K., U.S. Army, Research Lab., USA; 1997, pp. 196-208; In English; Copyright; Avail: Aeroplus Dispatch

In order for a mask to provide maximum protection to a soldier, it is important that a good seal be achieved between his face and the mask. In current Army mask designs, sealing is achieved by tightening the straps that are attached to the mask. In addition to achieving a proper fit (seal), it is also necessary to make the mask comfortable to wear. This dual requirement implies that a mask seal should conform closely to the underlying facial structure. The traditional process of testing the design of a mask using volunteers can quickly become very complex if size issues are introduced in the testing procedure. We examined the feasibility of developing an automated procedure for designing, testing and manufacturing masks. We attempted to integrate various elements of computer modeling, digitization, CAD technologies and FEM modeling technology, in order to develop a method to evaluate the fit of a mask seal about a human head form. We describe our initial efforts in the development of such a procedure using a standard M40 mask and a Hybrid III dummy head.
Author (AIAA)
Face (Anatomy); Computerized Simulation; Biological Models (Mathematics); Masks; Protectors; Flight Crews

19980070828
Helmet mounted display stability during +Gz exposure
Maoz, Tal, Elbit Systems, Ltd., Israel; 1997, pp. 220-227; In English; Copyright; Avail: Aeroplus Dispatch

The Display and Sight Helmet (DASH) achieves improved stability in the high +Gz environment by means of a well balanced helmet and a tight personal fit to the pilot's head. Several types of personal fit liners and retention straps are being used in the DASH to provide the required fit. The DASH stability during +Gz exposure was successfully verified in a centrifuge. Test subjects wearing several configurations of the DASH with and without Pressure Breathing for G schedule, were exposed to moderate and high +Gz levels, up to +9Gz, and evaluated the comfort and stability of the DASH. Objective as well as subjective data was collected about the helmet comfort and stability. The data collected and the conclusions will be implemented in ongoing programs as well

as in future helmet mounted display activities. This article details the procedures, results and conclusions of the DASH centrifuge evaluation.
Author (AIAA)
Helmet Mounted Displays; Systems Stability; High Gravity Environments; Aircraft Pilots; Human Centrifuges; Eye (Anatomy)

19980070834
Development of an integrated ejection seat/crewmember model
Ma, Deren, Systems Research Labs., USA; Rizer, Annette L., Systems Research Labs., USA; Obergefell, Louise A., USAF, USA; Rogers, Lawrence C., USAF, USA; 1997, pp. 284-292; In English; Copyright; Avail: Aeroplus Dispatch

Ejection seat dynamic characteristics are essential concerns for evaluating ejection systems. Because the crewmember's weight is the same order of magnitude as the ejection seat, his dynamic response during ejection directly affects performance. to assess the ejection seat/crewmember system, an ejection seat model has been coupled with an occupant model, the Articulated Total Body (ATB) model. The integrated ejection seat/crewmember model consists of four modules. The seat module determines the seat motion based on seat inertial properties, and forces and moments acting on the seat. The ATB crewmember module calculates the crewmember biodynamic responses based on the seat motion, body segment physical properties, contact properties, and restraint system. An interface module coordinates the data transfer between the two modules. The seat motion is transferred to the crewmember module that uses it for calculating the crewmember's biodynamics. Meanwhile, the forces and moments acting on the seat by the crewmember and restraint system are sent to the seat module and used to determine seat dynamics. An output module provides simulation results. The model successfully predicts the major features of the ejection seat motion and the crewmember biodynamic responses.
Author (AIAA)
Ejection Seats; Systems Integration; Flight Crews; Biological Models (Mathematics); Ejection Injuries; Biodynamics

19980070835
Data to design - Anthropometry in naval aviation
Tucker, Heather D., U.S. Navy, Naval Air Warfare Center, USA; Todd, Wendy L., U.S. Navy, Naval Air Warfare Center, USA; Kennedy, Greg, U.S. Navy, Naval Air Warfare Center, USA; 1997, pp. 304-310; In English; Copyright; Avail: Aeroplus Dispatch

The design of many aircrew systems depends on anthropometry, or the measurement of the human body's dimensions; inefficient traditional methods are being replaced by newer methods including multivariate statistical database derivation and digital measuring technologies. These data can be manipulated by various computer software applications to study, model, design, and prototype what naval aviators wear, and digitally quantify their accommodation within a crewstation. This paper discusses two new, statistically derived, anthropometric databases and their application in the reengineering design of naval aircraft crewstations and aircrew life support systems (ALSS); cockpit accommodation modeling and analysis using the CAD based, FaroArm portable coordinate measuring machine; ALSS design, sizing, and prototyping using whole body-scanning technology with CAD/CAM applications; and the potential for design integration of what the pilot wears with the crewstation in which he wears it.
Author (AIAA)
Flight Crews; Anthropometry; Human Body; Biological Models (Mathematics); Cockpits; Computer Aided Design

19980070838
Modeling of human neck response to vertical impact
Anderson, Beth, Systems Research Labs., Inc., USA; Rizer, Annette, Systems Research Labs., Inc., USA; Perry, Chris, USAF, Armstrong Lab., USA; Obergefell, Louise, USAF, Armstrong Lab., USA; Ziejewski, Mariusz, North Dakota State Univ., Fargo; 1997, pp. 328-335; In English; Copyright; Avail: Aeroplus Dispatch

Biodynamic models such as the Articulated Total Body (ATB) program are very useful tools in predicting human body response and providing injury assessment in different dynamic environments. In the ATB model, the upper torso/neck and neck/head connections are typically modeled as ball/socket joints, with a rigid segment representing the neck. Improved prediction of the head/neck response has been previously achieved by adding a slip joint/spring-damper system to the upper torso/neck joint. However, this model did not allow enough rotation of the head and neck. The focus of this study was to improve the existing slip joint neck model's prediction capability for head/neck rotation. Measured acceleration data from human volunteer tests were used for comparison with ATB simulation results. The joint characteristics of the model were adjusted until the predicted and experimental linear and angular head accelerations were in good agreement. Additional tests were simulated by changing the impact

test parameters while keeping the joint characteristics constant. The results of these simulations compared well with the impact tests in which the volunteer's neck and head rotated forward.
Author (AIAA)
Human Body; Neck (Anatomy); Impact Loads; Vertical Orientation; Helmet Mounted Displays; Biological Models (Mathematics)

19980070839
Anthropometric sizing and patterning of the new Eagle G-suit (CSU-20/P)
Bradtmiller, Bruce, Anthropology Research Project, Inc., USA; Capecci, Tara, STV Group, USA; 1997, pp. 336-343; In English; Copyright; Avail: Aeroplus Dispatch

The previous prototypes of the Eagle G-Suit had a number of problems in size and fit. Specifically, a large portion of the population fits into a single size, while only a few individuals fell into the remaining sizes. Further, many individuals could wear several sizes equally well. Clearly, this sizing system did not optimize fit, comfort, or functionality of this critical piece of protective clothing. Our approach to this problem was to first optimize the sizing. We made use of the significant adjustability of the garment to improve garment fit as well as reduce the number of sizes. Calculating the amount of adjustability at the waist, the hip, and down the legs allowed us to determine that two widths and two lengths (four sizes total) would accommodate the entire male flyer population. Second, we created a pattern mockup for a Large-Long test subject. The pattern was adjusted until the test subject was able to get an ideal fit. The pattern was then adapted to accommodate the body sizes of all the other subjects in the same sizing category, and a base pattern for the Large-Long was created. The base pattern was graded to create the other sizes, using anthropometric data to guide the grade.
Author (AIAA)
Anthropometry; Size (Dimensions); Protective Clothing; Patterns; Sizing

19980070841
The Swedish Tactical Flight Combat Suit is approved for production
Landervik, Bengt, Defence Materiel Administration, Sweden; 1997, pp. 356-361; In English; Copyright; Avail: Aeroplus Dispatch

The Tactical Flight Combat Suit (TFCS) developed by the Swedish Defence Materiel Administration has as its main components (1) underwear (2) flight boots (3) immersion suit (4) flight suit (5) full coverage anti-G suit, (6) flight jacket, (7) flight helmet with oxygen mask, and (8) biological/chemical protection system. The TFCS ensemble is designed to be used in the JAS 39 Gripen fighter, which is equipped with a Martin Baker MK 10LS ejection seat and EROS oxygen regulator/anti-G valve. The design has just been finalized and approved for production.
Author (AIAA)
Fighter Aircraft; Protective Clothing; Helmets; Flight Tests

19980070843
Anthropometric accommodation in training aircraft
Zehner, Gregory, USAF, Armstrong Lab., USA; Hudson, Jeffrey A., Sytronics, Inc., USA; Ivey, Larry, USAF, Aeronautical Systems Center, USA; Anderson, Jenny, USAF, Air Education and Training Command, USA; Kennedy, Kenneth; 1997, pp. 373-379; In English; Copyright; Avail: Aeroplus Dispatch

With the procurement of the Joint Primary Aircraft Training System (JPATS) and its eventual introduction into the USAF and USN inventories, it will be possible to train pilots whose body sizes are considerably smaller than ever before. The USAF is now considering expanding the body size entrance requirements for Undergraduate Pilot Training (UPT) (AFI 48-123) in order to take advantage of the increased accommodation offered by the JPATS aircraft and to provide equal access to flight training for both male and female pilot candidates. During the procurement process for new aircraft, measurements are taken to determine if an aircraft meets the specifications set by the USAF. Measurements are not taken, however, to determine the absolute limits of body size accommodation. We have started a research project to quantify the smallest and largest people that can safely and efficiently operate all types of USAF aircraft now in use. Only preliminary data on training aircraft are available at this time. The user command must define operational requirements, which determine pass/fail criteria for being safely accommodated in the aircraft.
Author (AIAA)
Anthropometry; Training Aircraft; Pilot Training; Flight Training; Size Determination; Cockpits

19980070844

NACES drogue parachute service life-extension evaluation program

Hunter, Richard W., U.S. Navy, Weapons Div., USA; 1997, pp. 380-389; In English; Copyright; Avail: Aeroplus Dispatch

The current need is to reduce life-cycle and maintenance costs of naval equipment without compromising its reliability. The latter is particularly true for emergency egress equipment, such as parachutes where failure is life-threatening. The NACES drogue parachute is pressure-packed in a sealed container that shelters it from the environment. Reducing the life-cycle costs of the parachute by extending its service life should be a minimum risk effort. For this reason, a program was performed to evaluate the feasibility of extending the parachute's service life. Evaluation of the data indicated that the service life of the packed parachute could be safely extended from 6-8 years. The serial number of the container and the serial number of the parachute are not related. The service life of the container is not controlled, and the user cannot determine the parachute serial number without unpacking the parachute. The results show an excessive amount of data scatter between testing facilities. This scatter results from the variety of test methods used and the inherent variable nature of textile materials.

Author (AIAA)

Flight Crews; Ejection Seats; Life Cycle Costs; Parachutes; Test Facilities; Fracture Strength

19980070845

Occupant safety simulations for interior design

Aljundi, Bachar, TNO-MADYMO North America, USA; Skidmore, Mark, TNO-MADYMO North America, USA; Poeze, Erwin, TNO Crash Safety Research Center, Netherlands; Slaats, Paul, TNO Crash Safety Research Center, Netherlands; 1997, pp. 390-404; In English; Copyright; Avail: Aeroplus Dispatch

Both acceptable occupant survivability and a more economical product can be achieved via efficient restraint system which can control the occupant motion. Innovative occupant-restraint system are being developed to meet increasing economic and occupant safety design needs. Also, interior components can be used to play an important role as a part of integrated occupant-restraint system. Seats and bulkheads in aircraft and knee bolsters in cars are some of the interior component which play detrimental role in occupant-safety design. As the occupant safety design process becomes more complex due to the higher number of elements involved (restraint system, interior components, etc.), finding an optimized and safe design through testing alone is no longer a productive approach. Numerical simulation with limited testing for validation has become the leading approach to reach a safe and optimized design. This paper gives an overview of the possibilities to use numerical simulations to optimize the different restraint systems and interior components that play a role in crash safety. Crash analysis software allows the designer to study effects of component variations and supports decisions on the application of certain safety features.

Author (AIAA)

Transport Vehicles; Structural Design; Safety Factors; Crashworthiness; Impact Loads; Seats

19980070846

Virtual horizon altitude warning system

Stevens, David E., Arnold Engineering Development Center, USA; 1997, pp. 405-416; In English; Copyright; Avail: Aeroplus Dispatch

Controlled flight into ground, particularly during reduced visibility, continues despite sophisticated displays and ground proximity warning devices; this could be because the pilot is not aware of the warning, not aware of its urgency, or has insufficient time to react. Current warnings must be visually or aurally detected, perceived and then cognitively interpreted. If the warning is not sufficiently compelling, it may be heard or seen but not perceived. Even if the warning is perceived, it may come too late. The Virtual Horizon Altitude Warning System concept uses the projection of a virtual horizon in the cockpit. This artificial horizon is superimposed over the position of the actual horizon. In addition to the pitch and roll display capability of the virtual horizon, a representation of elevation is added. During poor visibility or darkness, the elevation and rate of movement of the virtual horizon parallels that of the real horizon, subconsciously providing the pilot with descent rate and ground proximity cues. In extremis, the rate of elevation of the virtual horizon can be exaggerated to trigger a reflexive ground rush reaction in the pilot as a reflexive warning.

Author (AIAA)

Aircraft Accidents; Horizontal Orientation; Disorientation; Space Perception; Flight Control

19980070847

Helicopter Aircrew Underwater Breathing Device SRU-40/P

Gierbolini, Luis A., U.S. Navy, Naval Air Warfare Center, USA; Wensel, Janice, U.S. Navy, Naval Air Warfare Center, USA; 1997, pp. 417-424; In English; Copyright; Avail: Aeroplus Dispatch

The Helicopter Aircrew Underwater Breathing Device, SRU-40/P, is a compact, lightweight breathing assembly designed for emergency use by helicopter, E-2 and C-2 aircrew in the event of a crash landing in water ('ditching'). The SRU-40/P provides emergency breathing air on demand to aid in a safe egress from a submerged aircraft. The device provides 1-3 min of breathing air depending upon the depth underwater, water temperature, and the individual using the device. The SRU-40/P is commonly known as the Helicopter Emergency Egress Device. A general illustration of the SRU-40/P mounted on a SV-2 is provided. The SRU-40/P will be replacing a similar device, the SRU-36/P, which has been operational in the USN since 1986 and was the first such system introduced into the Navy helicopter community.
Author (AIAA)
Flight Crews; Helicopters; Underwater Breathing Apparatus; Emergencies; Crash Landing; Performance Tests

19980070848
Impact of recent altitude physiology research on design of cockpit pressurization systems
Webb, James T., Krug Life Sciences, Inc., USA; Pilmanis, Andrew A., USAF, Armstrong Lab., USA; 1997, pp. 425-430; In English
Contract(s)/Grant(s): F33615-92-C-0018; Copyright; Avail: Aeroplus Dispatch
The U-2 exposes the pilot to a cockpit altitude of approximately 30,000 ft with a 3.8 psid pressurization system. Approximately 70 percent of U-2 pilots reported that decompression sickness (DCS) occurred during their nine-hour missions at this altitude. Design of the F-22 pressurization system was based on previous fighter aircraft systems which maintain 5.0 psi differential pressure above 23,000 ft. Unfortunately, the 60,000 ft planned cruise capability of the F-22 places the pilot at 22,500 ft. The recently-reported threshold for DCS while breathing 100 percent oxygen is approximately 21,000 ft. The threshold altitude implies a need for greater cockpit differential pressure for the F-22 and reinforces the need for breathing 100 percent oxygen prior to and including the high altitude portions of the flight profile. Increasing the cockpit differential pressure to keep the pilot at less than 21,000 ft would eliminate the vast majority of DCS cases. Breathing 100 percent oxygen during this period would provide additional protection from hypoxia in the event of unexpected rapid decompression. Another recent finding indicates that denitrogenation by breathing 100 percent oxygen at altitudes up to 16,000 ft is as effective as ground-level prebreathing. In addition, gas emboli formation at 16,000 ft is lower than at higher altitudes.
Author (AIAA)
Flight Altitude; Cockpits; Pressurized Cabins; Structural Design; Aircraft Pilots; Physiological Responses

19980070850
Custom oxygen mask construction using computer assisted design and manufacturing (CAD/CAM) technologies
Diesel, Donald A., USAF, Armstrong Lab., USA; White, Curtis D., USAF, Armstrong Lab., USA; Chen, Yasu T., USAF, Armstrong Lab., USA; Self, Brian P., USAF, Armstrong Lab., USA; Zhou, Joe Y., Krug Life Sciences, Inc., USA; 1997, pp. 437-441; In English; Copyright; Avail: Aeroplus Dispatch
Production of custom oxygen masks for military aviation is a time-consuming, labor-intensive process. The use of digitized anthropometric data to produce custom masks through CAD/CAM technologies has been evaluated; success criteria include rapid production of a comfortable mask which will maintain 60 mmHg positive breathing pressure at acceleration forces of up to +9 Gz. A preliminary study revealed that custom mask design based on static facial surface scans is not optimum and requires modification to provide a seal during the dynamic conditions of flight. A device was invented to replicate facial geometry while simulating soft tissue deformation incurred by the compression required for mask seal. The resulting surface geometry is digitized using a laser surface scanner. The custom seal portion of the mask facepiece (i.e., the mask-face contact surface) is then merged with a standard mask design to form the custom mask computer model. This CAD model is used to build a mask hard-shell and a four-piece mold for the mask face piece (soft shell) by means of a rapid prototyping system called Fused Deposition Modeling. The face piece is then injection molded using silicone rubber. Functional masks have been built in both the MBU-20/P and MBU- 12/P design.
Author (AIAA)
Military Aircraft; Oxygen Masks; Computer Aided Design; Computer Aided Manufacturing; Flight Conditions

19980070852
A comparison of human and ejection seat test manikin static centers of gravity and moments of inertia
Albery, Christopher B., Systems Research Labs., USA; Bjorn, Valerie S., U.S. Naval Air Warfare Center Liaison, USA; Schultz, Rebecca B., USAF, Armstrong Lab., USA; 1997, pp. 452-464; In English; Copyright; Avail: Aeroplus Dispatch
Regardless of specific design differences, all manikins used for ejection seat testing mimic humans in ejection seats. We compare one key characteristic between manikins and humans, the static mass properties. to do this, a broad selection of ejection

seat test manikins (from the 1960s through today) was measured for Centers of Gravity (CG), Mass Moments of Inertia (MOI), and weight. In the measurement procedure, each manikin was seated and secured in an orthogonal, light alloy chair. The CG and MOIs were measured about the three cardinal axes (x, y, and z), and MOIs were also measured about the three noncardinal axes (xy, yz, and xz). The properties of the chair were subtracted to determine each manikin's mass properties alone in a seated position. These manikin data were then plotted against human data collected using identical methods. The human data were collected previously on 35 males and 34 females representing the anthropometric range of future Navy and Air Force pilots. Results indicated manikins are good approximations of their human counterparts, but manikin users are cautioned against altering manikin mass properties with ballasts without consideration of human segmental and whole-body mass properties data.
Author (AIAA)
Ejection Seats; Dummies; Center of Gravity; Moments of Inertia; Anthropometry; Body Weight

19980071161
Using night vision
Nadon, David, USA; Helicopter World; Nov. 1997; ISSN 0262-0448; Volume 16, no. 8, pp. 12-16; In English; Copyright; Avail: Aeroplus Dispatch

An account is given of the pioneering use of night vision goggles (NVGs) and thermal imaging equipment by the Ventura County (California) Sheriff's Aviation Unit. The NVGs are used aboard helicopters during nighttime surveillance activities for narcotics control, search-and-rescue, range fire detection, and hazardous materials spills.
AIAA
Night Vision; Rescue Operations; Medical Services; Civil Aviation

19980071962
The effect of reasoning logics on real-time decision making
Beroggi, Giampiero E. G., Delft Univ. of Technology, Netherlands; Wallace, William A., Rensselaer Polytechnic Inst., USA; Systems and Humans; Nov. 1997; ISSN 1083-4427; Volume 27, no. 6, pp. 743-749; In English; Copyright; Avail: Aeroplus Dispatch

The advent of satellite tracking and communications technology has motivated organizations to investigate centralized real-time support for remote and mobile units and operations. Transportation companies have begun to use satellite tracking systems, production and energy plants are employing intelligent monitoring systems, and on-site emergency managers are being supported by headquarters in their assessment and decision making process. Although different reasoning logics have been proposed for real-time decision making, little attention has been given to the comparative assessment of these approaches. This paper presents empirical evidence on the impact of alternative reasoning logics on individual decision making in real-time. Following the definition of the decision tasks for hazardous operations, commonly used reasoning logics are discussed. Then, results of an empirical comparison of different reasoning approaches are presented. The data were gathered during an experiment with experienced operators. The conclusions of this research are that the selection of the appropriate reasoning logic in support of real-time decision making is crucial.
Author (AIAA)
Decision Making; Logic; Real Time Operation; Satellite Tracking

19980071965
Comparing display symbology for an advanced air traffic control tower application
Small, Ronald L., Search Technology, Inc., USA; Rouse, William B., Search Technology, Inc., USA; Hammer, John M., Hammer & Associates, Inc., USA; Systems and Humans; Nov. 1997; ISSN 1083-4427; Volume 27, no. 6, pp. 783-790; In English
Contract(s)/Grant(s): DTFA01-92-C-00028; Copyright; Avail: Aeroplus Dispatch

This paper describes experiments that compare air traffic controller performance with two different types of simulated airport radar display formats. The formats differed in the method of presenting aircraft radar returns: analog or digital symbols. Pre-experimental studies examined potential airport tower automation systems and the opinions of various system stakeholders about these automated systems, and then modeled airport operations to discern the impact of these systems on controller workload and airport congestion. Results from the earlier studies helped focus the experiments which concluded that the digital icon format is likely to be better than the analog format at helping controllers accomplish their duties in a timely manner.
Author (AIAA)
Radarscopes; Display Devices; Air Traffic Control; Airports; Symbols

19980072180

The dependence of electromagnetic energy absorption upon human-head modeling at 1800 MHz

Meier, Klaus, Swiss Federal Inst. of Technology, Switzerland; Kaestle, Ralf, Swiss Federal Inst. of Technology, Switzerland; Kuster, Niels, Swiss Federal Inst. of Technology, Switzerland; Hombach, Volker, Deutsche Telekom, Technologiezentrum, Germany; Tay, Roger Y.-S., Motorola, Inc., USA; IEEE Transactions on Microwave Theory and Techniques; Nov. 1997; ISSN 0018-9480; Volume 45,, no. 11, pp. 2058-2062; In English; Copyright; Avail: Aeroplus Dispatch

The authors of a previously published paper on the dependence of electromagnetic (EM) energy absorption concluded that homogeneous modeling of the human head is suited for assessing the spatial-peak absorption for transmitters operating at 900 MHz or below. Additional studies became necessary for the frequency bands utilized by new mobile communications systems (i.e., 1.5 and 2.5 GHz) since some peripheral tissue layers have a thickness of the range of lambda/4-lambda/2. The results of the simulations combined with worst-case considerations confirmed the anticipated and more complex relationship between absorption and anatomical details at these higher frequencies. Nevertheless, a homogeneous representation of the head is suited for assessing the maximum specific absorption rate in the head of the user of mobile telecommunication equipment if the appropriate dielectric parameters are chosen.
Author (AIAA)

Microwave Absorption; Head (Anatomy); Bionics

19980072326

Dexterous robotic sampling for Mars in-situ science

Schenker, P. S., JPL, USA; Baumgartner, E. T., JPL, USA; Lee, S., JPL, USA; Aghazarian, H., JPL, USA; Garrett, M. S., JPL, USA; Lindemann, R. A., JPL, USA; Brown, D. K., JPL, USA; Bar-Cohen, Y., JPL, USA; Lih, S. S., JPL, USA; Joffe, B., JPL, USA; 1997, pp. 170-185; In English; Copyright; Avail: Aeroplus Dispatch

Robotic exploration of the Martian surface will provide important scientific data on planetary climate, life history, and geologic resources. In particular, robotic arms will assist in the detailed visual inspection, instrumented analysis, extraction, and Earth return of soil and rock samples. To this end, we are developing new robotic manipulation concepts for use on landers and rovers, wherein mass, volume, power and the ambient Mars environment are significant design constraints. We have conceived and implemented new, all-composite, very light robot arms: MarsArmII, a 4.0-kg, 2.3-m arm for lander operations, and MicroArm-1 and MicroArm-2, two smaller 1.0+-kg, 0.7-m rover arms for mobile sample acquisition and Mars sample return processing. Features of these arms include our creation of new 3-D machined composites for critical load-bearing parts; actuation by high-torque density, ultrasonic motors; and, visually-designated inverse kinematics positioning with contact force adaptation under a novel task-level, dexterous controls paradigm. Our demonstrated results include robotic trenching, sample grasp-manipulation-and-transfer, and fresh rock surface exposure-probing via the science operator's 'point-and-shoot' visual task designation in a stereo workspace.
Author (AIAA)

Mars Surface; Space Exploration; Mars Sample Return Missions; Robot Arms

19980072332

Stable grasp under external influences

Hor, Maw-Kae, Academia Sinica, Inst. of Information Science, Taiwan, Province of China; Wu, Shiaw-Chian, Academia Sinica, Inst. of Information Science, Taipei; National Tsing Hua Univ., Taiwan, Province of China; 1997, pp. 483-494; In English
Contract(s)/Grant(s): NSC-86-2745-E001-005; Copyright; Avail: Aeroplus Dispatch

In object manipulation or material handling, the grasped object becomes unstable when external impacts exist. In this paper, we investigate the grasping stability and optimality issues under the influence of external disturbances. A rotation-displacement geometry model is used in analyzing the changes of equilibrium grasping forces under the disturbances. The changes of the grasping forces can be computed systematically through the invariant grasping configuration base constructed on this geometry model. Based on these results, we introduce the concept of perturbation closure, which plays a central role in our analysis. A method for finding the minimum finger grasping forces required for impact resist grasps is developed using the perturbation closure. A grasp so determined is guaranteed to be stable if the external impacts do not exceed the given threshold. A quantitative measurement is developed that can be used to evaluate the performance of different grasping configurations in resisting any kind of external impacts. Using this performance measurement, we can distinguish a good grasping configuration from a set of feasible grasping configurations of the given object. This actually gives a solution in finding the optimal grasping locations.
Author (AIAA)

Target Acquisition; Robotics; Impact Resistance; End Effectors; Perturbation

19980072334

Human Factors and Ergonomics Society, Annual Meeting, 41st, Albuquerque, NM, Sept. 22-26, 1997, Proceedings. Vols. 1 & 2

1997; In English; Vol. 1, 754 p.; vol. 2, 740 p; ISBN 0-945289-07-3; Copyright; Avail: Aeroplus Dispatch

The present collection of papers on human factors and ergonomics discusses aerospace systems, aging, cognitive engineering and decision making, communications, computer systems, and consumer products. Attention is given to environmental design, individual differences in performance, industrial ergonomics, macroergonomics, medical systems and rehabilitation, safety, surface transportation, systems development, test and evaluation, training, virtual environments, and visual performance. Other topics addressed include advanced cockpit displays, a novel approach to cognitive compatability of aircraft displays, advances in automation research, emerging interface technologies, and interpretation and evaluation of measures of performance.

AIAA

Conferences; Human Factors Engineering; Man Machine Systems; Human Performance

19980072338

Free flight cockpit displays of traffic and weather - Effects of dimensionality and data base integration

O'Brien, Janelle V., Illinois, Univ., Savoy, USA; Wickens, Christopher D., Illinois, Univ., Savoy; 1997, pp. 18-22; In English

Contract(s)/Grant(s): NAG2-996; Copyright; Avail: Aeroplus Dispatch

In any free flight system, pilots must have displays which effectively depict traffic and weather information as more and more responsibility for separation from such hazards transfers from air traffic controllers to pilots. This research effort seeks to address the issues of dimensionality (3D vs 2D coplanar displays) and data-base integration (separation or integration of traffic and weather information within displays). Seventeen general aviation flight instructors flew a series of en route trials with four display types in which dimensionality, data base integration, and hazard geometries were manipulated. Analysis of the data revealed that the 2D displays resulted in a smaller percentage of conflicts with traffic and weather hazards. The results also suggested that displays in which traffic and weather were integrated resulted in fewer hazard conflicts for trials in which both hazard types were critical to maneuver selection. Maneuver strategy was also found to vary by scenario geometry.

Author (AIAA)

Free Flight; Display Devices; Air Traffic; Aviation Meteorology; Dimensions; Data Integration; Flight Hazards

19980072339

3-D electronic maps, design implications for the effects of elevation angle disparity, complexity, and feature type

Hickox, Joseph C., U.S. Air Force Academy, USA; Wickens, Christopher D., Illinois, Univ., Savoy; 1997, pp. 23-27; In English

Contract(s)/Grant(s): N00014-93-1-0253; Copyright; Avail: Aeroplus Dispatch

Three-dimensional navigational displays have received a fair amount of attention in the literature lately. In this study, we utilized a navigational checking task and manipulated elevation angle disparity, complexity and feature type (defined by man-made vs. natural) and measured its effects on latency and accuracy. Elevation angle disparity was measured in terms of the difference between the sin of the viewing angle or forward FOV (FFOV) and the sin of the map angle. A same/different paradigm was employed as subjects compared navigational scenes presented on both a CRT (simulating the map) and projected on a large screen (simulating the FFOV). Main effects were found with the elevation angle disparity, complexity, and feature type. Significant interactions were found with elevation angle disparity and feature type, and complexity and feature type. Conclusions are made based upon these findings and their implications for the design of 3D electronic maps.

Author (AIAA)

Three Dimensional Models; Elevation Angle

19980072341

An investigation of helmet-mounted display field-of-view and overlap tradeoffs

Jennings, Sion, NRC of Canada, Ottawa, Canada; Dion, Manfred, German Armed Forces Flight Test Center, Germany; 1997, pp. 32-36; In English; Copyright; Avail: Aeroplus Dispatch

NRC researchers investigated the tradeoffs between binocular-overlap and FOV in helmet-mounted displays. Four test pilots performed a series of maneuvers in a helicopter while wearing FOV limiting goggles. They evaluated a monocular FOV, a range of binocular overlaps, and unrestricted vision. Pilots evaluated the system performance and handling qualities using Cooper-Harper Handling Qualities Ratings, visual cue ratings, and subjective comments. The handling qualities of the helicopter/pilot system changed in a nonlinear fashion as the binocular overlap increased. Pilot comments, preferences, and visual cue ratings

showed the same trends as the handling qualities data. Practical applications of the results are discussed, including helicopter control system augmentation to allow improved performance in degraded visual conditions.
Author (AIAA)
Helmet Mounted Displays; Field of View; Tradeoffs; Binocular Vision; Monocular Vision; Helicopter Control; Pilot Performance; Controllability; Man Machine Systems

19980072343
On the application of cognitive compatibility to aircraft systems design and evaluation
Andre, Anthony D., Interface Analysis Associates, USA; 1997, pp. 43-45; In English; Copyright; Avail: Aeroplus Dispatch

Much research has been performed examining various aspects of the relationship between displays and controls in the aircraft cockpit as well as other, related contexts. Yet, the applicability of this work to the design or evaluation of modern aircraft systems is still limited. One reason for this limitation is the disproportionate focus on the physical (spatial) aspects of display-control relationships, often referred to as stimulus-response (S-R) compatibility, relative to the cognitive or perceptual aspects. Another reason for the limited applicability of this research to applied systems design is the lack of computer-aided models and automated tools which incorporate the established principles and guidelines. It is argued here that in order to optimize both the design process and design result of future cockpit interfaces, models of cognitive compatibility must be developed and incorporated into computer-based design and evaluation tools.
Author (AIAA)
Cognitive Psychology; Compatibility; Human Factors Engineering; Man Machine Systems; Display Devices; Aircraft Control; Control Systems Design

19980072344
An investigation of the relationship between task type and the cognitive compatibility of display formats
Jordan, C. S., Defence Evaluation and Research Agency, UK; Hodgson, S., Defence Evaluation and Research Agency, UK; Selcon, Stephen J., Defence Evaluation and Research Agency, UK; 1997, pp. 46-50; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes an experiment that examined the cognitive compatibility of display design solutions based on the appropriateness of their frame of reference to the task being conducted. Displays based on both egocentric and exocentric information representations were used. These were tested using tasks requiring responses based on either egocentric or exocentric criteria. Analysis of the data revealed a significant interaction between task type and symbology (F (3, 44) = 4.177, less than 0.05). This result suggests that the cognitive compatibility of the displays was dependent on the consistency of the frame of reference of the task and display. Design guidelines have been produced to enable the implementation of cognitively compatible displays.
Author (AIAA)
Cognitive Psychology; Display Devices; Man Machine Systems; Tasks

19980072345
Transforming incompatible stimulus-response pairs into compatible ones
Tlauka, Michael, Reading, Univ., UK; McKenna, Frank P., Reading, Univ., UK; 1997, pp. 51-55; In English; Copyright; Avail: Aeroplus Dispatch

The design of human-machine systems requires the consideration of a wealth of factors affecting human performance. One important factor concerns stimulus-response (S-R) compatibility effects. S-R compatibility refers to the finding that people respond faster when the relative spatial locations of stimuli and responses correspond (compatible S-R mappings) than when there is no correspondence (incompatible S-R mappings). For example, a visual stimulus that is presented to the right of a central fixation point is responded to more quickly by pressing a right key rather than a left key. In two experiments participants responded to compatible and incompatible S-R mappings. In Experiment 1 the stimuli were perceptually grouped, while in Experiment 2 they were arbitrarily associated. Both perceptual grouping and arbitrary associations were found to result in the transformation of incompatible S-R pairs into compatible ones. The results are of practical use for tasks requiring human-machine interactions.
Author (AIAA)
Compatibility; Man Machine Systems; Human Factors Engineering; Stimuli; Human Reactions; Reaction Time

19980072346
New light through old windows - The role of cognitive compatibility in aircraft dial design
Banbury, Simon P., Defence Evaluation and Research Agency, UK; Selcon, Stephen J., Defence Evaluation and Research Agency, UK; McCrerie, Claire M., Defence Evaluation and Research Agency, UK; 1997, pp. 56-60; In English; Copyright; Avail: Aeroplus Dispatch

This paper reports the results of a study investigating the role of cognitive compatibility in the design of aircraft dials. of particular relevance to this study is the relationship between the visual display and the required response. Using a four-by-four layout of aircraft engine dials, participants were instructed to respond to a single, disparate reading by making an appropriate left-right judgment. Both compatible and incompatible response mappings were tested: instruments grouped by engine (left and right), and instruments grouped by status (primary and secondary), respectively. The results indicated that a layout incompatible with the response significantly increased reaction times and error rate, regardless of graphical cues to encourage perceptual grouping into the correct response mapping. Finally, disparities between dial readings were harder to detect at oblique angles compared to those oriented to the horizontal axis. These results are interpreted in the light of current theories regarding cognitive compatibility and the oblique effect, and design guidelines for dials are discussed.
Author (AIAA)
Cognitive Psychology; Human Factors Engineering; Aircraft Instruments; Compatibility; Display Devices; Indicating Instruments

19980072348
Mechanical fault management in Navy helicopters
Deaton, John E., CHI Systems, Inc., USA; Glenn, Floyd A., III, CHI Systems, Inc., USA; Federman, Philip J., CHI Systems, Inc., USA; Nickerson, G. W., Pennsylvania State Univ., State College; Byington, Carl S., Pennsylvania State Univ., State College; Malone, Robert, Galaxy Scientific, USA; Stout, Renee, U.S. Navy, Naval Air Warfare Center, USA; Oser, Randall, U.S. Navy, Naval Air Warfare Center, USA; Tyler, Robert R., U.S. Navy, Naval Air Warfare Center, USA; 1997, pp. 66-69; In English; Copyright; Avail: Aeroplus Dispatch
The goal of this investigation was to conduct systematic interviews with flight crews regarding their information requirements for using new diagnostic systems to predict and mitigate inflight mechanical system emergencies. Future research in this area will determine how best to present information to the aircraft in order to improve aircraft safety and enhance mission effectiveness.
Author (AIAA)
Management Methods; Fault Detection; Navy; Helicopters; Aircraft Maintenance; Mechanical Engineering

19980072349
Predictability as a metric of automation complexity
Vakil, Sanjay S., MIT, USA; Hansman, R. J., MIT, USA; 1997, pp. 70-74; In English; Copyright; Avail: Aeroplus Dispatch
Current advanced commercial transport aircraft rely on flight management systems. The increasing complexity of these systems has caused an increase in errors in interaction with aircraft automation. Previous research focused on identification of the elements of automation (mode structure, consistency, command languages, etc.) which may lead to faulty human-automation interactions. These approaches require the complex system to have underlying structure in an available and communicable form. In contrast, this paper discusses a more easily testable 'end-to-end' metric which can be used independently of a knowledge of this structure. The concept of predictability is presented as a candidate metric of the complexity of automation and is defined as a measure of how well an operator can anticipate what the system will do at some point in the future. The goal of this work is to identify areas of flight management systems which have a strong impact on predictability to provide guidance in future designs and in current pilot training.
Author (AIAA)
Flight Management Systems; Automation; Complex Systems; Prediction Analysis Techniques; Commercial Aircraft; Man Machine Systems; Pilot Training

19980072350
Automation in general aviation. II - Four ways to reach zero feet AGL unintentionally: Autopilot and pitch trim malfunctions
Beringer, Dennis B., FAA, Civil Aeromedical Inst., USA; Harris, Howard C., Jr., FAA, Civil Aeromedical Inst., USA; 1997, pp. 75-79; In English; Copyright; Avail: Aeroplus Dispatch
Part I of this study examined four automation-related malfunctions and subsequent pilot responses. The present study examined four additional malfunctions, two more obvious (runaway pitch-trim down, runaway roll servo) and two more subtle (failed attitude indicator, pitch sensor drift down) than those in Part I, and the effect of an auditory warning. Data collection was performed in the Civil Aeromedical Institute's Advanced General Aviation Research Simulator, configured as a Piper Malibu. Results suggest that the first three of these failures may, in a significant percentage of cases (13 of 24 in the sample), lead to significant altitude loss, overstress of the airframe, disorientation of the pilot, or destruction of the aircraft. Percentages of successful

recoveries, detection/correction times, and related indices of performance are discussed in the context of malfunction type, flight profile, and auditory alerts.
Author (AIAA)
General Aviation Aircraft; Automation; Aerodynamic Balance; System Failures; Malfunctions; Pitch (Inclination); Automatic Pilots; Man Machine Systems

19980072351
A comparison of touch, manual, and head controllers for cursor movement
Liggett, Kristen K., USAF, Vehicle-Pilot Integration Branch, USA; Kustra, Todd W., USAF, Vehicle-Pilot Integration Branch, USA; Reising, John M., USAF, Vehicle-Pilot Integration Branch, USA; Hartsock, David C., Veda, Inc., USA; 1997, pp. 80-84; In English; Copyright; Avail: Aeroplus Dispatch

Three different cursor control techniques were used by subjects in a target designation and assignment task. A touch control, a manual control, and a head control technique were investigated. Subjects designated and assigned either individual targets or target groups displayed on a tactical situation format. Speed and accuracy data were collected to determine which of the techniques provided the pilot with the best performance. Results indicated that the touch screen controller allowed for the best performance. Designating groups of targets also resulted in faster times when compared with designating individual targets. These findings are consistent with the results from previous studies and have a significant bearing on the design and implementation of subsystem control mechanisms used in single-seat and multicrew civilian and military aircraft.
Author (AIAA)
Touch; Manual Control; Head Movement; Cognitive Psychology; Human Factors Engineering; Combat; Control Equipment; Tracking (Position)

19980072353
The impact of information technology on human space exploration missions
Gross, Anthony R., NASA Ames Research Center, USA; Gross, Madeleine M., Sigma2 Research Associates, USA; 1997, pp. 90-94; In English; Copyright; Avail: Aeroplus Dispatch

Human space expeditions have, from the beginning, involved great risk and complexity. Space flights, accordingly, have utilized substantial quantities of highly skilled labor. The rapid creation and evolution of increasingly powerful information technologies promise a new human-automation systems balance of work. This balance holds the potential of greatly increased crewed and robotic space exploration capability, along with dramatically reduced costs. Since further development of sophisticated information technology systems must, from the outset, consider both the human and the machine as 'components' of an integrated system, research supporting the development and optimal utilization of such systems will necessarily incorporate significant human factors components. This paper examines the impact of information technologies on lunar and planetary missions; exemplar-inherent human factors aspects, such as display and control in virtual environment/teleoperated systems, are considered.
Author (AIAA)
Space Exploration; Information Systems; Technology Assessment; Manned Space Flight; Man Machine Systems; Human Factors Engineering

19980072354
A full mission simulation success story - RPA simulation at CSRDF yields promising results
Casper, Patricia A., Monterey Technologies, Inc., USA; 1997, pp. 95-99; In English; Copyright; Avail: Aeroplus Dispatch

In support of the U.S. Army's Rotorcraft Pilot's Associate Advanced Technology Demonstration Program, the Crew Station Research and Development Branch (CSRDB) at NASA/Ames has recently completed a full mission simulation (FMS) experiment testing two alternative mission equipment packages (MEPs). Four crews of Army helicopter pilots flew 64 trials, performing representative combat helicopter tasks. Objective and subjective performance metrics provided statistically significant data supporting a priori hypotheses about performance differences between the two systems. Crews flying the advanced MEP killed more targets more efficiently, and were killed fewer times than when flying the baseline MEP. In addition, their workload was lower, and subjectively assessed situation awareness was higher with the advanced system. These results are encouraging for full mission simulation research, and suggest that a standard empirical model may in fact be applicable to full mission simulation.
Author (AIAA)
Military Helicopters; Research and Development; Crew Workstations; Pilot Support Systems; Combat; Flight Simulation; Systems Simulation; Man Machine Systems

19980072360

A comparison of alternatives for automated decision support in a multi-task environment

MacMillan, Jean, BBN Corp., USA; Deutsch, Stephen E., BBN Corp., USA; Young, Michael J., USAF, Armstrong Lab., USA; 1997, pp. 190-194; In English

Contract(s)/Grant(s): F33615-91-D-0009; Copyright; Avail: Aeroplus Dispatch

Complex, multitask work environments that require humans to 'juggle' many simultaneous tasks are becoming more widespread. How can automated capabilities best support the operator in these environments? We grouped the cognitive workload associated with multitask management into two broad areas: (1) creating, maintaining, and updating an awareness of the status of all of the active tasks, and (2) choosing actions from among these active tasks based on overall goals. We then developed automated decision support for each of these aspects of workload and assessed which type of support was more effective in improving performance. Our findings indicate that, in a simulated ATC environment, the effort associated with creating and maintaining situation awareness was overwhelmingly responsible for the operator's workload. The results suggest that effective decision support in this environment should focus on helping the operator maintain awareness of the changing status of the active tasks, not on setting priorities or choosing among alternative tasks.

Author (AIAA)

Decision Making; Task Complexity; Automation; Man Machine Systems; Cognitive Psychology; Workloads (Psychophysiology)

19980072362

Level of automation - Integrating humans and automated systems

Endsley, Mica R., Texas Tech Univ., Lubbock, USA; 1997, pp. 200-204; In English; Copyright; Avail: Aeroplus Dispatch

Automation is being implemented in a variety of systems in an effort to improve performance and overcome high operator workload. Evidence suggests that in many ways current automation approaches fail to achieve the desired reduction in workload, yet the prevailing approach to system design is still to automate to reduce workload. An alternate design approach is presented that focuses on utilizing intermediate levels of automation (LOAs) that integrate the human and the automated system in substantially different ways. Three studies are examined that explore the effects of LOA on performance, situation awareness, and workload under normal and failure conditions. Intermediate LOAs were found to significantly enhance SA and performance as compared to full automation or purely manual performance. Factors that determine when automation may be advantageous and when it may be detrimental are revealed through this systematic exploration of design options for combining humans and automated systems.

Author (AIAA)

Automation; Systems Integration; Man Machine Systems; Workloads (Psychophysiology)

19980072363

The combined effect of level of automation and adaptive automation on human performance with complex, dynamic control systems

Kaber, David B., Mississippi State Univ., Mississippi State, USA; Endsley, Mica R., MIT, USA; 1997, pp. 205-209; In English; Copyright; Avail: Aeroplus Dispatch

We discuss the current state of research into level of automation (LOA) and adaptive automation (AA) in complex, dynamic control systems. Different levels of automation and taxonomies of LOA, as well as strategies to AA, are identified. Empirical studies independently demonstrating the effectiveness of LOA and AA for combating negative consequences of out-of-the-loop performance and improving human functioning are reviewed. On the basis of these studies, the need to assess the combined effectiveness of LOA and AA in a dynamic control task is established. An experiment is presented which addresses this need. Thirty university students performed the control task and a secondary monitoring task with various levels of automation (varying degrees of computer assistance) and AA (varying durations of assistance) being applied to the former. Testing involved five levels of automation allocated over three different cycle times. Results suggest that LOA and AA are not additive in their effect on automated system functioning; however, each affects performance in very different ways. Level of automation was found to have a significant effect on functioning with the dynamic control task, while AA was found to significantly affect performance on the secondary monitoring task indicating an impact of operator workload.

Author (AIAA)

Automation; Adaptive Control; Human Performance; Complex Systems; Dynamic Control; Man Machine Systems

19980072373

Attention allocation within the abstraction hierarchy

Janzen, Michael E., Toronto, Univ., Canada; Vicente, Kim J., Toronto, Univ., Canada; 1997, pp. 274-278; In English; Copyright; Avail: Aeroplus Dispatch

Rasmussen (1985) proposed the abstraction hierarchy, consisting of physical and functional system models, as a basis for interface design for complex human-machine systems. In this study, subjects used an interface consisting of four windows, each representing a level of the abstraction hierarchy, to control a thermal-hydraulic process simulation. The goal was to investigate the relationship between attention allocation strategies and performance under normal and abnormal conditions. Subjects controlled the process for about one hour per weekday for approximately one month. The results indicate that subjects who made more frequent use of functional levels of information exhibited more accurate system control under normal conditions, and more accurate diagnosis performance under fault trials. Moreover, subjects who made efficient use of functional information exhibited faster fault compensation times. These results provide specific evidence of the advantages of functional information in an abstraction hierarchy interface.

Author (AIAA)

Attention; Hierarchies; Resource Allocation; Man Machine Systems; Complex Systems; Systems Engineering

19980072374

Visual metaphors and mental models in display design - A method for comparing intangibles

MacMillan, Jean, BBN Corp., USA; Getty, David J., BBN Corp., USA; Tatum, B. C., U.S. Navy, Navy Personnel Research and Development Center, USA; Ropp, Gary A., U.S. Navy, Navy Personnel Research and Development Center, USA; 1997, pp. 284-288; In English; Copyright; Avail: Aeroplus Dispatch

Visual metaphors are often used in designing human-computer interfaces for complex systems. In order to be useful, such metaphors must be congruent with users' underlying mental models of system organization or system function. When metaphors fail to be useful in interface design, it is difficult to know whether a better metaphor would improve performance or whether the use of a visual metaphor is, in general, inappropriate for the application. A method is needed to assess the congruence between users' conceptual models of a complex process and the visual metaphor used to represent that process, independent of users' performance with the interface. We developed and applied such a method as part of an evaluation of a user coach for a manpower planning application. The results indicate a high degree of congruence between the visual metaphor implemented in the interface and the conceptual features of the manpower planning process.

Author (AIAA)

Human-Computer Interface; Analogies; Complex Systems; Systems Engineering; Systems Simulation; Manpower; Management Planning

19980072375

The Interactive Monitoring and Control (IMaC) design methodology - Application and empirical results

Thurman, David A., Georgia Inst. of Technology, Atlanta, USA; 1997, pp. 289-293; In English

Contract(s)/Grant(s): NAG5-2227; NAG5-1044; Copyright; Avail: Aeroplus Dispatch

The IMaC methodology is a design methodology for operator interfaces to complex engineering systems. This four-step methodology helps designers tailor human-computer interaction to communicate monitoring and control activity requirements to the operator. This paper presents the methodology and associated design principles as well as the results of an empirical study assessing the effectiveness of a proof-of-concept operator interface. The study found that an interface designed by the IMaC methodology resulted in superior operator performance when compared to a conventional interface.

Author (AIAA)

Automation; Complex Systems; Interactive Control; Control Systems Design; Methodology; Human-Computer Interface; Satellite Ground Support; Ground Crews

19980072377

Tactical aviation and human factors - Designing the SIRE supercockpit

Brickman, Bart J., Logicon Technical Services, Inc., USA; Hettinger, Lawrence J., Logicon Technical Services, Inc., USA; Haas, Michael W., USAF, Armstrong Lab., USA; 1997, pp. 299-303; In English; Copyright; Avail: Aeroplus Dispatch

Modern air combat represents a highly complex, dynamic domain that presents many significant challenges for military aviators. Current military aircraft provide much more complex dynamic information than a single human has the ability to simultaneously attend to, let alone comprehend. As technological developments lead to the deployment of enhanced capabilities for information sharing, this trend is expected to continue. Consequently, a significant challenge for aircraft interface designers is to

provide mission critical information to pilots in a rapid and effective manner, and to facilitate intuitive and accurate comprehension and operation of aircraft systems. This paper describes the process and one product of an approach to the design of future tactical crewstations that employs human performance evaluations as a design tool, and is offered as a model for the development of any complex system in which enhanced human performance is the desired outcome.
Author (AIAA)
Human Factors Engineering; Cockpits; Military Aviation; Environment Simulation; Crew Workstations; Human Performance; Complex Systems

19980072379
Assessing cognitive workload metrics for evaluating telecommunication tasks
Whitaker, Leslie A., Dayton, Univ., USA; Hohne, Jennifer, Boeing Aircraft, USA; Birkmire-Peters, Deborah P., U.S. Army, Research Lab., USA; 1997, pp. 325-329; In English; Copyright; Avail: Aeroplus Dispatch

An experiment was conducted to test the sensitivity of three cognitive workload metrics to tasks performed under conditions of telecommunication vs face-to-face communication. Twenty-three teams participated as subjects. A block puzzle pattern task was tested at four levels of puzzle difficulty under the two communication conditions. Task performance (time to complete and errors), as well as cognitive workload ratings, were measured. Three workload metrics (Subjective Workload Assessment Technique (SWAT), NASA-TLX, and Modified Cooper Harper (MCH)) were compared. Each person's spatial ability was assessed using the Cognitive Laterality Battery. Both performance and workload varied as a function of puzzle difficulty. While all workload metrics were able to discriminate among some of the puzzle difficulty levels, SWAT had the two advantages of providing the most sensitive measure of difficulty plus a wider range of workload ratings.
Author (AIAA)
Workloads (Psychophysiology); Telecommunication; Cognitive Psychology; Psychometrics; Tasks; Human Performance

19980072380
Visualizing and exploring highly processed information spaces in tactical decision making
Coury, Bruce G., Johns Hopkins Univ., APL, USA; Donnald, Creighton R., Johns Hopkins Univ., APL, USA; Dykton, Michael D., Johns Hopkins Univ., APL, USA; Piatko, Christine D., Johns Hopkins Univ., APL, USA; 1997, pp. 330-334; In English; Copyright; Avail: Aeroplus Dispatch

Tactical decision makers rely on highly processed information to make decisions and solve problems. Such highly processed information spaces place unique demands on visualization and information management technologies. This paper describes our use of a visualization tool, called the Reasoning Systems and Information Space (RSIS) Navigator, which is being used to represent the information associated with a tactical scene for Navy command decision makers. The paper begins with a discussion of the rationale for our approach, shows how a cognitive metaphor is being used to construct visualizations, and concludes with a discussion of relevant R&D issues, and future work.
Author (AIAA)
Decision Making; Information Management; Cognitive Psychology; Graphical User Interface; Visual Aids

19980072381
Reducing the interaction burden of complex systems
Coury, Bruce G., Johns Hopkins Univ., APL, USA; Sadowsky, John, Johns Hopkins Univ., APL, USA; Schuster, Paul R., Johns Hopkins Univ., APL, USA; Kurnow, Michael, Orincon Corp., USA; Huber, Marcus J., Orincon Corp., USA; Durfee, Edmund H., Michigan, Univ., Ann Arbor; 1997, pp. 335-339; In English; Copyright; Avail: Aeroplus Dispatch

Reducing the burden of interacting with complex systems has been a long-standing goal of user interface design. In our approach to this problem, we have been developing user interfaces that allow users to interact with complex systems in a natural way and in high-level, task-related terms. These capabilities help users concentrate on making important decisions without the distractions of manipulating systems and user interfaces. to attain such a goal, our approach uses a unique combination of multimodal interaction and interaction planning. In this paper, we motivate the basis for our approach, describe the user interface technologies we have developed, and briefly discuss the relevant R&D issues.
Author (AIAA)
Complex Systems; Man Machine Systems; Workloads (Psychophysiology)

19980072382
Investigation of dwell time in cursor positioning movements
Bohan, Michael, Wichita State Univ., USA; Humphrey, Darryl G., Wichita State Univ., USA; Stokes, Alan F., Florida Inst. of

Technology, Melbourne; 1997, pp. 365-369; In English; Copyright; Avail: Aeroplus Dispatch

The present study tested the visual feedback processing hypothesis as an explanation for the functional significance of dwell time in cursor-positioning movements. Results indicate that the duration of dwell time could not be fully accounted for by changes in visual processing demands. Instead, it appears that a critical determinant of dwell time duration is the implementation of different cognitive strategies regarding the stage in the movement at which certain parameters (e.g., target width and distance) are accounted for.

Author (AIAA)

Human-Computer Interface; Dwell; Electromechanical Devices; Sensory Feedback; Cognitive Psychology; Target Acquisition

19980072383

The psychologies of human-computer interaction - An integrative approach

Gillan, Douglas J., New Mexico State Univ., Las Cruces, USA; 1997, pp. 385-389; In English; Copyright; Avail: Aeroplus Dispatch

Human-computer interaction (HCI) has been identified as a rich task for the real-world study of psychology; however, the theoretical approaches to the psychology of HCI have narrowly focused on problem-solving (e.g., GOMS and CE+), memory (e.g., mental models and metaphors), and social interaction (e.g., perceived control). An attempt to create a broader theoretical framework integrates the three approaches to the psychology of HCI with a theory, IP3. This paper discusses each of the three psychologies of HCI, describes the IP3 integrative theory (verbally, as well as by a graphical representation), applies the theory to one representative research area - transfer of training, and applies the theory to the interpretation of selected HCI design guidelines.

Author (AIAA)

Human-Computer Interface; Man Machine Systems; Problem Solving; Memory; Psychological Factors; Social Factors

19980072384

Nurturing and pampering paradigm for office ergonomics

Paul, Rajendra D., Boeing Commercial Airplane Group, USA; 1997, pp. 519-523; In English; Copyright; Avail: Aeroplus Dispatch

This paper proposes that current ergonomic practices for design of sedentary jobs, focusing on comfort and support, are inadequate to create healthy and productive workplaces. The key results from several research investigations supporting this proposition are: (1) Comfortable workstations adjusted to the user, along with training and education, were inadequate to relieve potentially harmful spinal stress and circulatory impedance caused by sedentary jobs. (2) Sedentary jobs induced cognitive mood states like drowsiness and lack of alertness that degrade cognitive function and performance. (3) Activity and movement, e. g., between sitting and standing, significantly reduced spinal stress and improved blood circulation. These results collectively provided foundation for the nurturing and pampering paradigm. In this paradigm, nurturing is the strategy to reduce discomfort, and pampering is the strategy to apply comfort. Nurturing promotes active, dynamic use of the body during workday to maintain health and prevent injuries. It is discussed using phrases like 'the best posture is the next posture' or 'use it or lose it'. Pampering with aesthetic and plush environments that induce comfortable perceptions, on the other hand, is a motivational tool with an inverted-U relationship to performance.

Author (AIAA)

Human Factors Engineering; Comfort; Workstations; Work

19980072391

A methodology for identifying ergonomics risk factors and measuring the results of implementation of corrective actions

Joyce, Marilyn, Joyce Inst., USA; Marcotte, Andrew J., Joyce Inst., USA; Barker, Richard, Joyce Inst., USA; Klinenberg, Edward J., USAF, Armstrong Lab., USA; 1997, pp. 717-721; In English; Copyright; Avail: Aeroplus Dispatch

A methodology for identifying ergonomics risk factors and control strategies in office environments has been developed and pilot tested. Developed as part of an overall ergonomics program being implemented by the USAF, the employees impacted include both civilian and military personnel performing a wide range of administrative tasks typically performed in offices. The research design included: a focused literature review; strategic site visits; a review of criteria established by the Air Force; an iterative developmental process of a Screening Survey and an Ergonomics Assessment Methodology Guide; and testing. The results indicate that the process can be used as an effective means for identifying and controlling ergonomics hazards in administrative work areas.

Author (AIAA)

Human Factors Engineering; Methodology; Workstations

19980072392

Management of Health, Environment and Safety (HES) in Royal Norwegian Air Force (RNoAF) flight operations

Fonne, Vivianne, Royal Norwegian Air Force, Inst. of Aviation Medicine, Norway; Wagstaff, Anthony S., Royal Norwegian Air Force, Inst. of Aviation Medicine, Norway; 1997, pp. 744-748; In English; Copyright; Avail: Aeroplus Dispatch

The Royal Norwegian Air Force (RNoAF) performs a large number of mission types. Many of these missions are undertaken in exceedingly difficult operational environments. Because of the challenges presented by seasonal variations, poor weather conditions, and demanding operational task requirements, the importance of an optimal working environment to ensure crew health and safe flight operations should be emphasized. In the Norwegian concept of Health, Environment and Safety (HES), all aspects of the working environment have been taken into consideration, including human factors, ergonomics, physical and chemical factors as well as social and organizational psychology. As civilian legislation excludes military aviation in this area, the RNoAF has developed a new system that allows HES improvements to be implemented in a more efficient way. This system is based on a new military regulation for HES in RNoAF flight operations. Good coordination of HES issues, predictability and standard handling procedures are key elements in this system which is meant to be an effective managerial tool for correct HES decision-making.

Author (AIAA)

Flight Operations; Norway; Safety Management; Human Factors Engineering; Environment Management; Management Methods; Armed Forces (Foreign)

19980072396

Virtual hazard analysis - A methodology

Ziolek, Scott A., Battelle Memorial Inst., USA; Hale, Robert C., Battelle Memorial Inst., USA; 1997, pp. 859-863; In English; Copyright; Avail: Aeroplus Dispatch

This paper presents a method for representing and analyzing hazards in virtual simulations as regions in 3D space. The objectives of this study are to provide designers and analysts a technique for evaluating hazards concerning human-machine interaction in virtual environments, as well as, initiating a dialog concerning future hazard simulation techniques and standards. Information obtained for this paper is based upon a study to incorporate hazard information into a human modeling simulation package called DEPTH (Design Evaluation for Personnel, Training, and Human Factors), which is being developed by U.S.A.F. Armstrong Laboratory.

Author (AIAA)

Virtual Reality; Hazards; Methodology; Man Machine Systems; Virtual Properties; Computerized Simulation

19980072397

Enhancing system safety with 3-D audio displays

Haas, Ellen C., U.S. Army, Research Lab., USA; Gainer, Charles, U.S. Army, Research Inst., USA; Wightman, Dennis, U.S. Army, Research Inst., USA; Couch, Michael, Anacapa Sciences, USA; Shilling, Russell, U.S. Air Force Academy, USA; 1997, pp. 868-872; In English; Copyright; Avail: Aeroplus Dispatch

The enhancement of multiple radio communications can be an important system safety consideration. This study was conducted to determine how accurately helicopter pilots could process radio communications information in a simulated cockpit environment when the messages were presented under different modes (diotic, dichotic, and 3D audio). The dependent variable was the total number of points scored in the radio communications identification task. Subjects were 11 certified U.S. Army AH-64 pilots between the ages of 18 and 35 who possessed hearing and visual acuity within thresholds acceptable to the U.S. Army. Multivariate statistical analysis indicated that presentation mode was significant. Pilots scored the greatest number of points in the identification task while using 3D audio, fewer with dichotic presentation, and the least with diotic presentation. There was a statistically significant difference between the 3D and the diotic presentation. The data imply that 3D audio provides an effective mode of message presentation in systems with multiple radio communications.

Author (AIAA)

Radio Communication; Aircraft Pilots; Aircraft Communication; Message Processing; Aviation Psychology; Cognitive Psychology

19980072398

A novel flight instrument display to minimize the risk of spatial disorientation

Braithwaite, Malcolm G., U.S. Army, Aeromedical Research Lab., USA; Durnford, Simon J., U.S. Army, Aeromedical Research Lab., USA; 1997, pp. 897; In English; Copyright; Avail: Aeroplus Dispatch

This novel flight instrument display presents information to the pilot in a simple and easily comprehensible format by integrating the five orientational flight parameters (aircraft attitude, airspeed, altitude, rate of climb or descent, and aircraft heading). It allows the pilot to select specific orientation parameters and then follow a simple tracking task which ensures that these parameters are maintained or, if necessary, recovered. Our assessment of the display in a UH-60 helicopter simulator showed that the novel display makes recovery from unusual aircraft attitudes and instrument flying more accurate, and easier than when using a standard instrument panel. The display will be demonstrated.
Author (AIAA)
Display Devices; Flight Instruments; Disorientation; Flight Safety; Flight Control

19980072399
Overview of the Advanced Qualification Program
Longridge, Thomas M., FAA, USA; 1997, pp. 898-901; In English; Copyright; Avail: Aeroplus Dispatch

The Advanced Qualification Program (AQP) is a voluntary alternative to the traditional regulatory requirements under CFR 14, Parts 121 and 135 for pilot training and checking. Under the AQP the FAA is authorized to approve significant departures from traditional requirements, subject to justification of an equivalent or better level of safety. The program entails a systematic from-end analysis of training requirements from which explicit proficiency objectives for all facets of pilot training are derived. It seeks to integrate the training and evaluation of cognitive skills at each stage of a curriculum. For pass/fail purposes, pilots must demonstrate proficiency in scenarios that test both technical and crew resource management skills together. Air careers participating in the AQP must design and implement data collection strategies which are diagnostic of cognitive and technical skills. In addition, they must implement procedures for refining curricula content based on quality control data. This paper presents an overview of the Advanced Qualification Program and identifies selected applied research issues of interest to the FAA for the purpose of improving the program.
Author (AIAA)
Qualifications; Pilot Training; Flight Safety

19980072400
Using the model AQP database to develop effective CRM training
Mangold, Susan J., Battelle Memorial Inst., USA; Neumeister, David M., Battelle Memorial Inst., USA; 1997, pp. 902-906; In English; Copyright; Avail: Aeroplus Dispatch

The Advanced Qualification Program (AQP) represents a dramatic shift in philosophy as to how best to train flight crews to handle the set of demands placed on them when operating a complex aircraft in a complex operational environment. The AQP process encourages a thoughtful and comprehensive evaluation of what constitutes the flying job and how training can be designed to provide effective and efficient coverage of important training issues. Through the process of designing a Model AQP Database to support AQP curriculum development, the concept of an event as a tool for supporting a situational approach to crew training was developed. This paper discusses the event concept, how events are designed, and the benefits gained by using events as the basic tool for developing a curriculum.
Author (AIAA)
Data Bases; Flight Crews; Flight Training; Models

19980072402
Rapidly reconfigurable event-set based line operational evaluation scenarios
Bowers, Clint, Central Florida, Univ., USA; Jentsch, Florian, Central Florida, Univ., USA; Baker, David, Central Florida, Univ., USA; Prince, Carolyn, U.S. Navy, USA; Salas, Eduardo, U.S. Navy, Naval Air Warfare Center, USA; 1997, pp. 912-915; In English; Copyright; Avail: Aeroplus Dispatch

An important cornerstone of the Advanced Qualification Program is the use of realistic flight simulations to train flight crews and evaluate their proficiency. This is achieved through the use of Line Operational Simulations (LOSs) which contain a number of realistic event sets that require flight crews to use the knowledge, skills, and abilities they gained in training in both technical and crew resource management areas. In the past, the development of LOS scenarios was complex, expensive, and time-consuming. As a result, the number of LOS scenarios used by any particular training organization was limited. This may have led, in some cases, to the LOS scenarios being compromised among flight crews, thus reducing the validity and reliability of the assessment process. In response to this problem, it has been suggested to create a methodology for quickly reconfiguring the content of flight simulator LOS scenarios. This paper provides a background for this new development and describes a research project that was

begun in response to this need. A number of specific research questions are discussed which need to be answered before the methodology can be adopted by participants in the AQP program.
Author (AIAA)
Flight Training; Flight Crews; Flight Simulation; Training Evaluation; Methodology; Qualifications

19980072404
Assessing the value of human performance modeling in exploring pilot-system dynamics
Bautsch, Holly S., Logicon Technical Services, Inc., USA; McNeese, Michael D., USAF, Armstrong Lab., USA; Narayanan, S., Wright State Univ., USA; 1997, pp. 1032-1036; In English; Copyright; Avail: Aeroplus Dispatch

All too often human-systems integration is not addressed until the final stages of systems development. Because of constraints in the time-cost-schedule, it is typically too late in the acquisition process to make adaptations that address cognitive engineering and user-centered performance. Traditionally, designers have not had methods/tools that comprehensively integrate them in the concept exploration stage of design decision-making. Human-systems integration may currently include cognitive engineering or human performance modeling but rarely combines these methods to comprehensively establish human design requirements. This paper assesses the value of both cognitive engineering and human performance modeling by evaluating pilot-system dynamics in an advanced mission. One model is informed through traditional task analysis, while the other model utilizes cognitive task analysis. An experiment is reported which analyzes model outcomes in contrast to a 'benchmark' (pilot-in-the-loop data). The results assess model similarities and differences. The discussion evaluates how human performance models can enhance cognitive engineering in design decision-making.
Author (AIAA)
Human Performance; Pilot Performance; Man Machine Systems; Models; Performance Prediction

19980072406
Factors affecting user response to polygon displays
Pionek, Jason, Wisconsin, Univ., Madison, USA; Geidenreich, Mike, Wisconsin, Univ., Madison; Shanahan, Matt, Wisconsin, Univ., Madison; Schoepke, Dan, Wisconsin, Univ., Madison; 1997, pp. 1052-1055; In English; Copyright; Avail: Aeroplus Dispatch

The concept of polygon displays as error detection devices is a recent area of interest in such environments as nuclear power plants and airplane and helicopter cockpits. Operators in these areas are concerned about the flooding of important information upon the limited capacity of the human eye and brain. A polygon display may alleviate the problem of confusing information by encompassing many fault displays into one simple, symmetric display. This type of visual display is an optimal method for 'at a glance' scanning and lower order perception. If a problem arises in the relevant system, the vertex that corresponds to the fault location will become skewed and the polygon will appear irregular. The authors propose that polygon displays of different sizes and types will elicit varying reaction times of the detection of faults in these displays. A pilot study was conducted to determine preliminary answers to this query.
Author (AIAA)
Polygons; Fault Detection; Display Devices; Human Performance; Man Machine Systems; Information Processing (Biology)

19980072407
Team ergonomics and human engineering methods for the design of collaborative work environments - A case study
Bohan, Jennifer A., U.S. Navy, Naval Surface Warfare Center, USA; Wallace, Daniel F., U.S. Navy, Naval Surface Warfare Center, USA; 1997, pp. 1066-1070; In English; Copyright; Avail: Aeroplus Dispatch

The design of collaborative work environments benefits greatly from the application of human engineering processes. The Tactical Information GUI Engineering & Requirements Specification (TIGERS) methodology was developed to define, articulate, and integrate user requirements into tactical computer interface design. This proven human engineering methodology has been applied to the redesign of the Naval Space Operations Center (NAVSPOC) at the Naval Space Command in Dahlgren, VA. This paper discusses the successful application of this human engineering method to the operations center domain.
Author (AIAA)
Human Factors Engineering; Graphical User Interface; Methodology

19980072408
The factor of significance in the operator's activity
Bendy, Gregory, Essex County College, USA; Meister, David; 1997, pp. 1075-1078; In English; Copyright; Avail: Aeroplus Dispatch

Activity theory has important applications in Russian engineering psychology and ergonomics. From the point of view of the activity approach, the operator is considered a subject who acts voluntarily within a man-machine system. The operator does not simply react to different stimuli, but considers updated input information to form different goals, according to personal motives, and then develops particular strategies to achieve these goals. The major units of analysis become actions performed by the operator. The factor of significance is important for the selection and development of various strategies for the operator.
Author (AIAA)
Human Factors Engineering; Man Machine Systems; Operators (Personnel); Activity (Biology); Motivation; Cognitive Psychology

19980072409
An adaptive survey method - Multiple interview techniques in dynamic environments
Calhoun, Christopher S., Logicon Technical Services, Inc., USA; Rogers-Adams, Beth M., Logicon Technical Services, Inc., USA; Selvaraj, Jonathan A., Logicon Technical Services, Inc., USA; Aleva, Denise L., USAF, Armstrong Lab., USA; 1997, pp. 1079-1083; In English
Contract(s)/Grant(s): F41624-94-D-6000; Copyright; Avail: Aeroplus Dispatch
The utility of a survey method which incorporates several different interview techniques to elicit data in dynamic environments is demonstrated. Adaptive survey is a combination of concept mapping, semistructured interviews, topical questionnaires, and forums used for the elicitation of knowledge from subject matter experts. Inherent in adaptive survey interview techniques is the flexibility to adapt to time constraints, schedule and interviewee changes, and the level of information obtained. Each interview technique is designed to apply to any user in the survey and to produce output which can be used to customize the other techniques. Therefore, the adaptive survey can be tailored to the unique needs and constraints of the interviewees and the environment. In field tests, concept mapping proved to be a particularly valuable interview technique because it was interactive, informative, and flexible.
Author (AIAA)
Surveys; Methodology; Procedures

19980072411
Meaningful assessments of simulator performance and sickness - Can't have one without the other?
Bittner, Alvah C., Jr., Battelle Seattle Research Center, USA; Gore, Brian F., Battelle Seattle Research Center, USA; Hooey, Becky L., Battelle Seattle Research Center, USA; 1997, pp. 1089-1093; In English; Copyright; Avail: Aeroplus Dispatch
The requirement to evaluate the differential impacts of simulator sickness on performance assessments was explored. Simulator sickness and performance data were analyzed in two phases that indicated: (1) an experimental display condition by age interaction with regard to development of simulator sickness; and (2) associated detrimental effects of simulator sickness on performance. Arguably, these results may be quite disturbing to users, and past users, of simulators for system and other Development, Test, and Evaluation efforts. The utility of simulator sickness measures as covariates, in the analysis of performance effects, is demonstrated as a means for their assessment and statistical control. It is strongly recommended that researchers explore and control the potential confounding effects of simulator sickness in order to assure meaningful performance assessments.
Author (AIAA)
Flight Simulators; Motion Sickness; Human Performance

19980072412
Operational test and evaluation of human factors interventions for airport security screeners
Neiderman, Eric C., FAA, USA; Fobes, J. L., FAA, USA; 1997, pp. 1094-1097; In English; Copyright; Avail: Aeroplus Dispatch
As the terrorist threat to civil aviation evolves, future improvements in aviation security must be accomplished by adopting innovative, proactive methods of enhancing screener contributions to overall security system effectiveness. The Screener Proficiency Evaluation and Reporting System (SPEARS) is a person-centered approach to improve screener selection, training, and performance. Screener selection uses a battery of perceptual tests to identify job candidates with optimal potential to be successful screeners. Computer-based training is multimedia instruction to prepare screeners for all of their job responsibilities, with an emphasis on identifying sophisticated threats. Threat Image Projection provides the capability to insert fictional threat images into the X-ray image displays of actual passenger bags. This is done to increase screener vigilance and measure system detection performance. A six-month test and evaluation of SPEARS is being conducted in conjunction with nine major air carriers, involving thousands of screeners at the 19 major U.S. airports.
Author (AIAA)
Human Factors Engineering; Airport Security; Screening; Education; Personnel Selection

19980072413

Assessing the effect of incompatible light on night vision goggle performance

Gibb, Randall W., Arizona State Univ., Tempe, USA; Reising, Jack D., Hughes Training, Inc., USA; 1997, pp. 1098-1102; In English; Copyright; Avail: Aeroplus Dispatch

Current specifications indicate that cockpit lighting designed for night vision goggle (NVG) operations is compatible with NVGs if it does not degrade NVG-aided visual acuity (VA). This study compared two measures of VA: USAF Tri-Bar Chart and NVG Chart. NVG-aided contrast sensitivity (cs) also was assessed; three CS charts having spatial frequencies (SF) of 3, 6, and 12 cycles/degree (cpd) were developed. VA and CS were measured with either low or high levels of incompatible light present. Results revealed that performance did not differ between the two VA measures. Under low incompatible light, CS was degraded only for the high SF. Under high incompatible light, CS was degraded for all SFs. These results suggest that the choice of VA measure should depend upon evaluation factors. CS can be used as an alternative to VA and may provide a more complete index of cockpit lighting compatibility.

Author (AIAA)

Night Vision; Goggles; Visual Acuity; Incompatibility; Performance Prediction

19980072414

Low-Altitude Parachute Extraction System (LAPES)

Gawron, Valerie J., Calspan SRL Corp., USA; Lopez, Miguel, USAF, Flight Test Center, USA; 1997, pp. 1103-1106; In English; Copyright; Avail: Aeroplus Dispatch

LAPES, a low-level self-contained extraction system capable of precision delivery of heavy loads into areas where other methods of aerial delivery or landing of aircraft are not possible or impractical, is discussed. The application to LAPES of Structured Test Procedures (STPs) for critical flight tests developed at the Air Force Flight Test Center is addressed.

AIAA

Parachutes; Low Altitude; Flight Tests; Knowledge Based Systems

19980072416

The use of executable cognitive models in simulation-based intelligent embedded training

Zachary, Wayne, CHI Systems, Inc., USA; Ryder, Joan, CHI Systems, Inc., USA; Hicinbothom, James, CHI Systems, Inc., USA; Bracken, Kevin, CHI Systems, Inc., USA; 1997, pp. 1118-1122; In English; Copyright; Avail: Aeroplus Dispatch

This paper defines a new role for expert models in intelligent embedded training-guiding practice. The integration of problem-based practice with focused, automated instruction has long proven elusive in training systems for complex real-world domains. The training strategy of 'guided practice' offers a way to merge the approaches of traditional simulation-based practice and intelligent tutoring's knowledge tracing. The performance of the trainee is dynamically assessed against scenario-specific expectations and performance standards, which are generated during the simulation by embedded models of expert operators. This research developed an executable cognitive model capable of solving realistic simulation scenarios in an expert-level manner, identified and implemented modifications and extensions to this baseline model needed to generate dynamic and adaptive expectations of future trainee actions, and developed means of providing cognitive state information for use in (separate) diagnostic processes, without resorting to fullscale knowledge tracing methods.

Author (AIAA)

Expert Systems; Flight Simulators; Flight Training

19980072417

Requirements for objective- and performance-based creation and modification of complex training materials

Stretton, Milton L., Sonalyst, Inc., USA; Cannon-Bowers, Janis A., U.S. Navy, Naval Air Warfare Center, USA; 1997, pp. 1128-1132; In English; Copyright; Avail: Aeroplus Dispatch

Implementation of simulation and scenario based training for teams and individuals requires generation and delivery of highly complex instructional material. In this paper, preliminary results of a multiyear effort are presented with a focus on scenario development tools in support of advanced individual and team training. As a first step in this effort, a review of the state-of-the-art in simulation- and scenario-based training systems was conducted examining over 20 simulation and scenario-based training systems. Consistently recurring limitations were evident across all systems in all aspects from preparation to debrief. These limitations, together with other research in automated data collection and diagnosis, have focused attention on the development of a 'learner centered', software-based training management system. The effort described herein supports the building of a system that allows relative novices to use historical performance data to create and modify scenarios based on specific objectives. This system

will also create appropriate support materials for training personnel. Success in this endeavor will provide a model for those who have straggled to harness the considerable potential afforded by simulation- and scenario-based training.
Author (AIAA)
Flight Training; Flight Simulation; Computer Programs

19980072418
Cybersickness is not simulator sickness
Stanney, Kay M., Central Florida, Univ., USA; Kennedy, Robert S., Essex Corp., USA; Drexler, Julie M., Essex Corp., USA; 1997, pp. 1138-1142; In English
Contract(s)/Grant(s): NAS9-19482; NAS9-19453; NSF DMI-95-61266; NSF IRI-96-24968; Copyright; Avail: Aeroplus Dispatch

Factor analysis of a large number of motion sickness self-reports from exposure to military flight simulators revealed three separate clusters of symptoms. Based on this analysis a symptom profile emerged for simulators where oculomotor symptoms predominated, followed by nausea and last by disorientation-like symptoms. Current users of virtual environment (VE) systems have also begun to report varying degrees of what they are calling cybersickness, which initially appeared to be similar to simulator sickness. We have found, after examination of eight experiments using different VE systems, that the profile of cybersickness is sufficiently different from simulator sickness - with disorientation being the predominant symptom and oculomotor the least. The total severity of cybersickness was also found to be approximately three times greater than that of simulator sickness. Perhaps these different strains of motion sickness may provide insight into the different causes of the two maladies.
Author (AIAA)
Motion Sickness; Flight Simulators; Factor Analysis

19980072419
Spatial mental representations in virtual environments
Hancock, P. A., Minnesota, Univ., Minneapolis, USA; Hendrix, Claudia, Minnesota, Univ., Minneapolis; Arthur, Eric, Minnesota, Univ., Minneapolis; 1997, pp. 1143-1147; In English; Copyright; Avail: Aeroplus Dispatch

Spatial mental representations learned by the study of maps are thought to be orientation-specific. Studies have shown that people have difficulty in making judgments from an orientation which is different from the orientation of the map itself. It has been hypothesized that such alignment effects can be attributed to differences in the number of viewpoints encountered during learning. The current study used virtual environments to test this hypothesis. Participants were presented several objects located on a plain within an immersive virtual environment. They learned the environment to a criterion level. The critical task for all experiments was to judge the accuracy with which subjects could identify correct triads of object layouts as well as the response latency to make the judgment. The results of the first experiment showed a linear increase in judgment time as the amount of normalization required of the stimulus increased thus supporting the multiple views theory. The results of the second experiment suggested that four viewpoints were needed for simple spacial configurations before orientation specificity could be eliminated.
Author (AIAA)
Virtual Reality; Cognitive Psychology; Spatial Distribution

19980072420
Locomotion in a virtual environment - Performance measures and physiological responses
Jorgensen, Craig, New Mexico, Univ., Albuquerque, USA; Ogden, Jeff, New Mexico, Univ., Albuquerque; Willis, E. K., New Mexico, Univ., Albuquerque; Blessing, Mary, New Mexico, Univ., Albuquerque; Caudell, Kathryn A., New Mexico, Univ., Albuquerque; Patrick, Graham, New Mexico, Univ., Albuquerque; Caudell, Thomas P., New Mexico, Univ., Albuquerque; 1997, pp. 1148-1151; In English; Copyright; Avail: Aeroplus Dispatch

We are developing and studying a human-computer interface that allows a scientist to interact with complex software systems through immersive virtual reality technology. Virtual tools are being developed to empower the user to view, manipulate, model, diagnose, analyze, navigate through the software simulations and the multidimensional data it generates. For these tools to be truly effective, they must be evaluated in the context of human performance studies. This paper addresses one such category of tool: an efficient and natural means of locomotion in 3D virtual spaces. The current study is investigating three different methods of virtual body locomotion in the following context. Subjects were required to fly through a series of 3D tunnels while performance times and number of wall collisions were used as response measures. In addition, during each trial subjects were continuously monitored for physiological responses and psychological assessments were performed before and after the series of flights. This

paper reports on the preliminary findings of the current study and the lessons learned in performing empirical studies on locomotion in virtual environments.
Author (AIAA)
Virtual Reality; Locomotion; Human-Computer Interface; Computer Programs

19980072421
Computer-based team training - The aircraft maintenance environment example
Kraus, David, Galaxy Scientific Corp., USA; Gramopadhye, Anand K., Clemson Univ., USA; Greenstein, Joel S., Clemson Univ., USA; Nowaczyk, Ronald H., Clemson Univ., USA; 1997, pp. 1154-1157; In English; Copyright; Avail: Aeroplus Dispatch

This research looked at the role of team training in aircraft maintenance, specifically that of advanced technology for team training. A controlled study was conducted to evaluate the effectiveness of advanced technology for team training. The study was conducted in two phases: (1) instructional phase where 18 subjects received training through a computer-based team training program and 18 subjects received training using a traditional instructor-based equivalent team training program, and (2) evaluation phase where the subjects were divided into three member teams and performance of the teams was evaluated as they completed a routine and a nonroutine maintenance task. The results of the study are reported as part of this paper.
Author (AIAA)
Computer Techniques; Aircraft Maintenance; Maintenance Training; Training Evaluation; Teams

19980072422
A design aid for improved documentation in aircraft maintenance - A precursor to training
Drury, Colin G., New York, State Univ., Buffalo, USA; Sarac, Abdulkadir, New York, State Univ., Buffalo; 1997, pp. 1158-1162; In English; Copyright; Avail: Aeroplus Dispatch

With the increasing demand for error reduction in civil aviation maintenance has come a need to ensure that complex work instructions are presented so as to minimize error opportunities. Guidelines have been developed for improving human factors aspects of work control cards and proven effective in the design of both paper-based and computer-based. The current study examined ways of providing such guidelines in a form which document writers will use. Guideline content came from a literature search, plus currently-available design guides. Guideline structure was developed in conjunction with a user team at a partner airline. Both paper-based and computer-based versions of a Documentation Design Aid (DDA) were developed, with iterative input from the user team. These versions were tested on engineering technical writers to measure performance and usability, with generally positive results. The user team approach produced a list of issues in documentation which went beyond document design into the whole document production/testing/using process. Thus, an effort parallel to the design aid development resulted in a review of the macro-ergonomic aspects of the work documentation system.
Author (AIAA)
Aircraft Maintenance; Maintenance Training; Documentation; Technical Writing

19980072423
Development of a situation awareness training program for aviation maintenance
Robertson, Michelle M., Southern California, Univ., USA; Endsley, Mica R., MIT, USA; 1997, pp. 1163-1167; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes a training program designed to enhance situation awareness across the multiple, distributed teams found in aircraft maintenance. Problems with poor situation awareness in aircraft maintenance and gaps in situation awareness across the multiple teams engaged in this process have been linked to aircraft accidents, damage and inefficiencies in airline operations. The training program was developed based on an instructional systems design model. A front-end analysis was conducted which resulted in a determination of instructional objectives and goals. Five concepts for training to improve team SA were specified and developed into a deliverable training program: shared mental models, verbalization of decisions, shift meetings and teamwork, provision of feedback, and individual SA training. The instructional design process used and the Team SA Training Program developed for this domain are discussed.
Author (AIAA)
Aircraft Maintenance; Maintenance Training

19980072424
Human factors training for aviation maintenance personnel
Johnson, William B., Galaxy Scientific Corp., USA; 1997, pp. 1168-1171; In English; Copyright; Avail: Aeroplus Dispatch

This paper discusses the growing demand and rationale for training related to human factors in aviation maintenance. The paper describes various course offerings and experiences of the author as a provider of maintenance human factors training.
Author (AIAA)
Human Factors Engineering; Aircraft Maintenance; Maintenance Training

19980072433
Assessing virtual reality's potential for teaching abstract science
Salzman, Marilyn C., George Mason Univ., USA; Dede, Chris, George Mason Univ., USA; Loftin, R. B., Houston, Univ., USA; Sprague, Debra, George Mason Univ., USA; 1997, pp. 1208-1212; In English
Contract(s)/Grant(s): NSF RED-93-53320; NAG9-713; Copyright; Avail: Aeroplus Dispatch

Understanding how to leverage the features of immersive, 3D multisensory virtual reality to meet user needs presents a challenge for human factors researchers. This paper describes our approach to evaluating this medium's potential as a tool for teaching abstract science. It describes some of our early research outcomes and discusses an evaluation comparing a 3D VR microworld to an alternative 2D computer-based microworld. Both are simulations in which students learn about electrostatics. The outcomes of the comparison study suggest: (1) the immersive 3D VR microworld facilitated conceptual and 3D learning that the 2D computer microworld did not, and (2) VR's multisensory information aided students who found the electrostatics concepts challenging. As a whole, our research suggests that VR's immersive representational abilities have promise for teaching and for visualization. It also demonstrates that characteristics of the learning experience such as usability, motivation, and simulator sickness are important part of assessing this medium's potential.
Author (AIAA)
Virtual Reality; Science; Learning Theory; Education

19980072434
A usability assessment of virtual reality simulation for aerial gunner training
Silverman, Denise R., Hughes Training, Inc., USA; Spiker, V. A., Anacapa Sciences, Inc., USA; 1997, pp. 1218-1222; In English; Copyright; Avail: Aeroplus Dispatch

The 58th Training Support Squadron (58 TRSS) has begun use of a one-of-a-kind virtual reality (VR) simulator for training aerial gunner/scanner (AG/S) tasks. This paper briefly describes the development considerations of the device and an initial usability assessment of the helmet mounted display (HMD) and the helmet. Eleven experienced rotary-wing instructors with varying levels of experience in the Aerial Gunner Scanner Simulator (AGSS) were surveyed. Their ratings and comments regarding 17 helmet components are summarized. The results suggested that overall the helmet is acceptable. However, critical components require improvements. There is a need to improve the cathode ray tubes (CRTs) and to increase the update rates for the head trackers. The results also indicated that helmet comfort factors and fitting procedures are problematic. Several recommendations are made based on these central findings applicable to both AGSS-users in particular and VR-users in general.
Author (AIAA)
Virtual Reality; Training Evaluation; Gunnery Training; Helmet Mounted Displays; Human Factors Engineering

19980072435
Empirical modeling of perceived presence in virtual environments using sequential experimentation techniques
Snow, Michael P., USAF, USA; Williges, Robert C., Virginia Polytechnic Inst. and State Univ., Blacksburg; 1997, pp. 1224-1228; In English; Copyright; Avail: Aeroplus Dispatch

Investigations of perceived presence in a virtual environment (VE) consist primarily of single studies examining only a few independent variables at once. A series of three studies was conducted to test a ratio-scale measure of presence and to examine the first- and second-order effects of 11 VE system parameters on perceived presence. Sequential experimentation techniques were used to build an integrated empirical model using polynomial regression. The resulting primary predictors of perceived presence using a head-mounted display included field of view, sound, and head-tracking. Secondary predictors included visual display resolution, texture-mapping, stereopsis, and scene update rate. The procedures and limitations of sequential experimentation, and its application to the examination of perceived presence in a VE are discussed. It is concluded that sequential experimentation is a useful tool for examining perceived presence, but the subjective nature of this phenomenon and individual differences can make data bridging across sequential studies problematic.
Author (AIAA)
Virtual Reality; Visual Perception; Models

19980072436

Scientific visualization performance in virtual environments

McCormick, Edward P., USAF, USA; Wickens, Christopher D., Illinois, Univ., Urbana; Banks, Rachel, Illinois, Univ., Urbana; Yeh, Michelle, Illinois, Univ., Urbana; 1997, pp. 1229-1233; In English
Contract(s)/Grant(s): DAAL01-96-2-0003; Copyright; Avail: Aeroplus Dispatch

Three frames of reference (full exocentric, full egocentric, and tethered) were contrasted in three experiments to measure performance of four different scientific visualization subtasks: search, travel, local judgment support, and global judgment support. Participants were instructed to locate and follow a designated path through simple virtual environments and to answer simple questions about that environment. Each subject completed five trials in every frame of reference condition with the subject's first trial serving as a practice trial. The results revealed that frames of reference that utilize egocentric or tethered viewpoints support better travel performance, especially when nearing the target. However the exocentric frame of reference supported better performance in the search subtasks and the local and global judgment subtasks.
Author (AIAA)

Scientific Visualization; Virtual Reality; Human Performance; Performance Prediction

19980072437

Influence of head motion on the judged distance of monocularly presented virtual objects

Ellis, Stephen R., NASA Ames Research Center, USA; Menges, Brian M., NASA Ames Research Center, USA; Jacoby, Richard H., NASA Ames Research Center, USA; Adelstein, Bernard D., NASA Ames Research Center, USA; McCandless, Jeffrey W., NASA Ames Research Center, USA; 1997, pp. 1234-1238; In English; Copyright; Avail: Aeroplus Dispatch

Human subjects localized a monocularly viewed, space-stabilized virtual object presented on a head-mounted, see-through display. They either kept their head stationary or rocked it laterally to produce motion parallax. Their distance estimates had less variability in a head moving condition than in a head stationary condition, but in general were much less precise and much less accurate than comparable stereo-based localizations.
Author (AIAA)

Head Movement; Virtual Reality; Monocular Vision; Space Perception

19980072438

Perceptual effects in aligning virtual and real objects in Augmented Reality displays

Milgram, Paul, Toronto, Univ., Canada; Drascic, David, Toronto, Univ., Canada; 1997, pp. 1239-1243; In English; Copyright; Avail: Aeroplus Dispatch

The concept of Augmented Reality (AR) displays is defined, in relation to the amount of real (unmodelled) and virtual (modelled) data presented in an image, as those displays in which real images, such as video, are enhanced with computer generated graphics. For the important class of stereoscopic AR displays, several factors may cause potential perceptual ambiguities, however, which manifest themselves in terms of decreased accuracy and precision whenever virtual objects must be aligned with real ones. A review is given of research conducted to assess both the magnitude of these perceptual effects and the effectiveness of a computer-assisted Virtual Tape Measure (VTM), which has been developed for performing quantitative 3D measurements on real-world stereo images.
Author (AIAA)

Space Perception; Stereoscopic Vision; Visual Perception

19980072439

Field of view effects on a direct manipulation task in a virtual environment

Eggleston, Robert G., USAF, Human Engineering Div., USA; Janson, William P., Logicon Technical Services, Inc., USA; Aldrich, Kenneth A., Logicon Technical Services, Inc., USA; 1997, pp. 1244-1248; In English; Copyright; Avail: Aeroplus Dispatch

Experiments were conducted to investigate the field-of-view (FOV) characteristics of a virtual reality system and how they affected aimed movement behavior across a natural and virtual environment. Utilizing three levels of FOV, and two levels of task difficulty, subjects performed a reciprocal tapping task. FOV was found to differentially affect movement time performance between the two environments for the moderate level of task difficulty, but not for the more highly difficult level. This significant effect for longer movement times in the virtual environment was traced to the smallest FOV, involving those targets appearing outside the instantaneous FOV. Movement times in the virtual environment were also uncharacteristically nonlinear across target

configurations within the same level of difficulty. These findings, as well as other movement time differences between environments, are discussed in terms of image resolution, stereopsis and helmet weight considerations.
Author (AIAA)
Field of View; Virtual Reality; Remote Manipulator System; Visual Tasks

19980072440
Investigating coordination in multidegree of freedom control. I - Time-on-target analysis of 6 DOF tracking
Zhai, Shumin, IBM Almaden Research Center, USA; Senders, John W., Toronto, Univ., Canada; 1997, pp. 1249-1253; In English; Copyright; Avail: Aeroplus Dispatch

In these two companion papers, methods developed in a series of studies in the 1940's and 1950's are applied to the analysis of 6 DOF control devices used in modern human machine systems such as teleoperation and virtual environments. Contrary to the early studies, the current work showed that the simultaneous time-on-target in multi-DOF tracking was higher than the product of component time on target scores. The distribution of linear correlation coefficients between the tracking errors of different degrees of freedom tended to be skewed towards the positive values. These results suggested that subjects' discoordination in early multi-DOF tracking studies was likely due to the limitation of human machine interfaces at that time. With well designed interfaces, subjects exhibited more coordinated trials than discoordinated trials in multidegree of freedom tracking.
Author (AIAA)
Degrees of Freedom; Man Machine Systems; Teleoperators; Remote Manipulator System; Tracking (Position)

19980072441
Investigating coordination in multidegree of freedom control. II - Correlation analysis in 6 DOF tracking
Zhai, Shumin, IBM Almaden Research Center, USA; Senders, John W., Toronto, Univ., Canada; 1997, pp. 1254-1258; In English; Copyright; Avail: Aeroplus Dispatch

Methods developed in a series of studies in the 1940's and 1950's are applied to the analysis of 6-DOF control devices used in modern human machine systems such as teleoperation and virtual environments. Contrary to the early studies, the current work shows that the simultaneous time-on-target in multi-DOF tracking is higher than the product of component time on target scores. The distribution of linear correlation coefficients between the tracking errors of different DOFs tends to be skewed towards the positive values. These results suggest that subjects' discoordination in early multi-DOF tracking studies is likely due to the limitation of human machine interfaces at that time. With well-designed interfaces, subjects exhibit more coordinated trials than discoordinated trials in multi-DOF tracking.
Author (AIAA)
Degrees of Freedom; Correlation; Tracking (Position); Man Machine Systems; Remote Manipulator System; Teleoperators

19980072442
Fitts and VR - Evaluating display and input devices with Fitts' Law
McGee, Mike, Virginia Polytechnic Inst. and State Univ., Blacksburg, USA; Amento, Brian, Virginia Polytechnic Inst. and State Univ., Blacksburg; Brooks, Patrick, Virginia Polytechnic Inst. and State Univ., Blacksburg; Harley, Hope, Virginia Polytechnic Inst. and State Univ., Blacksburg; 1997, pp. 1259-1262; In English; Copyright; Avail: Aeroplus Dispatch

This paper describes an experiment using Fitts' Law to evaluate performance in target acquisition tasks comparing a typical virtual reality (VR) display and input device with a typical computer workstation display and input device. The objective was to determine the effects of using VR hardware on target acquisition performance and validate Fitts' Law in a VR setting. Participants performed 2D target acquisition tasks varying width of target, distance of target, and angle of target from starting point. Factors that showed significantly different acquisition times included input device, distance from target, width of target, and angle of target from starting point. Display type did not show significance. In addition, acquisition times significantly increased throughout the experiment, indicating fatigue. Extending the use of Fitts' Law as an evaluation tool for VR systems is discussed.
Author (AIAA)
Virtual Reality; Target Acquisition; Display Devices; Psychomotor Performance

19980072443
Virtual vision and auditory display aids for a peg insertion task
Nemire, Kenneth, Interface Technologies Corp., USA; 1997, pp. 1263-1267; In English; Copyright; Avail: Aeroplus Dispatch

Effects of visual and auditory display enhancements to a pick-and-place task performed in an immersive virtual environment were evaluated to determine whether the enhancements may replace depth information provided by stereoscopic visual displays. Participants used a commercial head-mounted display, spatial trackers on the head and hand, and a control wand. Independent

variables included biocular or stereo viewing, movement amplitude, target diameter, and audio or visual enhancements. Dependent variables were movement time and number of discrete movements required to complete the task. Results indicated the stereo display and the display enhancements provided no performance advantages over the biocular display for the easier task conditions. Further, visual and auditory enhancements to the biocular display were found that resulted in performance that was not different from using stereoscopic displays. Implications of the results are discussed.
Author (AIAA)
Virtual Reality; Display Devices; Visual Aids; Audio Visual Equipment; Visual Tasks

19980072444
Factors influencing spatial awareness and orientation in desktop virtual environments
Neale, Dennis C., Virginia Polytechnic Inst. and State Univ., Blacksburg, USA; 1997, pp. 1278-1282; In English; Copyright; Avail: Aeroplus Dispatch

This study investigated influences on human spatial orientation and representation resulting from manipulations in the geometric field of view (GFOV) of a perspective display. Also examined was the impact of incorporating symbolic virtual environment enhancements in the interface based on visual momentum (VM) techniques. Sixty participants, pretested for spatial ability, were required to navigate through a virtual office building while performing a variety of spatial orientation tasks. A 3 x 2 x 2 mixed subjects design compared three levels of GFOV, two levels of VM, and two levels of difficulty. The findings indicate that decreases in GFOV produce spatial orientation and representation errors, and as task difficulty increases, errors are more pronounced. Furthermore, VM was shown to alleviate errors in spatial orientation and representation, especially when task difficulty was increased. Design recommendations are discussed based on the implications of the results.
Author (AIAA)
Virtual Reality; Field of View; Space Perception; Display Devices

19980072449
Effects of SAR image compression on image interpretability and detection performance
See, Judi E., Logicon Technical Services, Inc., USA; Kuperman, Gilbert G., USAF, Armstrong Lab., USA; 1997, pp. 1308-1312; In English; Copyright; Avail: Aeroplus Dispatch

The present study was designed to compare the relative impact of three image compression techniques on the interpretability of SAR imagery: multiresolution encoding (MRES), Joint Photographic Experts Group (JPEG), and vector quantization (VQ). These three techniques were examined at three compression ratios and two image resolutions to determine which is most suitable for SAR imagery. Six experienced image analysts provided subjective ratings of image interpretability for original and compressed SAR images via the Radar National Imagery Interpretability Rating Scale (RNIIRS). The subjective ratings were further supplemented with objective indicators of target detection performance. For each dependent variable, difference scores representing the difference in value for comparable uncompressed and compressed images were computed and analyzed. In terms of both subjective and objective measures of effectiveness, MRES was most similar to the uncompressed imagery.
Author (AIAA)
Synthetic Aperture Radar; Image Analysis; Radar Imagery; Performance Prediction

19980072450
Designing for multi-tasking environments - Multiple monitors vs. multiple windows
St. John, Mark, Pacific Science and Engineering Group, USA; Harris, Wayne C., Mankato State Univ., USA; Osga, Glenn, U.S. Navy, Naval Command, Control, and Ocean Surveillance Center, USA; 1997, pp. 1313-1317; In English; Copyright; Avail: Aeroplus Dispatch

With the advent of good flat panel displays for real monitors and with the advent of Head Mounted Display (HMD) technology for creating virtual monitors, multiple monitors become a promising possibility even in cramped environments like cockpits and shipboard control rooms. to determine the true value of multiple monitors (real or virtual) we must understand their capabilities and integration with human cognitive and perceptual abilities, then design for their ultimate use. In a first experiment, we found that accessing information distributed across an array of monitors was at least as effective as locating and managing windows on a single monitor. In a second experiment, we found that a task that requires only infrequent monitoring can be moved to a secondary, peripheral monitor without disrupting performance on that or any other concurrent task.
Author (AIAA)
Monitors; Display Devices; Man Machine Systems; Virtual Reality; Windows (Computer Programs); Human Factors Engineering

19980072451

Evaluation of CRT flicker under office viewing conditions

Sidebottom, Shane D., Virginia Polytechnic Inst. and State Univ., Blacksburg, USA; Beaton, Robert J., Virginia Polytechnic Inst. and State Univ., Blacksburg; 1997, pp. 1318-1322; In English; Copyright; Avail: Aeroplus Dispatch

Flicker detection thresholds were assessed for 10 participants with CRT screens of varying luminance, size, viewing angle eccentricity, and ambient illumination. The test conditions were selected to span the range of typical office applications. Under the test conditions, CRT refresh rate was manipulated using a psychophysical method of limits procedure to estimate the 50 percent Critical Flicker Frequency (CFF) threshold. Results indicate that CFF increases with increasing display luminance, ambient illumination, and display size. CFF also increases with increasing eccentricity up to about 30 deg of visual angle. These findings confirm and extend previous research and provide a coherent database for development of quantitative image quality models for use by display designers and for display ergonomics technical standards.

Author (AIAA)

Cathode Ray Tubes; Flicker; Office Automation; Visual Perception

19980072452

Ocular dominance effects on the application of monocular, occluding head-mounted displays

Kancler, David E., Dayton, Univ., USA; Quill, Laurie L., Dayton, Univ., USA; 1997, pp. 1323-1327; In English; Copyright; Avail: Aeroplus Dispatch

This study investigates the effects of ocular dominance when maintenance procedures are presented on a monocular, occluding head-mounted display (HMD). It addresses the effect of ocular dominance on performance times, subjective workload ratings, self-reports, and preference rankings. Consistent with previous research, ocular dominance did not have a significant effect on any of the dependent measures. However, order of presentation (dominant eye before non-dominant eye vs. dominant eye after non-dominant eye) did provide some differences in performance times and workload scores. Explanations for these differences are discussed.

Author (AIAA)

Helmet Mounted Displays; Monocular Vision; Visual Perception; Human Factors Engineering; Eye Dominance; Human Performance

19980072453

Attentional control in 3-D space

Atchley, Paul, Illinois, Univ., Urbana, USA; Kramer, Arthur F., Illinois, Univ., Urbana; Theeuwes, Jan, TNO, Human Factors Research Inst., Netherlands; 1997, pp. 1328-1332; In English

Contract(s)/Grant(s): DAAL01-96-2-0003; Copyright; Avail: Aeroplus Dispatch

Two experiments investigated the nature of attention in 3D space. In Experiment I, the hypothesis that attention can be localized to a depth plane was tested. Observers searched for a red line in two arrays of green lines. The arrays of lines were near in 2D space but separated in depth. Search for the target was faster when the depth plane where the target would appear was cued, indicating attention can be localized in depth. A second experiment tested the hypothesis that attending to a location in depth would reduce the effect of a distracter at other depth locations. In this experiment, search for a tilted red line was faster when a distracting vertical line was present at another depth than when it was present at the same depth as the target. Implications for display design using depth information is discussed.

Author (AIAA)

Attention; Space Perception; Visual Perception; Visual Tasks

19980072456

Discrimination between functions in tables and graphs

Meyer, Joachim, Negev, Univ., Beersheva; Technion - Israel Inst. of Technology, Haifa, Israel; Gopher, Daniel, Technion - Israel Inst. of Technology, Haifa; Levy, Jonathan, California, Univ., San Diego; 1997, pp. 1348-1351; In English; Copyright; Avail: Aeroplus Dispatch

An experiment assessed the relative efficiency of tables and graphs for the discrimination between two system states, indicated by different frequencies of sine functions, in a simulated process. Graphic displays allowed significantly better discrimination than tables. The interval between the feed back for one trial and the beginning of the next trial affected performance for both displays. In graphs rapid learning occurred for all durations of the interval, but when the interval was 0 seconds the initial performance was lower than when the interval was 2 or 6 seconds. For tables only the 6 seconds interval showed faster learning than

the other conditions, but performance was still much lower than for graphs. The results lend support to the claim that graphic displays are of advantage when the displayed data has structure and when the task relies on this structure.
Author (AIAA)
Tables (Data); Graphs (Charts); Visual Discrimination

19980072524
Exogenous melatonin's phase-shifting effects on the endogenous melatonin profile in sighted humans - A brief review and critique of the literature
Lewy, Alfred J., Oregon Health Sciences Univ., Portland, USA; Sack, Robert L., Oregon Health Sciences Univ., Portland; Journal of Biological Rhythms; Dec. 1997; ISSN 0748-7304; Volume 12, no. 6, pp. 588-594; In English; Copyright; Avail: Aeroplus Dispatch

Melatonin's phase-shifting effects in humans are thought by some investigators to be subtle, particularly in comparison to those achieved with appropriately timed bright light exposure. When holding the light-dark cycle constant, consistent phase advances the day after melatonin administration in sighted people were first shown in the course of describing the melatonin phase response curve (PRC), which also provided the first evidence that melatonin could cause phase delays. More recent studies have replicated the PRC and shown that phase shifts can occur in response to physiological doses within 1 d. This article reviews this literature and attempts to reconcile some of the results from differing studies. If the timing of melatonin administration is optimized according to the melatonin PRC, then consistent phase advances and delays can be achieved. If a reliable and sensitive circadian phase marker (e.g., the highly resolved dim light melatonin onset) is used, then phase shifts can be demonstrated consistently - even a small shift the day after a single physiological dose. It is predicted that in the near future, melatonin administration will become as useful as bright light exposure in the treatment of circadian phase disorders.
Author (AIAA)
Phase Shift; Human Body; Reviewing; Light (Visible Radiation)

19980072969
Development of a virtual visualization environment for large-scale design
Abdul-Jalil, M. K., New York, State Univ., Buffalo, USA; Winer, E. H., New York, State Univ., Buffalo; Bloebaum, C. L., New York, State Univ., Buffalo; 1998, pp. 3062-3070; In English
Contract(s)/Grant(s): NSF DMI-95-53210; NSF DMI-96-22314
Report No.(s): AIAA Paper 98-2067; Copyright; Avail: AIAA Dispatch

This paper describes the development of a virtual visualization environment for large-scale Multidisciplinary Design Optimization (MDO) problems. The environment described provides a designer with the ability to see and interact with a 3D virtual reality (VR) representation of the design or problem being worked on. The designer also has the option of working with subsets of the design space on either a 2D or 3D coordinate axis system. The environment provides a means of viewing an actual system being designed (beam, truss, etc.) as well as visual representations of that system in a VR-based environment. The designer can make graphical alterations to the design and see the effects in real time.
Author (AIAA)
Systems Engineering; Virtual Reality; Finite Element Method; Structural Design; Cantilever Beams; Load Distribution (Forces)

55
SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

19980064070
The case for relic life on Mars
Gibson, Everett K., Jr., NASA Johnson Space Center, USA; McKay, David S., NASA Johnson Space Center, USA; Thomas-Keprta, Kathie, NASA Johnson Space Center, USA; Romanek, Christopher S., NASA Johnson Space Center, USA; Scientific American; Dec. 1997; ISSN 0036-8733; Volume 27, no. 6, pp. 58-63; In English; Copyright; Avail: Aeroplus Dispatch

Minute structures resembling fossilized bacteria have been found in a carbonate globule in the Antarctic meteorite ALH84001, which is strongly believed to be of Martian origin. The most visually compelling evidence that at least vestiges of

microbes have come into contact with the rock are objects that appear to be fossilized remains of microbes. HREM has revealed unusual features that are similar to those seen in terrestrial samples associated with biogenic activity.
AIAA
Microbiology; Extraterrestrial Life; Exobiology; Mars (Planet); SNC Meteorites

19980065367
The rise of life on Earth
Monastersky, Richard, USA; National Geographic; Mar. 1998; ISSN 0027-9358; Volume 19, no. 3, pp. 54-81; In English; Copyright; Avail: Aeroplus Dispatch

The evolution of microscopic life-forms on Earth is examined with reference to recent findings in prebiotic chemistry and microbial biology. These findings lead some scientists to believe that life on Earth started about four billion years ago in a scalding environment, perhaps around volcanic hot springs on the ocean bottom. According to this idea, seafloor springs simmered the sterile primordial ocean, causing chemicals to join together in myriad ways to create totally new molecules. Today, microscopic interplanetary dust particles deliver the same types of compounds which contributed to the development of life in the premordial ocean. The role of microscopic organisms in the production of oxygen, development of DNA and proteins, the basic molecules that sustain all living cells, and photosynthesis is discussed.
AIAA
Paleobiology; Biological Evolution; Meteorites

19980066953
An exobiological strategy for Mars exploration
Kerridge, John F., California, Univ., La Jolla, USA; 1997, pp. 15-19; In English; Copyright; Avail: Aeroplus Dispatch

Exobiological goals for Mars exploration concern the extent of prebiotic chemical evolution, prebiotic yielding of replicating molecules that have become extinct, and the identification of possible remaining populations of replicating organisms. A critical initial task for studies bearing on these goals is the completion of orbital missions capable of identifying promising Martian surface lithologies.
AIAA
Exobiology; Mars (Planet); Mission Planning; Mars Sample Return Missions

19980066955
Detection of amino acids on Mars
Bada, Jeffrey L., Scripps Institution of Oceanography, USA; 1997, pp. 26-29; In English; Copyright; Avail: Aeroplus Dispatch

Any strategy for investigating whether organic molecules are present on Mars should focus on compounds that can be easily synthesized under plausible prebiotic conditions, are abundant in carbonaceous meteorites, and play an essential role in biochemistry. Amino acids, which are the building-blocks of proteins and enzymes, are one of the few classes of compounds that satisfy all these requirements; they can serve as indicators of abiotic and/or biotic chemistry on Mars.
AIAA
Amino Acids; Mars (Planet); Mission Planning; Exobiology; Mars Sample Return Missions

19980066956
Searching for biogeochemical cycles on Mars
Des Marais, David J., NASA Ames Research Center, USA; 1997, pp. 30-33; In English; Copyright; Avail: Aeroplus Dispatch

Certain key planetary processes can offer clues as to whether there have ever been biogeochemical cycles on Mars. Active volcanism can offer reduced chemical species that biota can use for organic synthesis, and volcanic CO2 and CH4 can serve as greenhouse gases; the geologic processing of the crust can affect the availability of nutrients and control the deposition of minerals that could serve as a medium for fossil preservation.
AIAA
Biogeochemistry; Exobiology; Mars Sample Return Missions

19980067588
Influence of Allende minerals on deuterium retention of products of the Strecker synthesis
Lerner, Narcinda R., NASA Ames Research Center, USA; Geochimica et Cosmochimica Acta; Nov. 1997; ISSN 0016-7037; Volume 61,, no. 22, pp. 4885-4893; In English; Copyright; Avail: Aeroplus Dispatch

The Strecker synthesis, R2CO + HCN + NH3 yields (reversible) R2C(NH2)CN + H2O yields R2C(NH2)CO2H has been proposed as a source of amino acids in meteorites (Peltzer et al., 1984). The detection in the Murchison meteorite of carbonyl compounds, the precursors of the amino acids in the Strecker synthesis, and of alpha-hydroxy acids, important byproducts of the Strecker synthesis, supports this conjecture. to assess whether alpha-hydroxy acids exchange their carbon-bonded hydrons more readily than do alpha-amino acids, carbon-bonded hydron exchange of hydroxy acids was measured in D2O (with pH = 6, 8, and 10) at temperatures as high as 120 C for as long as two weeks, in both the presence and the absence of meteorite dust. Allende dust was used here because it can be considered to have a mineral assemblage similar to that which Murchison would have had prior to aqueous alteration. to determine whether alpha-amino acids retain the isotopic signature of their carbonyl precursors better than alpha-hydroxy acids, laboratory simulations of the Strecker synthesis using deuterated carbonyls under plausible parent body conditions were carried out. For most of the experiments reported here, the concentrations of the reactants used were those estimated for the Murchison parent body from published reports on the abundances of products and reactants in the Strecker synthesis found on Murchison. However, it was necessary to use solutions with concentrations quite different from these estimates in order to produce hydroxy acids from ketones. Simulations were done both in the presence and absence of meteorite dust. The observations show that the collective amino acids are more heavily deuterated than the collective hydroxy acids found in Murchison. However, the Strecker hypothesis cannot be ruled out for their origin.
AIAA
Allende Meteorite; Meteoritic Composition; Minerals; Deuterium; Carbonaceous Chondrites; Murchison Meteorite

19980068077
C'est la vie - Searching for life in the solar system
Cowen, Ron, USA; Science News; Nov. 01, 1997; ISSN 0036-8423; Volume 152, no. 18, pp. 284, 285; In English; Copyright; Avail: Aeroplus Dispatch

Recent discoveries of primitive organisms on Earth that flourish in harsh habitats have sparked a revolution in the search for life throughout the solar system. Citing the three ingredients necessary for life: organic compounds, liquid water, and a source of energy, planetary scientists have zeroed in on two places in the solar system: the planet Mars and Jupiter's moon Europa. A third locale, Saturn's largest moon, Titan, does not meet all three requirements, but it may offer a laboratory for scientists studying the chemical processes that fed life. These three solar system bodies are discussed in this article from the viewpoint of studying the possibility of life or conditions which could bring about life in solar system bodies other than the Earth.
AIAA
Solar System; Extraterrestrial Life

19980069525
Titan and the origin of life on Earth
Owen, T., Hawaii, Univ., Honolulu, USA; Raulin, F., Paris, Univ., France; Mckay, C. P., NASA Ames Research Center, USA; Lunine, J. I., Arizona, Univ., Tempe; Lebreton, J.-P., ESA, Netherlands; Matson, D. L., JPL, USA; ESA Bulletin; 1997; ISSN 0376-4265, no. 92, pp. 51-53; In English; Copyright; Avail: Aeroplus Dispatch

The relevance of Titan to the study of prebiotic chemistry and the origin of life on Earth will be addressed by an interdisciplinary group of Cassini/Huygens scientists using the different, but synergistic, data sets obtained by NASA's Cassini Orbiter and ESA's Huygens Probe. Titan's special importance lies in the primitive, chemically-reducing nature of its atmosphere. Cassini/Huygens instruments will determine what compounds form in this environment, and the results will be compared with models for prebiological chemical evolution on Earth.
Author (AIAA)
Titan; Life Sciences; Biological Evolution; Earth (Planet)

19980070419
On the microscopic basis of self-organization
Sanduloviciu, M., Iasi, Univ., Romania; Journal of Technical Physics; 1997; ISSN 0324-8313; Volume 38, no. 2, pp. 263-267; In English; Copyright; Avail: Aeroplus Dispatch

A phenomenological model able to explain the spontaneous self-assemblage of a membranous vesicle in the form of a self-consistent gaseous body, bordered by a spherical electrical double layer, is described. Such a vesicle, appearing in an asymptotically stable medium, could be an essential step in the origin and evolution of the earliest cells. The model is grounded on a a self-organization physical scenario that explains the genesis of complex space charge configurations in physical plasmas.
Author (AIAA)
Self Organizing Systems; Phenomenology; Plasma Physics; Magnetohydrodynamic Stability

19980070671

Ozone and the habitability of Mars

Hiscox, Julian A., Alabama, Univ., Birmingham, USA; Lindner, Bernhard L., Charleston, Univ., USA; From imagination to reality: Mars exploration studies of the Journal of the British Interplanetary Society. Pt. 2 - Base building, colonization and terraformation; 1997, 2 - Base building, colonization and terraformation, pp. 327-338; In English

Report No.(s): AAS 97-391; Copyright; Avail: Aeroplus Dispatch

Current thought experiments for planetary engineering on Mars propose an increase in the atmospheric pressure of carbon dioxide, leading to an increase in surface temperature, permitting the stability of liquid water at certain latitudes. In addition to increasing surface temperature, we show that this should lead to a concomitant rise in the amount of ozone, perhaps to levels that should permit planetary habitability by attenuating lethal UV radiation. At such levels, ozone should provide significant greenhouse warming. by attenuating lethal UV radiation, conditions would be favorable for the introduction of selected organisms to facilitate the planetary engineering process and regulate the resulting biosphere.

Author (AIAA)

Mars Atmosphere; Ozone; Space Habitats; Atmospheric Pressure; Carbon Dioxide; Surface Temperature

19980071531

Looking inside Earth for life on Mars

Nadis, Steve, USA; Technology Review; Dec. 1997; ISSN 0040-1692; Volume 10, no. 8, pp. 14-16; In English; Copyright; Avail: Aeroplus Dispatch

The possibility that microbial life forms existing inside the Earth, and discoverable in caves, have analogs on Mars is considered. Several expeditions to Lechuguilla cave are described whose goal was to help determine how and where and how future space probes should look for life on Mars.

AIAA

Extraterrestrial Life; Caves; Mars (Planet)

19980071538

Sulfide isotopic compositions in shergottites and ALH84001, and possible implications for life on Mars

Greenwood, James P., Tennessee, Univ., Knoxville, USA; Piciputi, Lee R., Oak Ridge National Lab., USA; McSween, Harry Y., Jr., Tennessee, Univ., Knoxville; Geochimica et Cosmochimica Acta; Oct. 1997; ISSN 0016-7037; Volume 61,, no. 20, pp. 4449-4453; In English

Contract(s)/Grant(s): DE-AC05-96OR-22464; Copyright; Avail: Aeroplus Dispatch

Ion microprobe measurements of the sulfur isotopes of sulfides have been made on five shergottites and ALH84001. The analysis of a fine-grained sulfide zone within a carbonate globule falls in the range of values found for the associated pyrites. The present findings do not support the hypothesis that ALH84001 preserves evidence of ancient biogenic activity.

AIAA

Sulfides; Mars Environment; Extraterrestrial Life; Sulfur Isotopes; Shergottites

19980071728

Astronomical and biochemical origins and the search for life in the universe; Proceedings of the 161st IAU Colloquium, Capri, Italy, July 1-5, 1996

1997; In English; ISBN 88-7794-092-1; Copyright; Avail: Aeroplus Dispatch

The present volume on astronomic and biochemical origins and the search for life in the universe discusses interstellar molecules of prebiotic interest, photochemical evolution of interstellar/precometary organic material, the diffuse interstellar bands and organic molecules in space and comets, and life on the primitive Earth. Attention is given to Titan's atmosphere and surface from IR spectroscopy and imagery, an overview of the Mission to Mars, the infancy of solar-type stars and its relevance for the origin of life, and IR interferometers for observing extrasolar planets. Other topics addressed include the origin of biological information, self-replication and evolution in primordial mutually catalytic sets, optical and IR SETI, and nonrepeatable SETI signals due to gravity-plasma lenses of stars.

AIAA

Conferences; Exobiology; Extraterrestrial Life; Universe; Biological Evolution; Project Seti

19980071729

Interstellar molecules of prebiotic interest

Winnewisser, Gisbert, Koeln, Univ., Germany; 1997, pp. 5-22; In English

Contract(s)/Grant(s): DFG-SFB-301; Copyright; Avail: Aeroplus Dispatch

The field of interstellar molecules is reviewed, with special consideration for molecules of potential biological interest. At present more than 110 interstellar molecules have been identified in interstellar clouds and circumstellar envelopes. The more complex molecules are found in the dense cores which are often the sites of active star formation. These locations represent prime targets for the search of larger molecules such as glycine and possibly other amino acids. However, in the list of detected interstellar molecules many simple hydrides are still missing, e.g., SH, PH, PH2, etc., which constitute the building blocks for larger molecules and biomolecules. With the technological opening of the terahertz region to both laboratory and interstellar spectroscopy, great scientific advances are expected. These include the direct detection of the low energy bending vibrations of larger (linear) molecules or the ring-puckering motion of larger ring molecules like the polycyclic (multiring) aromatic hydrocarbons, which might shed new light on the assignment of the 'unidentified IR' features or even on the diffuse visible interstellar bands DIBs.
Author (AIAA)

Interstellar Matter; Biological Evolution; Molecular Clouds; Stellar Envelopes; Star Formation; Amino Acids

19980071730

Photochemical evolution of interstellar/precometary organic material

Allamandola, Louis J., NASA Ames Research Center, USA; Bernstein, Max P., NASA Ames Research Center, USA; Sandford, Scott A., NASA Ames Research Center, USA; 1997, pp. 23-47; In English; Copyright; Avail: Aeroplus Dispatch

Ices in molecular clouds contain the very simple molecules H2O, CH3OH, CO, CO2, CH4, H2, and probably some NH3 and H2CO, as well as more complex species including nitriles, ketones, and esters. The evidence for these, as well as carbon-rich materials such as PAHs, microdiamonds, and amorphous carbon is briefly reviewed. This is followed by a detailed summary of interstellar/precometary ice photochemical evolution based on laboratory studies of realistic polar ice analogs. UV photolysis of these ices produces H2, H2CO, CO2, CO, CH4, HCO, and the moderately complex organic molecules: CH3CH2OH (ethanol), HC (= O) NH2 (formamide), CH3C (= O) NH2 (acetamide), R-CN (nitriles), and hexamethylenetetramine (HMT, C6H12N4), as well as more complex species, including polyoxymethylene and related species (POMs), amides, and ketones. The ready formation of these organic species from simple starting mixtures, the ice chemistry that ensues when these ices are mildly warmed, plus the observation that the more complex refractory photoproducts show lipidlike behavior and readily self-organize into droplets upon exposure to liquid water suggest that comets may have played an important role in the origin of life.
Author (AIAA)

Interstellar Chemistry; Photochemical Reactions; Organic Compounds; Comets; Molecular Clouds; Chemical Evolution

19980071732

Infrared signatures of prebiology - or biology?

Wickramasinghe, Nalin C., Univ. of Wales, UK; Hoyle, Fred, Univ. of Wales, UK; Al0Nufti, Shitwan, Univ. of Wales, UK; 1997, pp. 61-76; In English; Copyright; Avail: Aeroplus Dispatch

Data on IR spectra of astronomical sources and on the unidentified IR bands is reviewed and compared with a range of predictions from organic models of interstellar grains. The best fits to a wide range of data appear to require the widespread occurrence of functional groups distributed in exactly the proportions that characterize biosystems. The question of whether these agreements are consistent with extraterrestrial prebiology, or even cosmic biology, is discussed.
Author (AIAA)

Exobiology; Infrared Signatures; Biological Evolution; Interstellar Matter; Organic Compounds; Extraterrestrial Life

19980071733

Interaction of energetic particles with extraterrestrial ice

Pirronello, Valerio, Catania, Univ., Italy; 1997, pp. 77-87; In English; Copyright; Avail: Aeroplus Dispatch

The interaction of energetic particles with ice mixtures can induce important chemical effects. Such interactions occur in several environments in space and may produce complex prebiotic molecules whose formation may help to shed some light on the fascinating problem of the origin of life in our universe. Experimental work performed by several groups to simulate as closely as possible conditions and processes occurring in extraterrestrial scenarios is reported. Special attention is paid to applications of the results of laboratory investigations to interstellar and cometary environments.
Author (AIAA)

Energetic Particles; Particle Interactions; Extraterrestrial Resources; Ice; Chemical Effects; Biological Evolution

19980071734

On the nature of interstellar organic chemistry

Charnley, Steven B., NASA Ames Research Center, USA; 1997, pp. 89-96; In English

Contract(s)/Grant(s): NCC2-5083; Copyright; Avail: Aeroplus Dispatch

A theory for the origin of all organic molecules observed in regions of massive and low-mass star formation, as well as in dark molecular clouds, is described. On dust grains, single atom addition reactions and stability of the intermediate radicals, mechanisms similar to those believed to form the organic component of the Murchison meteorite, lead to a very limited number of mantle compositions depending upon the degree of hydrogenation. The key step in the theory is the formation of the formyl radical by H atom addition (by quantum tunneling) to CO. Subsequent H atom additions lead to formaldehyde and methanol, as previously suggested; C, N, and O atoms can also undergo additions to HCO. For increasing hydrogenation, the mantle types include: one in which there is little contribution from formyl-initiated chemistry; one in which an acetylenic chain develops through C atom additions; and others where the acetylenic chain is increasingly hydrogenated to form aldehydes and alcohols.

Author (AIAA)

Interstellar Chemistry; Biological Evolution; Organic Chemistry; Exobiology; Star Formation; Molecular Clouds

19980071735

Comets and life on the primitive Earth

Oro, Juan, Houston, Univ., USA; Cosmovici, Cristiano B., CNR, Ist. di Fisica dello Spazio Interplanetario, Italy; 1997, pp. 97-120; In English; Copyright; Avail: Aeroplus Dispatch

Comets may have contributed substantial amounts of water, volatiles, and organic precursors, such as HCN, for the synthesis of biochemical compounds on the primitive Earth. This suggestion followed dosely the prebiotic synthesis of adenine, purines, and amino acids from HCN. Recent studies on the terrestrial heavy noble gases provide evidence that comets are the principal external source of Earth's volatiles. During the encounter of Comet Halley, strong jets of CN, C2, C3, and NH2 were measured from Earth observatories, and by spacecraft mass spectrometry HCN, formaldehyde, adenine, and many other organic compounds were detected, except amino acids. Upon capture of comets by the Earth, and melting of the frozen water, the synthesis of most biochemical compounds could take place readily. The detection of water, HCN, and other organics of cometary origin after the impact of Comet SL-9 with Jupiter demonstrated the capability of survival of these molecules even after catastrophic events. In conclusion, comets probably provided the necessary molecular precursors for the generation of life on the Earth.

Author (AIAA)

Earth (Planet); Biological Evolution; Organic Compounds; Protoplanets; Rare Gases

19980071736

Organics in comets

Mumma, Michael J., NASA Goddard Space Flight Center, USA; 1997, pp. 121-142; In English; Copyright; Avail: Aeroplus Dispatch

The birth-endowed organic fraction of the newly formed (hot) Earth was destroyed by thermal decomposition during the cooling epoch. After Earth cooled sufficiently, an early organic inventory was likely replenished by the impact of comets and asteroids - a process which continues even today. The present organic composition of comets and asteroids can provide information relevant to this secondary organic seeding of the planets, for comparison with scenarios leading to self-replicating organic entities. Although impacts no longer deliver organics in significant quantities, compared with the existing terrestrial inventory, small bodies can deliver their organics intact to Earth's surface, while giant impacts may cause punctuated extinction of living species (and create opportunities for renewed speciation). Hence, the exogenous organic flux has great importance for life's origins and terminations. Current knowledge of the organic composition of comets is reviewed, and recent progress in our understanding of the chemical evolution of organic material from its formation to its incorporation into comets and later into planets is outlined. The need for detailed quantitative chemical analysis of material obtained directly from the cometary nucleus is indicated.

Author (AIAA)

Organic Compounds; Chemical Evolution; Asteroids; Planetary Composition; Biological Evolution

19980071737

Radiation chemistry approach to cometary chemistry

Ramos-Bernal, Sergio, Univ. Nacional Autonoma de Mexico, Coyoacan, Mexico; Negron-Mendoza, Alicia, Univ. Nacional Autonoma de Mexico, Coyoacan; 1997, pp. 143-148; In English; Copyright; Avail: Aeroplus Dispatch

The chemistry of comets is analyzed in the light of radiolytic processes occurring in the lifetime of the comet due to its interaction with radiation. A simple model of a cometary nucleus is carried out at the laboratory which simulates as a first approximation

the behavior of the organics in the comet. Most of the results obtained confirm that the parent molecules of the observed ones can be deduced from these simple simulated experiments. A variety of molecules (amino acids, carboxylic acids, gaseous products, etc.) were obtained; even in frozen solutions the formation of oligomers was observed. The simplified mixture consisted of five compounds in a proportion in which they appear in a dense interstellar cloud. The total amount was adjusted to correspond to a C/N ratio of 1.8. Radiation chemistry can be a very precise and useful tool to simulate the evolution of organic molecules exposed to high energy radiation, such as cosmic rays, during the lifetime of a comet.
Author (AIAA)
Comet Nuclei; Organic Compounds; Radiation Chemistry; Biological Evolution; Interstellar Chemistry; Cosmic Rays

19980071741

Hydrogen cyanide polymers from the impact of Comet P/Shoemaker-Levy 9 on Jupiter

Matthews, Clifford N., Illinois, Univ., Chicago, USA; Pesce-Rodriguez, Rose A., U.S. Army, Research Lab., USA; Liebman, Shirley A., CECON Group, Inc., USA; 1997, pp. 179-187; In English; Copyright; Avail: Aeroplus Dispatch

Hydrogen cyanide polymers - heterogeneous solids ranging in color from yellow to orange to brown to black - may be among the organic macromolecules most readily formed within the solar system. The nonvolatile black crust of Comet Halley, for example, as well as the extensive orange-brown streaks in the atmosphere of Jupiter, might consist largely of such polymers synthesized from HCN formed by photolysis of methane and ammonia, the color observed depending on the concentration of HCN involved. Laboratory studies of these ubiquitous compounds point to the presence of polyamidine structures synthesized directly from hydrogen cyanide. These would be converted by water to polypeptides which can be further hydrolyzed to q-amino acids. Black polymers and multimers with conjugated ladder structures derived from HCN could also be formed and might well be the source of the many nitrogen heterocycles, adenine included, observed after pyrolysis. The dark brown color arising from the impacts of Comet P/Shoemaker-Levy 9 on Jupiter might therefore be mainly caused by the presence of HCN polymers, whether originally present, deposited by the impactor or synthesized directly from HCN.
Author (AIAA)
Hydrocyanic Acid; Polymers; Hypervelocity Impact; Jupiter Atmosphere; Organic Chemistry

19980071742

Organic syntheses during the impact of a comet with a gaseous planet

Guaita, Cesare, G.A.T. Centro Astronomico, Tradate; Merate, Italy; Crippa, Roberto, G.A.T. Centro Astronomico, Tradate; Merate, Italy; Manzini, Federico, Stazione Astronomica, Sozzago; Merate, Italy; 1997, pp. 189-195; In English; Copyright; Avail: Aeroplus Dispatch

A large amount of CO has been detected above many SL9/Jupiter impacts. This gas was never detected before the collision. So, in our opinion, CO was released from a parent compound during the collision. We identify this compound as POM (polyoxymethylene), a formaldehyde (HCHO) polymer that, when suddenly heated, reforms monomeric HCHO. At temperatures higher than 1200 K, HCHO cannot exist in molecular form, and the most probable result of its decomposition is the formation of CO. At lower temperatures, HCHO can react with NH3 and/or HCN to form high UV-absorbing polymeric material. In our opinion, this kind of material has also to be taken in to account to explain the complex evolution of some SL9 impacts that we observed in CCD images taken with a blue filter.
Author (AIAA)
Comets; Hypervelocity Impact; Jupiter Atmosphere; Carbon Monoxide; Organic Compounds; Chemical Reactions

19980071743

Asteroid and comet impact speeds upon Mars - Significance for panspermia and the supply of organics

Steel, Duncan, Adelaide, Univ., Australia; 1997, pp. 197-201; In English; Copyright; Avail: Aeroplus Dispatch

While lithopanspermia depends upon massive impacts occurring at a speed above some limit, the intact delivery of organic chemicals or other volatiles to a planet requires the impact speed to be below some other limit such that a significant fraction of that material escapes destruction. Thus the two opposite ends of the impact speed distributions are the regions of interest in the bioastronomical context, whereas much modeling work on impacts delivers, or makes use of, only the mean speed. Here the probability distributions of impact speeds upon Mars are calculated for the orbital distribution of known asteroids, and the expected distribution of near-parabolic cometary orbits. It is found that cometary impacts are far more likely to eject rocks from Mars (over 99 percent of the cometary impacts are at speeds above 20 km/s, but at most 5 percent of the asteroidal impacts); paradoxically,

the objects impacting at speeds low enough to make organic/volatile survival possible (the asteroids) are those which are depleted in such species.
Author (AIAA)
Mars (Planet); Asteroids; Comets; Hypervelocity Impact; Organic Compounds; Panspermia

19980071744
Mars - Was there an ancient Eden?
Owen, Tobias, Hawaii, Univ., Honolulu, USA; 1997, pp. 203-218; In English; Copyright; Avail: Aeroplus Dispatch

The clear evidence of water erosion on the surface of Mars suggests an early climate much more clement than the present one. Using a model for the origin of inner planet atmospheres by icy planetesimal impact, it is possible to reconstruct the original volatile inventory on Mars, starting from the thin atmosphere we observe today. Evidence for cometary impact can be found in the present abundances and isotope ratios of gases in the atmosphere and in SNC meteorites. If we invoke impact erosion to account for the present excess of Xe-129, we predict an early inventory equivalent to at least 7.5 bars of CO2. This reservoir of volatiles is adequate to produce a substantial greenhouse effect, provided there is some small addition of SO2 (volcanoes) or reduced gases (cometary impact). Thus it seems likely that conditions on early Mars were suitable for the origin of life - biogenic elements and liquid water were present at favorable conditions of pressure and temperature. Whether life began on Mars remains an open question, receiving hints of a positive answer from recent work on one of the Martian meteorites. The implications for habitable zones around other stars include the need to have rocky planets with sufficient mass to preserve atmospheres in the face of intensive early bombardment.
Author (AIAA)
Mars Surface; Water Erosion; Mars Atmosphere; Atmospheric Models; Hypervelocity Impact; Biological Evolution

19980071745
Prebiotics on Titan - From available to expected measurements
Gautier, Daniel, Paris, Observatoire, France; 1997, pp. 219-226; In English; Copyright; Avail: Aeroplus Dispatch

An intense organic chemistry occurs in the atmosphere of Titan. The detected species are too far to be uniformly spatially distributed. Their mixing ratios vary with altitude and latitude. Interpretations of these data are examined. Available photochemical models are discussed and shown to fail to reproduce observed abundances of hydrocarbons and nitriles, whatever the assumed eddy diffusion coefficient profile. Future models will have to explicitly take into account polymerization, distributions of aerosols, seasonal effects, and atmospheric circulation. The Cassini Huygens mission, to be launched towards Saturn and Titan in 1997, will provide significant information on the atmospheric composition of organics and on the mapping of the most abundant species. The nature of the aerosols is investigated. Current theories on the chemical composition of the subnebulae of Saturn in which Titan was formed are discussed. We conclude that billions of Titan-like objects may exist in the universe.
Author (AIAA)
Titan; Satellite Atmospheres; Biological Evolution; Organic Compounds; Photochemical Reactions; Atmospheric Composition

19980071762
The chemical origin of life
de Duve, Christian, International Inst. of Cellular and Molecular Pathology, Brussels, Belgium; Rockefeller Univ., New York, Belgium; 1997, pp. 391-399; In English; Copyright; Avail: Aeroplus Dispatch

Fifty years ago, the problem of the origin of life was largely inaccessible to scientific research. Not only was almost nothing known of the conditions that surrounded the appearance of life on Earth, but there was so little understanding of life itself that the problem could not even be defined in concrete terms. The situation is very different today. Astronomical observations, geochemical findings, and laboratory investigations have illuminated the problem with much relevant information. In particular, the basic mechanisms of life are now understood in considerable detail. We know what to look for. Some important notions that have emerged in this way are briefly surveyed in this essay, which summarizes views presented in two recent books (de Duve, 1991, 1995).
Author (AIAA)
Biological Evolution; Earth (Planet); Chemical Evolution; Space Exploration

19980071763
Prebiotic-related chemistry in the present outer solar system
Raulin, Francois, CNRS, LISA; Paris VII, Univ.; Paris XII, Univ., France; Coll, Patrice, CNRS, LISA; Paris VII, Univ.; Paris XII, Univ., France; Gazeau, Marie-Claire, CNRS, LISA; Paris VII, Univ.; Paris XII, Univ., France; Bruston, Paul, CNRS, LISA; Paris

VII, Univ.; Paris XII, Univ., France; 1997, pp. 401-412; In English; Copyright; Avail: Aeroplus Dispatch

There are numerous places in the outer solar system where the formation of the starting ingredients which are involved in early terrestrial prebiotic chemistry is currently going on. Organic chemistry is largely present in the outer planets, particularly in Titan. Titan has a dense atmosphere, mainly composed of N2 and CH4 and very rich in organic compounds, both in gas and aerosol phases. The study of Titan should provide information on prebiotic chemistry - at least prebiotic chemistry in the absence of liquid water. This quasi-planet is a natural laboratory making it possible to study prebiotic evolution toward complex organic systems in a planetary environment over a long time scale. A detailed study of this natural prebiotic laboratory is precisely one of the main objectives of the Cassini-Huygens mission. With the sending of the Cassini orbiter around Saturn and the Huygens probe in the atmosphere of Titan, this mission, due to be launched in October 1997, for a Saturn arrival in 2004, will offer a unique opportunity to study in detail extraterrestrial prebiotic processes, together with important implications for the field of bioastronomy and the origins of life.

Author (AIAA)

Exobiology; Organic Chemistry; Chemical Evolution; Titan; Satellite Atmospheres

19980071764

Hydrogen cyanide polymers as prebiotic sources of biological compounds in terrestrial and extraterrestrial environments

Negron-Mendoza, Alicia, Univ. Nacional Autonoma de Mexico, Coyoacan, USA; Ramos-Bernal, Sergio, Univ. Nacional Autonoma de Mexico, Coyoacan; 1997, pp. 413-418; In English; Copyright; Avail: Aeroplus Dispatch

Aqueous solutions of cyanides are frequently used in experiments related to prebiotic chemistry. CN-containing molecules are key compounds in this type of synthesis. This is due to the high chemical reactivity of the CN group, their abundance in the interstellar space, in comets, and the facility of their formation from simulated experiments. Implications for prebiotic chemistry are profound mainly because these polymeric materials upon hydrolysis release compounds of biological significance such as amino acids, purines, carboxylic acids, etc. Since the products formed from a CN-containing compound have different chemical groups and a great variety of molecular weights, the potentiality and versatility for prebiotic synthesis is enormous. The gamma irradiation of very diluted aqueous solutions of HCN yields oligomeric material among the radiolytic products. These oligomers are constituted of polyamides and substituted ureas. However, radiation-induced polymers have different characteristics than the polymers formed by thermal polymerization.

Author (AIAA)

Exobiology; Hydrocyanic Acid; Polymer Chemistry; Biological Evolution

19980071765

The tempo and mode(s) of prebiotic evolution

Lazcano, Antonio, Univ. Nacional Autonoma de Mexico, Coyoacan, USA; 1997, pp. 419-429; In English; Copyright; Avail: Aeroplus Dispatch

Different current ideas on the origin of life are critically examined. Comparison of the now fashionable FeS/H2S pyrite-based autotrophic theory of the origin of life with the heterotrophic viewpoint suggest that the later is still the most fertile explanation for the emergence of life. However, the theory of chemical evolution and heterotrophic origins of life requires major updating, which should include the abandonment of the idea that the appearance of life was a slow process involving billions of years. Stability of organic compounds and the genetics of bacteria suggest that the origin and early diversification of life took place in a time period of the order of 10 million years. Current evidence suggests that the abiotic synthesis of organic compounds may be a widespread phenomenon in the Galaxy and may have a deterministic nature. However, the history of the biosphere does not exhibit any obvious trend towards greater complexity or 'higher' forms of life. Therefore, the role of contingency in biological evolution should not be underestimated in the discussions of the possibilities of life in the universe.

Author (AIAA)

Biological Evolution; Organic Compounds; Chemical Evolution; Bacteria; Milky Way Galaxy; Biosphere

19980071766

Violent primitive Earth might have harmonized with the origin of life

Shimizu, Mikio, Inst. of Space and Astronautical Science, Japan; 1997, pp. 431-436; In English; Copyright; Avail: Aeroplus Dispatch

At the end of the planetesimal infall on the surface of the primitive Earth, hot dry beaches might have been useful for the formation of various activated monomers and oligomers (peptides and small RNAs). We discuss the possibility that a small system composed of small RNAs (about 10 mers) and dipeptides might have mimicked the contemporary biosystem, based on experimental results suggesting the presence of previously overlooked weak but specific interactions between three bases and one amino

acid (of genetic code type) and also those between a dipeptide and a biosubstrate (of ligase, transferase, hydrolase, lyase, isomerase, and dehydrogenase type). The K(m)s obtained for these dipeptide enzymes were of the order of 1 M, in accord with the association constant for the binding of guanosine to cytocine in water. In this oligomer world, the genotype and phenotype evolution was closely coupled, resulting in a very rapid rate of evolution.
Author (AIAA)
Earth Surface; Biological Evolution; Oligomers; Monomers; Planetary Evolution; Organic Chemistry

19980071767
Redox reactions in lipid membranes as a model for primordial energy-conserving systems
Di Bernardo, Salvatore, Bologna, Univ., Italy; Fato, Romana, Bologna, Univ., Italy; Lenaz, Giorgio, Bologna, Univ., Italy; 1997, pp. 437-442; In English; Copyright; Avail: Aeroplus Dispatch

One of the peculiar aspects of living systems is the production and conservation of energy. This aspect is provided by specialized organelles, such as the mitochondria and chloroplasts, in developed living organisms. In primordial systems lacking specialized enzymatic complexes, the energy supply was probably bound to the generation and maintenance of an asymmetric distribution of charged molecules in compartmentalized systems. On the basis of experimental evidence, we suggest that lipophilic quinones were involved in the generation of this asymmetrical distribution of charges through vectorial redox reactions across lipid membranes.
Author (AIAA)
Redox Cells; Lipids; Cell Membranes (Biology); Biological Models (Mathematics); Organic Compounds

19980071768
The origin of biological information
Eigen, Manfred, Max-Planck-Inst. fuer Biophysikalische Chemie, Germany; 1997, pp. 443-453; In English; Copyright; Avail: Aeroplus Dispatch

New physical concepts have been introduced in order to deal quantitatively with the dynamics of the molecular generation of genetic information. They provide a physical formulation for Darwinian behavior, yet they introduce major modifications in its interpretation. The study deals with these physical concepts, such as 'sequence space', 'quasi-species', and 'hypercycles', and scrutinizes their adequacy for rationalizing experimental results obtained with molecular model systems and with viruses under natural conditions. Elucidating the principles of molecular self-organization has made it possible to construct automated machines that enable genetic information to evolve under controlled conditions in an abridged time scape.
Author (AIAA)
Biological Evolution; Molecular Structure; Self Organizing Systems; Genetics

19980071769
The origin of biological structures: Information theory and the creation of order - Some new insights
Bauer, Carlo, Pisa, Univ., Italy; Morelli, Roberto, Milano, Univ., Italy; Spanedda, Andrea, CNR, Ist. di Chimica Quantistica ed Energetica Molecolare, Italy; Paolini, Moreno, Lab. di Tossicologia Biochimica, Italy; 1997, pp. 455-459; In English; Copyright; Avail: Aeroplus Dispatch

On the basis of the existence of two types of entropy - geometric and energetic entropy, we explain the spontaneous formation of order with a draft of geometric information by the destruction of a suitable amount of energetic information. Thus the original chaos was a geometric chaos, but rich in energetic information. We propose that if there is a variation in the DOFs in the system, due to some quantum restrictions, the ensuing variation of microscopic kinetic energy at constant T must be subtracted from both the enthalpic and entropic terms of Delta-G, resulting in a restatement of the conditions of spontaneity which may even be very great. This (Delta-E(k)) sub T corrective term is linked to the difference of heat capacities in the process. Biochemical examples are given.
Author (AIAA)
Biological Evolution; Kinetic Energy; Biochemistry; Exobiology

19980071770
Self-reproduction of chemical structures and the question of the transition to life
Luisi, Pier L., Zuerich, Eidgenoessische Technische Hochschule, Switzerland; 1997, pp. 461-468; In English; Copyright; Avail: Aeroplus Dispatch

The principles which underlay the chemical approach to the origin of life are discussed, beginning with Oparin's notion of molecular evolution, whereby the minimal living emerged from the nonliving via a natural increase of molecular complexity and

organization. The philosophical and methodological difficulties inherent in such a view are briefly examined. The scenario of the origin of life provided by the RNA-world is then reviewed, and the great difficulties inherent in this view are emphasized, particularly the one according to which an RNA family is created ex novo in an enzyme-free world in a way which is capable of self-replicating. It is concluded that the view of the RNA world regarding the origin of life, despite its popularity, is not very realistic at all; however, it is of great importance, as it has introduced a series of fundamental new concepts into the field of origin of life. Particularly important is the notion of self-reproduction, and in the paper the self-reproduction of vesicles is reviewed, with emphasis on the fact that it is a thermodynamically driven process based on spontaneously self-assembling macromolecular aggregates. The possible relevance of these experiments for assessing a prebiotic 'pre-RNA' world is discussed.
Author (AIAA)
Biological Evolution; Molecular Structure; Chemical Evolution; Ribonucleic Acids; Reproduction (Biology)

19980071771
Self-replication and evolution in primordial mutually catalytic sets
Serge, Daniel, Weizmann Inst. of Science, Israel; Pilpel, Yitzhak, Weizmann Inst. of Science, Israel; Glusman, Gustavo, Weizmann Inst. of Science, Israel; Lancet, Doron, Weizmann Inst. of Science, Israel; 1997, pp. 469-476; In English; Copyright; Avail: Aeroplus Dispatch

A kinetic model for random mutually catalytic chemical sets is used to estimate the probability for the spontaneous origin of molecular self-replication. Simplifying assumptions on the chemistry in such systems enable us to explore the possible mechanisms for chemical evolution of simple metabolic networks, and the emergence of well organized structures. The model affords an estimate of the probability that a given rate of growth or replication will appear by chance in a pre-biotic milieu, thus assisting in understanding the potential precursors of life.
Author (AIAA)
Biological Evolution; Catalytic Activity; Organic Chemistry; Chemical Evolution; Biological Models (Mathematics)

19980071772
Did a precellular RNA world ever exist?
Rizzotti, Martino, Padova, Univ., Italy; 1997, pp. 477-481; In English; Copyright; Avail: Aeroplus Dispatch

The so-called 'RNA world' is the most fashionable hypothesis on the origin of the biosphere on the Earth. It states that cells derived from aggregates made of RNA in contact with the superficial waters. Its presumed pieces of evidence are drawn either from simulation experiments or from RNA molecules of present-day organisms. However, both kinds of evidence are better explained by alternative hypotheses.
Author (AIAA)
Biological Evolution; Ribonucleic Acids; Biosphere; Earth (Planet); Water

19980071773
Molecular evolution of aminoacyl tRNA synthetases and origin of universal genetic code
Ishigami, Masahiro, Osaka Prefecture Univ., Japan; Ihara, Hideshi, Osaka Prefecture Univ., Japan; Shinoda, Hiroyuki, Osaka Prefecture Univ., Japan; 1997, pp. 483-489; In English; Copyright; Avail: Aeroplus Dispatch

It is thought that living things first appeared on the primitive Earth 35 hundred million years ago. At that time, a primitive protein synthesis mechanism was thought to have been established, a genetic code system evolved, and a universal genetic code system developed. Aminoacyl tRNA synthetase must have evolved with the genetic code system. The aim of the present study is to clarify the evolution of aminoacyl tRNA synthetase and the process and era of the establishment of the universal genetic code system.
Author (AIAA)
Biological Evolution; Ribonucleic Acids; Molecular Structure; Genetic Code; Earth (Planet); Amino Acids

19980071775
Homochirality as the signature of extra-terrestrial life
MacDermott, Alexandra J., Cambridge, Univ., UK; 1997, pp. 505-510; In English; Copyright; Avail: Aeroplus Dispatch

The most characteristic hallmark of life is its homochirality: all biomolecules are usually of one hand, e.g., on Earth life uses only L-amino acids for protein synthesis and not their D mirror images. We therefore suggest that a search for extraterrestrial life can be approached as a Search for Extraterrestrial Homochirality (SETH). The natural choice for a SETH instrument is optical rotation, and we describe a novel miniaturized space polarimeter, called the SETH Cigar, which could be used to detect optical rotation as the homochiral signature of life on other planets. Moving parts are avoided by replacing the normal rotating polarizer

by multiple fixed polarizers at different angles as in the eye of the bee. We believe that homochirality may be found in the subsurface layers on Mars as a relic of extinct life, and on other solar system bodies as a sign of advanced pre-biotic chemistry. We discuss the chiral GC-MS planned for the Roland lander of the Rosetta mission to a comet and conclude with theories of the physical origin of homochirality.
Author (AIAA)
Extraterrestrial Life; Chirality; Amino Acids; Earth (Planet); Protein Synthesis; Rosetta Mission

19980071776
Search for life in the universe with terrestrial microbes which thrive under extreme conditions
Seckbach, Joseph, Jerusalem, Hebrew Univ., Israel; 1997, pp. 511-523; In English; Copyright; Avail: Aeroplus Dispatch

This article lists Extremophiles and their various terrestrial enigmatic environments. We discuss the possibilities of Martian life and the origin and evolution of the eukaryotic cell and present some early protists and the Acidothermophilic algae. Among several microbes which can 'fit' for extraterrestrial life, one eukaryotic algal group (Cyanidiophyceae) is treated here. The hot spring Cyanidium caldarium members (there are three genera and several species in this family) thrive in excessive growth conditions like in acidic medium, under pure CO2 atmosphere, in elevated temperature and auto or heterotrophic conditions. These hot spring unicellular algae do not require oxygen for such conditions of growth.
Author (AIAA)
Extraterrestrial Life; Bacteria; Mars (Planet); Cells (Biology); Organic Compounds

19980071777
A search for extraterrestrial eukaryotes - Biological and planetary science aspects
Chela-Flores, Julian, International Centre for Theoretical Physics, Trieste, Italy; Dublin Inst. for Advanced Studies, Ireland; 1997, pp. 525-532; In English; Copyright; Avail: Aeroplus Dispatch

One pressing question in bioastronomy is to attempt to devise assays in the search for extraterrestrial eukaryotes (SETE). We sketch a possible experimental set-up required for a robot to investigate whether eukaryogenesis has already taken place in Mars or Europa. We also discuss the biological and astronomical implications of a SETE program. Previous observations and theoretical work have suggested that underneath the ice crust of the Jovian satellite Europa there may be an ocean of liquid water. We therefore argue that as hot springs may be present at the bottom of that ocean, eukaryotes should be searched for, not only deep in the Martian permafrost, as discussed by others, but a SETE program should be extended to the aquatic environment of the Jovian satellite as well. Our current work emphasizing gene silencing may suggest how to decide on the degree of evolution which microbiota may have reached in the Europa ocean, a topic which deserves our attention, as eukaryogenesis is the process which introduced the basic cellular plan of those Earth-bound organisms that have been raised to the level of intelligent beings. We make a specific suggestion for a robotic investigation of eukaryogenesis in solar system exploration.
Author (AIAA)
Extraterrestrial Life; Exobiology; Mars (Planet); Eukaryotes; Europa; Biological Evolution

19980071778
On the existence of stable isolated ecosystems outside the Earth
Benci, Vieri, Pisa, Univ., Italy; Galleni, Lodovico, Pisa, Univ., Italy; Santini, Francesco, Pisa, Univ., Italy; 1997, pp. 533-537; In English; Copyright; Avail: Aeroplus Dispatch

The planetary biosphere can easily be recognized because, according to Lovelock (1995), living beings maintain the atmosphere of a planet far from chemical equilibrium. According to this idea, it is thought that within the solar system there is no life outside the planet Earth. But this is true if we suppose that all the ecosystems are interconnected and easily detectable, because their presence would have effects at a planetary level. After the discovery since the end of the seventies of a series of ecosystems that do not have their source of energy in solar light and which are more or less isolated from other ecosystems, is it possible to hypothesize the existence of biospheres being smaller than the planetary biosphere?
Author (AIAA)
Earth Atmosphere; Ecology; Biosphere; Extraterrestrial Life

19980071779
Panspermia revisited - Astrophysical and biological constraints
Wesson, Paul S., Waterloo, Univ., Canada; Secker, Jeff, McMaster Univ., Canada; Lepock, James R., Waterloo, Univ., Canada; 1997, pp. 539-544; In English; Copyright; Avail: Aeroplus Dispatch

We have carried out a series of calculations involving bacteria and viruses embedded in dust grains that are ejected from our solar system by radiation pressure, and travel through space to other star systems. Under many conditions, this kind of panspermia is impractical, mainly because the UV radiation of the present sun kills the microorganisms. However, if the organisms are shielded by an absorbing material like carbon and if ejection takes place in the late sun (red giant) phase, there is a significant probability that these microorganisms can reach another star system alive. In addition to panspermia with living microorganisms, we note that it is possible to seed the Galaxy with dead ones, whose DNA fragments might provide the initial information necessary to start biological evolution in favorable environments.
Author (AIAA)
Exobiology; Panspermia; Microorganisms; Bacteria; Cosmic Dust; Biological Evolution

19980071780
Can spores survive a million years in the radiation of outer space? I - Protection against photons above 0.5 keV
Mileikowsky, Curt, Switzerland; 1997, pp. 545-552; In English; Copyright; Avail: Aeroplus Dispatch

It is conceivable that microorganisms could be transported over long distances in space inside natural 'vehicles' such as molecular clouds, comets, or meteors. to traverse a distance of 30 ly at speeds of 10 km/s (to another planetary system) would then take a million years. Due to the intense radiation in space by both photons and cosmic ray charged particles, microorganisms, including the most radiation-resistant spores known, need radiation protection in order to survive the million-year dormancy. From the absolute energy distribution in the ISM of the photon radiation of energies from 0.5 keV and up - known by measurement, the dose rates, in Mrad/My, have been calculated for spores of volume g/cu cm which are assumed to have escaped out into interstellar space. Taking into consideration the energy dependence of photon attenuation in organic material, of absorption restriction in small bodies, and of attenuation in the shielding material, these calculations have been done for unprotected spores, for spores in the central regions of seven different molecular clouds characterized by radial column densities from 0.01 to 1.3 g/sq cm, and for spores inside porous meteors and in comets.
Author (AIAA)
Exobiology; Spores; Radiation Protection; Photons; Cosmic Rays; Molecular Clouds

19980071811
The biophysical cosmology - The place of bioastronomy in the history of science
Dick, Steven J., U.S. Naval Observatory, USA; 1997, pp. 785-788; In English; Copyright; Avail: Aeroplus Dispatch

The recent discoveries of planets around sunlike stars, possible primitive Martian fossil life, and conditions on Europa conducive to microbial life render more urgent the question of the place of bioastronomy in the history of science. This paper argues that the tenets of bioastronomy constitute a 'biophysical cosmology', a scientific world view that holds that life is common throughout the universe. Many of the activities in the field of bioastronomy are tests of this cosmology. Like other cosmologies, the biophysical cosmology bears strongly on humanity's place in the universe. Cosmological status may also be useful in discussing the implications of contact, when one considers the response to other cosmologies as partial, if imperfect, analogues.
Author (AIAA)
Extraterrestrial Life; Bacteria; Biophysics; Exobiology; Mars Environment; Europa

19980072483
No 'nanofossils' in Martian meteorite
Bradley, J. P., MVA, Inc., USA; Harvey, R. P., Case Western Reserve Univ., USA; McSween, H. Y., Jr., Tennessee, Univ., Knoxville; Nature; Dec. 04, 1997; ISSN 0028-0836; Volume 390,, no. 6659, pp. 454; In English; Copyright; Avail: Aeroplus Dispatch

Fracture surfaces of the Martian meteorite ALH84001, where proposed Martian 'nanofossils' were found, were studied using the techniques described by McKay et al. (1996), and no nanofossils were found. Elongated forms observed in the specimen are explained in terms of inorganic processes. In a reply, McKay et al. agree with the principal findings of the authors, but maintain that the features they observed by TEM may be biogenic.
AIAA
SNC Meteorites; Exobiology; Extraterrestrial Life; Fossils

Subject Term Index

A

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