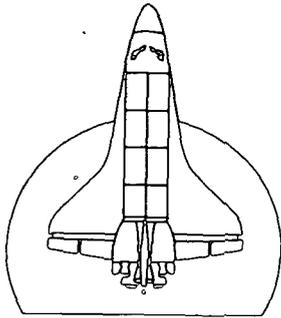


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A Continuing
Bibliography
with Indexes

NASA SP-7011 (217)
March 1981



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(NASA-SP-7011 (217)) AEROSPACE MEDICINE AND
BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH
INDEXES, SUPPLEMENT 217, MARCH 1981
(National Aeronautics and Space
Administration) 50 p HC \$7.00

N81-22680

Unclas
21925

CSSL 06E 00/52

Aerospace Medicine & Biology

ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series) N81-12011 – N81-13913

IAA (A-10000 Series) A81-12785 – A81-16480

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 217)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in February 1981 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Branch

1981

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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* (NASA SP-7011) lists 130 reports, articles and other documents announced during February 1981 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964; since that time, monthly supplements have been issued.

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

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections: *IAA Entries* and *STAR Entries*, in that order. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

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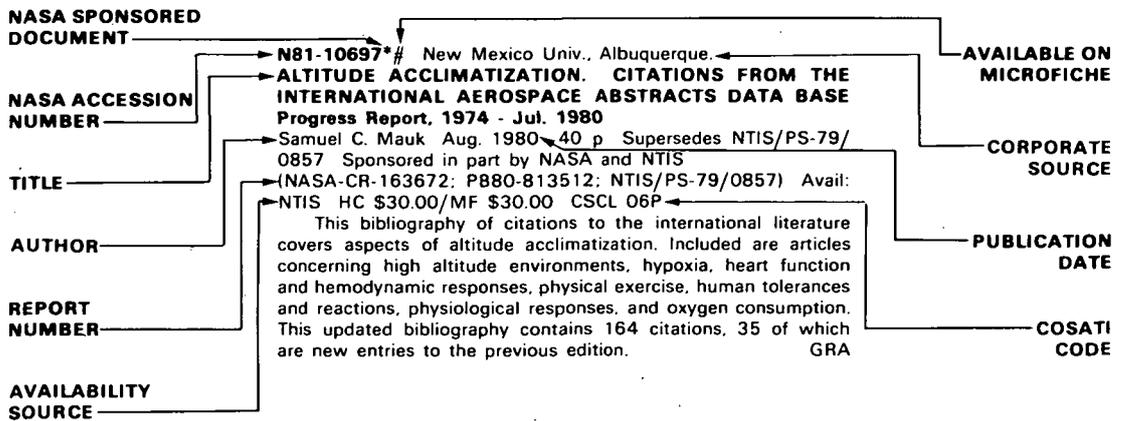
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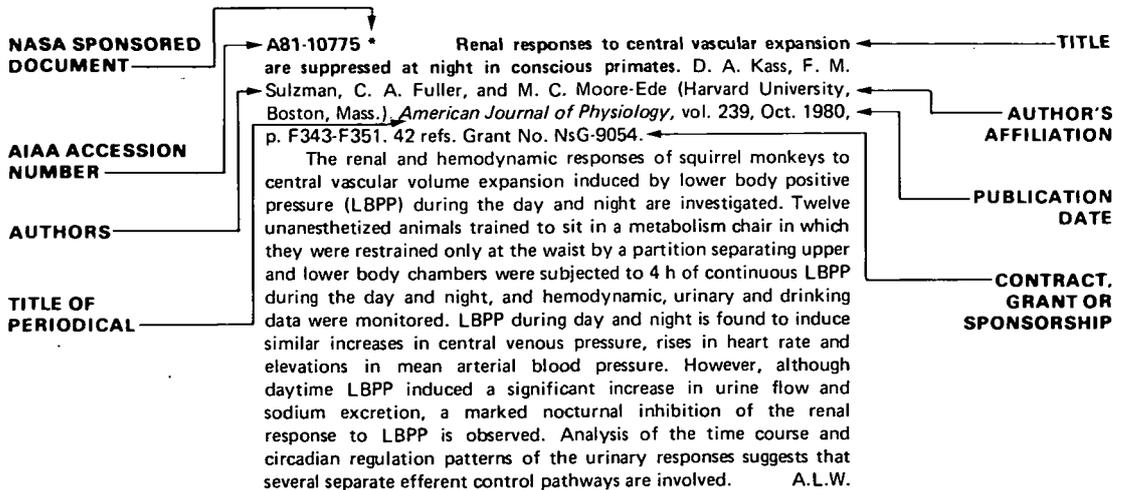
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AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 217)

MARCH 1981

IAA ENTRIES

A81-12969 # Transmission of signals of a pilot's physiological functions during flight (Prenos signálu fyziologických funkcí pilota za letu). J. Hanousek. *Zpravodaj VZLU*, no. 3, 1980, p. 119-126. 12 refs. In Czech.

An 11-channel PCM biotelemetry system is described. This system, in conjunction with a preamplifier, permits the transmission of signals of different combinations of physiological functions of the pilot of any combat aircraft. Random noise is analyzed along with the noise immunity properties of the system. B.J.

A81-13055 # Human decision making in aircraft control systems (Priniatie reshenii chelovekom v aviatsionnykh sistemakh upravleniia). P. P. Novikov. Moscow, Izdatel'stvo Vozdushnyi Transport, 1980. 349 p. 155 refs. In Russian.

The problem of human decision making is examined as it relates to aircraft control systems. Several conceptual models of human activity are formulated, with the structuring, functional content and multi-leveled organization of decision making taken into account, and a formal description of models of decision making is presented within the framework of one of the activity models in terms of complexly structured texts and dispositions. Consideration is then given to the experimental identification of the concepts and procedures of models of decision making based on the monitoring of human activities in actual and laboratory environments. Results are presented for both ground-based air traffic controllers and pilots involved in aircraft landing, and the internal logic of the identified models is verified by digital computer iterations. Practical aspects of the use of models of decision making in the prediction and detection of conflict situations, aircraft landing algorithms, and the modeling and evaluation of air traffic control systems are discussed. A.L.W.

A81-13063 # The design of industrial robots (Ustroistvo promyshlennykh robotov). E. I. Iurevich, B. G. Avetnikov, O. B. Korytko, Iu. D. Andrianov, V. A. Korolev, and V. G. Savin. Leningrad, Izdatel'stvo Mashinostroenie, 1980. 331 p. 72 refs. In Russian.

The overall and component design of industrial robots is considered. The development of pneumatic, hydraulic, and electro-mechanical robots is described, and the design of drive and control systems is examined. The use of manipulators with perception systems is discussed. B.J.

A81-13116 Aerospace Medical Association, Annual Scientific Meeting, Anaheim, Calif., May 12-15, 1980, Preprints. Washington, D.C., Aerospace Medical Association, 1980. 257 p. \$15.

Papers are presented in the areas of clinical aerospace medicine, decompression sickness, nursing, hypokinesia, hypoxia, heat and cold stresses, acceleration stresses, visual physiology, oxygen systems, impact injuries, flight safety, pilot performance, motion sickness, stress physiology and vestibular function. Specific topics include the detection of coronary artery disease in asymptomatic aircrew members by Th-201 scintigraphy, procedures for the protection of Space Shuttle crews from decompression sickness during EVAs, the

cardiovascular effects of horizontal and head-down bed rest, the use of ear oximetry in hypobaric research, a burn prediction model for the evaluation of thermally protective clothing, and the response to acceleration following horizontal casting. Attention is also given to the effects of test and training intervals on acceleration performance, UV-B exposure in commercial airline operations, glaucoma management in aviation personnel, current Air Force oxygen delivery components, the implications of dynamic preload for human impact tolerance, human errors in aircraft accidents, the assessment of performance by the use of television computer games, environmental health nursing, motion sickness effects on psychomotor performance, stress-induced changes in the immune system, and the influence of Coriolis acceleration on saccadic eye movements. A.L.W.

A81-13199 Thirst following water deprivation in humans. B. J. Rolls, R. J. Wood, E. T. Rolls, H. Lind, W. Lind, and J. G. G. Ledingham (Oxford University, Oxford, England). *American Journal of Physiology*, vol. 239, Nov. 1980, p. R476-R482. 24 refs. Research supported by the Medical Research Council of England.

The effect of 24-h water deprivation and subsequent drinking on systemic fluid balance and subjective sensations has been determined in human beings. The deprivation caused significant intracellular and extracellular depletions, thirst, and a dry unpleasant tasting mouth. During rehydration, subjects drank 65% of their total intake within 2.5 min. The marked decrease in drinking rate thereafter, and the alleviation of thirst, occurred before plasma dilution had become significant. Following rehydration, the concentrated urine of hyponatremia had disappeared. However, the excretion of solute-free water varied between subjects. Plasma renin activity was significantly elevated by water deprivation, while after rehydration this activity had decreased to levels not significantly different from predeprivation values. (Author)

A81-13212 Discomfort produced by impulsive whole-body vibration. M. J. Griffin and E. M. Whitham (Southampton, University, Southampton, England). *Acoustical Society of America, Journal*, vol. 68, Nov. 1980, p. 1277-1284. 19 refs.

The paper investigates the effect of whole-body duration vibrations on human discomfort for periods up to 32 seconds. Four experiments are conducted which examine respectively: (1) the effect of exposure durations up to 4 s on the discomfort produced by sinusoidal whole-body vibrations at 4, 8, 16, and 32 Hz, (2) the effect of exposure to 8 Hz motions for durations up to 32 s, (3) the effects of five different 10 s test motions each of 8 Hz vibrations in which the peak cycle is varied, and (4) the effect of vibration duration at different vibration frequencies. The results of the first two experiments conflict with previous reports of a short finite integration time for human response to vibration. A prediction procedure is devised which might be appropriate for the assessment of the discomfort produced by complex time-varying motions. The procedure which indicates that motions of the same frequency and same rms level will cause greater discomfort with increasing peak levels is discussed in relation to its possible applications. A.C.W.

A81-13214 Time dependency of whole-body vibration discomfort. M. J. Griffin and E. M. Whitham (Southampton,

University, Southampton, England). *Acoustical Society of America, Journal*, vol. 68, Nov. 1980, p. 1522, 1523.

A81-13226 # Vectorcardiographic changes in hypoxic environment. P. C. Chatterjee and B. R. S. Reddy (Indian Air Force, Institute of Aviation Medicine, Bangalore, India). *Aviation Medicine*, vol. 24, June 1980, p. 1-5. 19 refs.

A vectorcardiographic study of changes in cardiac, hemodynamic and respiratory function associated with short-duration moderate hypoxia at a simulated altitude of 15,000 feet is presented. Fifteen healthy adult male subjects were fitted with eight electrodes each in a standard Frank lead configuration and monitored at ground level, immediately upon reaching a simulated altitude of 15,000 feet in moderate hypoxia, following a stay the of 30 min, and upon return to ground-level conditions. The magnitude of the maximum QRS vector is found to decrease significantly upon initial exposure to altitude, then recover partially after 30 min, with no significant change in orientation. When subjects breathed 100% oxygen, the magnitude of the QRS vector is found to increase further, often becoming larger than ground-level values. The changes observed are explained in terms of known circulatory adjustments during hypoxia, thus demonstrating the usefulness of vectorcardiography for the determination of hypoxic responses in normal individuals and the assessment of cardiovascular abnormalities. A.L.W.

A81-13227 # Pulmonary fat embolism in aircrew fatalities. W. K. Adaval (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), G. N. Kunzru (Air Force Hospital, India), and R. N. Verma. *Aviation Medicine*, vol. 24, June 1980, p. 6-8, 15 refs.

Findings on 305 autopsies conducted on aircrew fatalities have been studied. Histological sections from lungs were available in 182 cases which have been reviewed to determine the incidence of pulmonary fat embolism and to correlate its occurrence with some aetiological factors. It is observed that only 25% of the cases showed evidence of pulmonary fat embolism. Probable factors for this low incidence have been discussed and significance of this finding in accident investigation has been highlighted. (Author)

A81-13228 # Ambulatory monitoring in evaluation of aircrew with cardiovascular problems. M. Akhtar, B. K. Das (Army Hospital, New Delhi, India), and J. C. Chatterji. *Aviation Medicine*, vol. 24, June 1980, p. 9-14. 20 refs.

The usefulness of 24-h ambulatory monitoring in addition to traditional stress testing and noninvasive tests in the evaluation of air crew members with cardiovascular problems is investigated. Sixty two air crew members including 10 cases of old stabilized myocardial infarction as controls and 52 cases with suspected ischemic heart disease, asymptomatic nonspecific ECG abnormalities or cardiac arrhythmias were fitted with electrodes at the CM5 position which were connected to a portable tape recorder, and recorded ST segment displacements, ectopic counts and heart rates were analyzed. On the basis of the results of ambulatory monitoring, a conclusive diagnosis of heart disease was obtained for 23, and 29 were cleared from suspicion of heart disease, in contrast to the 10 who could have been diagnosed by combined stress testing. It is recommended that ambulatory monitoring be used more frequently in the evaluation of air crew with suspected cardiovascular problems. A.L.W.

A81-13229 # Aeromedical assessment of cockpit control - 'Canopy jettisoning handle'. R. Singh (Indian Air Force, Institute of Aviation Medicine, Bangalore, India). *Aviation Medicine*, vol. 24, June 1980, p. 15-18. 5 refs.

The objective assessment of the operation of cockpit control devices is discussed in the case of the canopy jettisoning handle in the Ajeet trainer and Gnat aircraft. Difficulties in subjective assessments of cockpit controls are pointed out, and the intended operation of the canopy jettisoning handle, which is designed to be used as an emergency measure in case of smoke in the cockpit, crash landing or failure of the primary control, is described. Results are then presented of subjective and objective integrated electromyographic

measurements of the stress involved in the operation of the handle in the Ajeet trainer compared to that of the Gnat by pilots of sizes spanning the 5th to the 95th percentile of the pilot population. It is shown that the control can best be operated by the hand in a pronated position, and both methods demonstrate the greater effectiveness of the Gnat controls. It is pointed out that the objective technique may be useful in the design of cockpit controls. A.L.W.

A81-13230 # Spatial orientation test - Its use in aviation. N. Ramachandran (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), K. Prabha (DIPAS, New Delhi, India), V. Kumar (Indian Air Force, Central Medical Establishment, New Delhi, India), and K. R. Banerjee. *Aviation Medicine*, vol. 24, June 1980, p. 19-22. 6 refs.

A Spatial Orientation Test (SOT) has been fabricated to assess the ability of a subject to orientate in space. A subject is presented with a number of diagrams of aircraft in different attitudes in rapid succession. The wing tips of the aircraft are coloured red in one and green in the other. A colour code of red and green is also presented with each diagram. The colour code is compared with the wing tips to determine the orientation of the aircraft in the diagrams. The test is conducted very fast and the judgement depends upon the memory, visual imagery and discriminative ability. The test has been found to discriminate between fliers and non-fliers and to be of help in the assessment of the effects of sleep deprivation and head injuries. (Author)

A81-13231 # Problems of high speed low level flying - A pilot's point of view. P. M. Ramachandran (Aircraft and Systems Testing Establishment, Bangalore, India). (*Symposium on Aeromedical Problems of High Speed Low Altitude Flying, Bangalore, India, Nov. 9, 10, 1979.*) *Aviation Medicine*, vol. 24, June 1980, p. 23-27.

The problems encountered by a pilot flying at high speeds at very low altitudes, a tactic employed to minimize radar detection, are outlined, and the current approach to their solution is indicated. Types of missions flown at low altitudes and the tasks of the pilot involved in them are discussed briefly. Attention is then given to problems of low-level flying itself, aircraft systems management, navigation, formation flying, spotting and reporting enemy aircraft, bird collisions, hot-weather flying, low-level turbulence and light levels. Solutions suggested to these problems include increased automation, head-up displays, improved aircraft handling and performance characteristics, smoke-free exhausts, the wearing of helmet visors, and adequate air conditioning. A.L.W.

A81-13232 # Physiological aspects of high speed low level flying. M. L. Wadhawan (Indian Air Force, Institute of Aviation Medicine, Bangalore, India). (*Symposium on Aeromedical Problems of High Speed Low Altitude Flying, Bangalore, India, Nov. 9, 10, 1979.*) *Aviation Medicine*, vol. 24, June 1980, p. 28-30.

The physiological effects of low-altitude atmospheric turbulence-induced vibrations on the crews of aircraft in high speed low level flight are discussed. Consideration is given to the visual motor performance, comfort, respiratory and cardiovascular changes brought about by differential vibratory motion, which causes the deformation of body structures and depends on vibration frequency, and changes in the cellular and molecular composition of the blood brought about as an intensity- and duration-dependent response to stress. Alterations in the level of arousal possibly due to the stimulation of the vestibular organs, are also noted. A.L.W.

A81-13233 # Heat problems in high speed low level flight. M. B. Dikshit (Indian Air Force, Institute of Aviation Medicine, Bangalore, India). (*Symposium on Aeromedical Problems of High Speed Low Altitude Flying, Bangalore, India, Nov. 9, 10, 1979.*) *Aviation Medicine*, vol. 24, June 1980, p. 31-36. 23 refs.

Physiological problems associated with the excessive heats generated in high speed low level flying during the summer in tropical areas, where cockpit temperatures can exceed 50 C, are

discussed. Increases in body temperature measured upon exposure to simulated or actual high-temperature flight conditions are presented, and mechanisms allowing compensation for the heat are considered. It is pointed out, however, that in spite of these mechanisms, body temperature will continue to rise, eventually leading to a physiological collapse point and, long before that, a significant degradation in psychomotor performance. Measures for the alleviation of the cockpit heat load are then considered, including cabin air conditioning, body precooling, air-ventilated suits, liquid-cooled suits, head cooling and the breathing of 100% O₂, and it is noted that while none of the methods presented is foolproof, the liquid-cooled suit seems to best meet the requirements. A.L.W.

A81-13234 # **Vibration and high speed low level flying.** K. Rai (Indian Air Force, Institute of Aviation Medicine, Bangalore, India). (*Symposium on Aeromedical Problems of High Speed Low Altitude Flying, Bangalore, India, Nov. 9, 10, 1979.*) *Aviation Medicine*, vol. 24, June 1980, p. 37-39. 5 refs.

Vibrations encountered during high speed low level flight are discussed. Sources of cockpit vibration are identified, including engine vibrations, armament vibrations and gust-induced vibrations, and estimates of the frequencies and intensities of gust-induced vibrations are presented. Means for the protection of air crews from vibration are then considered, with attention given to the reduction of vibrations at the source (power sources, atmospheric interactions), the reduction of their transmission to man by isolation and the use of nodal positions, and the reduction of the effects of vibration on the body by suitable posture and the design of displays and controls. A.L.W.

A81-13235 # **Visual problems in high speed low level flying.** J. N. Singha. (*Symposium on Aeromedical Problems of High Speed Low Altitude Flying, Bangalore, India, Nov. 9, 10, 1979.*) *Aviation Medicine*, vol. 24, June 1980, p. 40-43. 9 refs.

Visual problems encountered in high speed low level flight are discussed. Consideration is given to the limitations to visual capacities posed by finite reaction times, the presence of a blur zone in dynamic vision, vibrations, degradations in depth perception, linear or angular accelerations, factors influencing night vision, optical illusions and the difficulty of foveal fixation at high speeds. Problems relating to aging, cockpit lighting, cockpit temperature and atmospheric visibility are also identified, and it is concluded that in order to ensure proper visual functioning, adequate and repeated ophthalmic examinations of flight personnel are required. A.L.W.

A81-13236 # **Mechanism of stress on human body - Psychophysiological aspects.** V. Kumar (Indian Air Force, Central Medical Establishment, New Delhi, India). (*Symposium on Aeromedical Problems of High Speed Low Altitude Flying, Bangalore, India, Nov. 9, 10, 1979.*) *Aviation Medicine*, vol. 24, June 1980, p. 44-46.

Psychophysiological aspects of the response of the human body to physical and psychological stresses are discussed in relation to the stresses encountered in high speed low altitude flying. The complex physiological and psychological interactions involved in the adaptation to stress are indicated, and psychological stresses which lie along the perception-decision-action axis, which involves the peripheral and central nervous systems and psychomotor coordination, are examined. The presence of other stresses including fear, fatigue and social stresses in the flight situation is also indicated. A.L.W.

A81-13237 # **Escape during high speed low level flying.** R. Singh (Indian Air Force, Institute of Aviation Medicine, Bangalore, India). (*Symposium on Aeromedical Problems of High Speed Low Altitude Flying, Bangalore, India, Nov. 9, 10, 1979.*) *Aviation Medicine*, vol. 24, June 1980, p. 47-49.

Problems in the design of escape systems for aircraft flying below 300 ft at speeds exceeding Mach 0.9 are discussed. Assisted escape devices available for use in modern aircraft are indicated, including the open ejection seat, closed ejection, capsule ejection,

underwater ejection and specialized developments, and the influence of aircraft flight characteristics on possible ejection systems is considered. The limits of human tolerances to ejection conditions are pointed out, and problems of escape at high speeds and low altitude are examined for the pre-ejection, ejection, post-ejection and landing phases. Specific problems identified include possible spinal and contact injuries during the egress phase, and high ram pressures, wind shear, excessive heat and wind drag deceleration during the post-ejection phase. It is concluded that at speeds in excess of 600 knots only canopy/capsule ejection systems are suitable due to the wind drag deceleration. A.L.W.

A81-13241 **A comparison between saccades and quick phases of vestibular nystagmus in the cat.** D. Guitton and G. Mandl (McGill University, Montreal, Canada). *Vision Research*, vol. 20, no. 10, 1980, p. 865-873. 28 refs. Research supported by the Medical Research Council and Defence Research Board of Canada.

The time courses of horizontal saccades, and quick phases of vestibular nystagmus, were compared in alert chronic cats. Despite considerable variability it appears that saccades and quick phases have identical temporal characteristics. It is shown that there is no linear addition between the oppositely directed slow and quick phase movements during vestibular nystagmus in either the light or dark. The results suggest that during a quick phase there is a pause in the signal responsible for generating the slow phase of vestibular nystagmus. (Author)

A81-13242 **Oblique saccades of the cat - A comparison between the durations of horizontal and vertical components.** D. Guitton and G. Mandl (McGill University, Montreal, Canada). *Vision Research*, vol. 20, no. 10, 1980, p. 875-881. 19 refs. Research supported by the Medical Research Council and Defence Research Board of Canada.

A81-13417 **Some human factors aspects of computer-aiding concepts for air traffic controllers.** D. Whitfield (Aston University, Birmingham, England), R. G. Ball, and G. Ord (Royal Signals and Radar Establishment, Malvern, Worcs., England). *Human Factors*, vol. 22, Oct. 1980, p. 569-580. 28 refs. Ministry of Defence of England Contract No. AT/2097/024.

This paper sets out the basic philosophy of a developing program of computer-aiding concepts for the controller's decision-making. A brief review is given of early work on the computer-assisted approach sequencing (CAAS) concept for a major airport, and the main topic is the interactive conflict resolution (ICR) concept for assisting the en route controller in conflict detection and resolution. ICR is a predictive aid used interactively by the controller; the concept is described in detail. A real-time simulation experiment is reported, in which each of three pairs of controllers acted as an executive/support team in handling traffic samples in a busy sector. Objective records and subjective data suggest the effectiveness and acceptability of ICR. Further research on the controller's activities within, and attitudes toward, computer-based tasks is outlined. (Author)

A81-13418 **Controller evaluation of a touch input air traffic data system - An 'indelicate' experiment.** R. B. Stammers and J. M. Bird (Aston University, Birmingham, England). *Human Factors*, vol. 22, Oct. 1980, p. 581-589. 10 refs. Ministry of Defence Contract No. AT/2097/024.

An evaluation of a system for data transfer and display for airport air traffic control (ATC) by practicing controllers is described. The system is computer based, handling the data normally used in airport ATC at Heathrow. The system displays the controller's data on a single screen. Data transfer and modification are enabled via a touch-sensitive surface on the display. Sinaiko's term 'indelicate experiment' is used since the evaluation fell into middle ground of system design, between 'expert knowledge' and 'controlled and lengthy experimentation.' The major objective was to judge the opinions and attitudes of controllers. The study used a

simulation of normal operations. Fifteen controllers - five groups of three - participated in 5-h-long exercises over 3 days. The main source of information was a questionnaire completed after the exercises. There was also a limited use of video tape. The results and implications of the study are discussed. (Author)

A81-13422 Separation discrimination in a simulated air traffic control display. P. Stager (York University, Toronto, Canada) and T. G. Paine (Transport Canada, Air Traffic Services Branch, Ottawa, Canada). *Human Factors*, vol. 22, Oct. 1980, p. 631-636. Research supported by Transport Canada.

The ability of air traffic controllers to judge aircraft separations accurately on an air map is investigated. Sixteen experienced terminal controllers were shown pairs of aircraft at different locations, orientations and separations in sequence on terminal sector maps and were required to indicate whether the separation between the targets was greater than or less than the standard separation distance of 3 n mi. The point of subjective equality, at which the probabilities of each possible response are equal, is found to correspond to a separation of 3.05 n mi for maps covering 40 and 55 n mi, and to vary slightly with aircraft orientation and position on the map. The psychometric functions obtained also indicate a mean increment in separation required for discrimination of 0.14 n mi. It is pointed out that the results can be used to provide information useful in the selection of appropriate separation standards in air traffic control operations. A.L.W.

A81-13501 Human responses to repeated high G simulated aerial combat maneuvers. R. R. Burton (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1185-1192. 14 refs.

Five subjects wearing standard USAF anti-G suits and seated at a 65 deg back angle were exposed to a simulated aerial combat maneuver (SACM) which was repeated five times with 4-min 1-G rests between each SACM exposure. The SACM was 122 sec in duration with 10-sec acceleration peaks of 10, 8, and 6 G; between these peaks, the subject was at 4 G for 15 sec. This series of repeated SACM exposure fatigued four of the five subjects. Heart rate and rhythm, arterial oxygen saturation, expired gases, lactate, pyruvate, glucose, CPK enzymes and isoenzymes, blood volume, subjective fatigue measurements, and subject performance were examined relative to the development of fatigue, the energy cost of the M-1, and tolerance to the SACM. All physiologic-metabolic parameters were significantly affected by the repeated SACMs, however, only heart rate changes appeared to be correlated with developing fatigue. A significant amount of energy is required to perform the M-1. Subjects whose energy-metabolic and cardiovascular states are least disturbed by high G exposure are those persons who will perform best and become least fatigued during repeated aerial combat maneuvers. (Author)

A81-13502 The importance of myocardial perfusion in the pathogenesis of the cardiac pathology associated with +Gz exposure in miniature swine. M. H. Laughlin, J. T. Young, W. M. Witt, and P. P. Crump (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1197-1204. 49 refs.

Minor cardiomyopathy has been associated with the exposure of miniature swine to levels of high sustained +Gz which can be attained routinely in new USAF high-performance aircraft. One possible cause of these lesions is total or regional myocardial ischemia. To test this hypothesis, regional coronary blood flow was measured with the radiolabeled microsphere technique in chronically instrumented miniature swine during 60-sec exposures to +3Gz, +5Gz, or +7Gz. Acceleration exposure resulted in detectable left ventricular subendocardial hemorrhage in one of five animals exposed to +3Gz, in seven of eight animals exposed to +5Gz and in all eight animals exposed to +7Gz. All levels of +Gz stress caused two to three-fold increases in coronary blood flow. The regional distribution of coronary blood flow during +Gz was similar to that under resting control conditions

as long as aortic diastolic pressure was maintained. There was no clear evidence of total or regional myocardial ischemia during +Gz or of any relationship between regional coronary blood flow and the presence of subendocardial hemorrhage. It is concluded that myocardial ischemia is not a primary factor in the pathogenesis of the cardiac lesions associated with the exposure of miniature swine to +Gz stress. (Author)

A81-13503 Orthostatic responses in heat tolerant and intolerant subjects compared by three different methods. G. Keren, Y. Epstein, A. Ohri, and A. Magazanik (Chaim Sheba Medical Center, Ramat-Gan; Tel Aviv University, Tel Aviv, Israel). *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1205-1208. 9 refs.

The orthostatic responses of 10 heat tolerant and five intolerant subjects were evaluated by three different test methods - standing, head-up tilt (HUT), and head-up tilt after prolonged exercise (HUTPE) - in a hot environment of 40 C, 40% RH. No difference was found within the normal group between responses in the standing and HUT test. In the HUTPE test, orthostatic responses were inadequate and 5 of 10 subjects fainted. The heat intolerant subjects reacted to all three tests similarly to the normal group, though their heart rate was higher and 3 out of 5 fainted at an earlier phase in the HUTPE test. (Author)

A81-13504 * Long-term follow-up of Skylab bone demineralization. F. E. Tilton (USAF, School of Aerospace Medicine, Brooks AFB, Tex.), J. J. C. Degioanni (NASA, Johnson Space Center, Medical Operations Branch, Houston, Tex.), and V. S. Schneider (U.S. Public Health Service Hospital, San Francisco, Calif.). (*Aerospace Medical Association, Annual Scientific Meeting, 50th, Washington, D.C., May 14-17, 1979.*) *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1209-1213. 16 refs.

The os calcis mineral was measured in the nine Skylab crew members and in eight control subjects, 5 years after the Skylab Program, utilizing a photon absorptiometric technique. These measurements were compared with preflight measurements in an attempt to discover any long-term effects of space flight on the skeletal system. A statistically significant loss of bone mineral was found in the crew members who flew, but caution is urged in the interpretation of this difference. A recommendation to continue studies of this type is made. (Author)

A81-13505 A comparison between freon and acetylene rebreathing for measuring cardiac output. F. Bonde-Petersen, P. Norsk (Copenhagen, University, Copenhagen, Denmark), and Y. Suzuki. *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1214-1221. 19 refs. Danish Space Board Grant No. 1112-46/78; Statens Laegevidenskabelige Forskningsrad Grant No. 512-10450/78.

Freon and acetylene rebreathing are compared as noninvasive methods for the measurement of cardiac output to be used under space flight conditions. Ten young, healthy males rebreathed a mixture of 0.7-1.2% acetylene, 3-4.2% freon-22, 6-7% argon and about 40% O₂ in nitrogen at rest and during submaximal exercise on a bicycle ergometer, using spontaneous and forced respiration, and gas fractions during and at the end of the experiment were measured. Calculations of cardiac output on the basis of the acetylene results are found to correspond to literature values, with the freon values following those of acetylene but systematically lower. A forced respiratory rate of 30-32/min is observed to result in increased CO and oxygen consumption during rebreathing at rest and at lower exercise levels, while a spontaneous rate did not change oxygen consumption as compared to steady state Douglas measurements. The advantages of freon over acetylene in a space environment are pointed out, and it is concluded that freon-22 can be used as the foreign, inert, blood soluble gas in rebreathing determinations of cardiac output in space, with a spontaneous respiratory rate preferred over forced respiration. A.L.W.

A81-13506 * **Fitness variables and the lipid profile in United States astronauts.** M. A. Berry, W. G. Squires, and A. S. Jackson (NASA, Johnson Space Center; Kelsey/Seybold Clinic, Houston, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1222-1226. 29 refs.

The study examines the relationship between several measures of fitness and the lipid profile in United States astronauts. Data were collected on 89 astronauts, previously selected (PSA) and newly selected (NSA), during their annual physical examinations. Several similarities were seen in the two groups. The PSA (mean age of 46.1) had a lower maximum oxygen capacity (41.7 ml/kg/min vs. 47.5 ml/kg/min); when adjusted for age, it was no different from the NSA (mean age 33.5). The PSA had similar body composition with 15.7% lower than expected for age. The lipid profiles of the two groups were basically the same with the differences being a function of age. Compared to a normative population, the astronauts had similar cholesterols, lower triglycerides, and higher HDLs. The astronaut profiles were generally more favorable than the age-matched controls, which is felt to be a result of the self-supervised conditioning program and annual preventive medicine consultation and education.

(Author)

A81-13507 **Effects of whole-body vibration on spinal reflexes in man.** J. P. Roll, B. Martin, G. M. Gauthier, and F. Mussa Ivaldi (Aix-Marseille I, Université, Marseille, France). *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1227-1233. 44 refs. Research supported by the Société Nationale Industrielle Aérospatiale; Centre National de la Recherche Scientifique Grant No. ERA-272.

Recent studies have described sensory-motor function alterations resulting from vibrations applied to various parts of the body. The present work describes the effects produced at the myotatic loop level by long-term vibration. Hoffmann and tendon reflexes as well as tendon vibration response were substantially depressed by 18 Hz, plus or minus 0.25 G vibration applied to the whole body or to the legs of seated human subjects. The reflex inhibition lasted throughout the 15-min vibration period and persisted minutes after stimulus cessation. In contrast, vibration limited to the S's head and trunk showed much weaker effects. This suggests that the vibration acts mainly upon extero- and proprioceptive receptors rather than upon the vestibular organs. The results are discussed in relation to findings derived from experiments involving locally applied short-duration vibration.

(Author)

A81-13508 **Blood pressure and oxygenation in different cardiovascular compartments of a normal man during postural exposures.** V. E. Katkov (Ministerstvo Zdravookhraneniia SSSR, Institut Mediko-Biologicheskikh Problem, Moscow, USSR) and V. V. Chestukhin (Ministry of Health of USSR, Institute of Transplantology and Artificial Organs, Moscow, USSR). *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1234-1242. 63 refs.

The effects of head-up and head-down postures on the pressure, oxygenation and acid-base equilibrium of the blood in different cardiovascular components are investigated. Ten healthy male subjects were fitted with catheters in the upper bulb of the internal jugular vein, right atrium, coronary sinus, pulmonary artery, left ventricle, femoral artery and vein and foot artery and vein, and exposed to head-up and head-down tilts of 0, 10, 30 and 75 deg. In the head-up position, pressure in the jugular vein is found to vary independently of right atrium pressure, which became negative, while the transpulmonary gradient of the intravascular pressure increased; pressure in the leg artery is always observed to increase more than in the leg vein. In the head-down position, pressure in the jugular vein, cardiac cavities and pulmonary artery is found to increase, with that in the leg vessels decreasing and that in the foot approaching zero at an angle of 75 deg. Arterio-venous oxygen differences are shown to remain constant in the brain and myocardium, and increase in the leg, foot and systemic circulation. Possible mechanisms for these effects are discussed.

A.L.W.

A81-13509 **Exposure to radio-frequency radiation from an aircraft radar unit.** R. A. Williams and T. S. Webb (USAF, Regional Medical Center Clark, Clark Air Base, Philippines). *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1243, 1244. 6 refs.

The case is reported when two airmen were exposed to radio-frequency radiation thirty-eight times above the Air Force permissible level. Medical evaluation showed initial anxiety and hypertension, which resolved with therapy. It is noted that the body organs least able to dissipate heat are the organs most susceptible to microwave radiation, such as eyes and testicles. Except for the eyes, the sensation of warmth provides a warming mechanism. Exposure standards for microwave radiation in the United States are compared with those in the Soviet Union. The Soviet Union uses more stringent standards of 1-2.5 mW/sq cm, that include shorter wavelengths which produce no heating. These 'athermal' effects, the USSR reported, include headaches, fatigue, and behavioral changes in humans and animals.

S.S.

A81-13510 **Stress and adaptation - The interaction of the pilot personality and disease.** R. J. Ursano (University of the Health Sciences, Bethesda, Md.). *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1245-1249. 17 refs.

The concept of health of aircrew members is examined in terms of the biological, psychological, sociocultural, and symbolic systems implicit in the psychosomatic model. The exploration of this complex pattern of interactions occurring over time is the process of diagnosis. Cases are presented to illustrate the importance of understanding the time course of disease and utilizing a comprehensive model of disease in the appropriate diagnosis and treatment of flying personnel.

V.L.

A81-13511 **Detection of coronary artery disease in asymptomatic aircrew members with thallium-201 scintigraphy.** G. S. Uhl, T. N. Kay, J. R. Hickman, Jr., M. A. Montgomery, and G. M. McGranahan, Jr. (USAF, Aerospace Medical Div., Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 51, Nov. 1980, p. 1250-1255. 30 refs.

Thallium-201 exercise myocardial perfusion scintigraphy was accomplished in 130 aircrew members prior to their undergoing coronary angiography. Most were undergoing cardiac catheterization for an abnormal exercise response to treadmill testing. Of these, 22 men had arteriographic evidence of obstructive coronary disease of at least 50% narrowing in a single vessel. All had abnormal myocardial scintigrams. There were 12 other aviators who had minimal degrees of coronary artery disease with lesions less than 50% as the maximum degree of obstruction. Of these, eight had abnormal thallium scans showing a perfusion defect in the area of the myocardium, presumably supplied by the diseased coronary artery. Of the 96 men with normal angiograms, only four had abnormal myocardial scintigraphy. An abnormal myocardial scintigram was often associated with significant obstructive disease. A normal scan accurately ruled out the presence of high-grade obstructive lesions and missed only four cases of minimal coronary disease. The application of gated thallium myocardial perfusion scans in the practice of aerospace cardiology has important significant applications for the followup of therapeutic modalities as well as screening for evidence of myocardial ischemia in apparently healthy aircrew members.

(Author)

A81-13525 # **The psychophysiological basis for optimal interflight intervals for flight crews (Psikhofiziologicheskoe obosnovanie optimal'nykh pereryvov mezhdru poletami u letnogo sostava).** V. V. Kniga. *Voenna-Meditsinskii Zhurnal*, Sept. 1980, p. 54-57. In Russian.

The professional abilities of pilots performing flight operations at intervals of from less than two to 30 days are investigated in order to determine the optimal interval between flights for flight personnel. Integral evaluations of the quality of the analysis and synthesis of instrumental data were performed along with an assessment of

subject physiological stress levels for experienced and novice pilots from 30 to 90 min before scheduled flights. The highest level of work capacity is found to occur after flight intervals of two to seven days. Measurements of the structure of movements involved in manual engine and stabilizer control during landing also are found to exhibit the most stability in flights after intervals of two to seven days. Self-derived indices of physical condition, and cardiovascular and respiratory stability are observed to peak at intervals from two to five days in younger pilots and two to seven days in more experienced pilots. It is thus concluded that the optimal length of the interval between flights to be used in scheduling is from two to seven days. A.L.W.

A81-13919 Cost of locomotion and heat balance during rest and running from 0 to 55 C in a patas monkey. S. A. Mahoney (Harvard University, Bedford, Mass.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 49, Nov. 1980, p. 789-800. 35 refs. NSF Grant No. PMC-75-22684; Grant No. NIH-HL-02228.

The effects of exercise and ambient temperatures up to the effective temperatures encountered in a natural environment on the thermal balance of the patas monkey are investigated. A young patas monkey was run on a treadmill at speeds from 3 to 16 km/h for 11-22 min at ambient temperatures from 0 to 55 C, and metabolic heat production, evaporative heat loss and heat storage were measured. Results indicate that at rest at ambient temperatures below body temperature, most of the metabolic heat load of the animal is lost through convection and radiation, while at higher temperatures evaporation, primarily cutaneous, plays the dominant role. During running, metabolic heat production is found to be independent of temperature and dependent solely on running speed, reaching three to eight times the resting rate. At low ambient temperature, heat loss is again principally through convection and radiation, while at higher temperatures heat generated from exercise and from the environment, which are at approximately the same level at 55 C, is lost through evaporation, principally sweating at rates up to 0.5 mg/sq cm per min. Whole-body dry thermal conductance is observed to increase two- to three-fold during exercise compared to the values obtained at rest for a given temperature. A.L.W.

A81-13920 Autonomic mechanisms in the initial heart rate response to standing. D. J. Ewing, L. Hume, I. W. Campbell, A. Murray, J. M. M. Neilson, and B. F. Clarke (Edinburgh, University; Royal Infirmary, Edinburgh, Scotland). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 49, Nov. 1980, p. 809-814. 24 refs.

Autonomic mechanisms underlying the initial heart rate response to standing were analyzed in nine normal subjects. The normal pattern of response was altered by atropine to a small and gradual R-R interval shortening over 30 beats, with no rebound R-R interval lengthening. With additional propranolol, R-R interval shortening was even less and confined to the first 15-20 beats, whereas propranolol alone did not affect the normal response pattern, showing that this is under vagal control with increased cardiac sympathetic activity occurring only if the vagus is blocked. The response was reproducible in 23 normal subjects. Heart rate variation during quiet standing was almost completely abolished by atropine, but unaffected by propranolol, confirming that it is also under vagal control. In four normal subjects no rebound R-R interval lengthening occurred during either 'fast' or 'slow' tilt, whereas it was present during both 'slow' and 'fast' standing. The rebound R-R interval lengthening is determined by the muscular activity involved in standing up, rather than by the speed of the maneuver. (Author)

A81-13921 Vasodilator and constrictor responses to hypoxia in isolated pig lungs. J. T. Sylvester, A. L. Harabin, M. D. Peake, and R. S. Frank (Johns Hopkins Medical Institutions, Baltimore, Md.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 49, Nov. 1980, p. 820-825. 29 refs.

Research supported by the Peel Medical Research Trust and Wellcome Trust.

A81-13922 Stability of alveolar hypoxic vasoconstriction with intermittent hypoxia. M. A. Miller (Massachusetts General Hospital, Boston, Mass.) and C. A. Hales (Harvard University, Boston, Mass.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 49, Nov. 1980, p. 846-850. 22 refs. Research supported by the Hartford Foundation; Grant No. NIH-HL-06664.

The stability of the hypoxic pulmonary vasoconstriction response to intermittent unilateral alveolar hypoxia is investigated. Fifteen anesthetized dogs were intubated with a double-lumen endotracheal tube allowing the separate ventilation of one lung with 100% N₂ as a hypoxic challenge and the other with 100% O₂ to maintain adequate systemic oxygenation, which was carried out for 15 min periods alternating with 15 min of air breathing for a total of 6 h. Measurements of the distribution of pulmonary perfusion made with Xe-133 and external chest detectors allow the division of the animals into two groups based on the strength of their vasoconstriction responses. In the first group, consisting of six dogs, relative perfusion to the test lung fell 29% on the first challenge and remained statistically unchanged over the course of the experiment. In the second group vasoconstriction was initially weak (5%) but perfusion decreased to the levels of the first group with time or successive challenges. A nonspecific vasodilator decreasing with time and inhibiting alveolar hypoxia and hypoxia induced by the infusion of prostaglandin F₂ alpha is invoked to explain the response of the second group. A.L.W.

A81-13923 * Body acceleration distribution and O₂ uptake in humans during running and jumping. A. Bhattacharya, E. P. McCutcheon, E. Shvartz, and J. E. Greenleaf (NASA, Ames Research Center, Biomedical Research Div., Moffett Field, Calif.; Kentucky, University, Lexington, Ky.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 49, Nov. 1980, p. 881-887. 26 refs.

The distribution of body acceleration and associated oxygen uptake and heart rate responses are investigated in treadmill running and trampoline jumping. Accelerations in the +Gz direction were measured at the lateral ankle, lumbosacral region and forehead of eight young men during level treadmill walking and running at four speeds and trampoline jumping at four heights, together with corresponding oxygen uptake and heart rate. With increasing treadmill speed, peak acceleration at the ankle is found always to exceed that at the back and forehead, and acceleration profiles with higher frequency components than those observed during jumping are observed. Acceleration levels are found to be more uniformly distributed with increasing height in jumping, although comparable oxygen uptake and heart rates are obtained. Results indicate that the magnitude of the biomechanical stimuli is greater in trampoline jumping than in running, which finding could be of use in the design of procedures to avert deconditioning in persons exposed to weightlessness. A.L.W.

A81-14100 # The Sled programme. J. A. Steinz (ESA, Sled Projects Div., Noordwijk, Netherlands). *ESA Bulletin*, no. 22, May 1980, p. 59-65.

The program schedule for the Sled (a system being developed to study the effects of weightlessness on man during a Spacelab mission) is extremely short, with a span of less than two years from original conception to the final delivery of the flight unit for Spacelab. This rigid time constraint has not permitted the usual selection of an industrial prime contractor, with the result that responsibility for the execution of all system-level work has been assigned to the Sled Project Division, with major subsystems being contracted to industry. The paper describes the Sled program, the scientific objectives, the design features of the Sled, and the working arrangement established to produce the Sled. B.J.

A81-14124 # A 175-day space flight - Some results of medical studies (175-sutochnyi kosmicheskii polet - Nekotorye rezul'taty meditsinskikh issledovani). O. G. Gazenko and A. D. Egorov. Akademiia Nauk SSSR, Vestnik, no. 9, 1980, p. 49-58. In Russian.

The paper deals with the results of a medical and physiological examination of the cosmonauts Liakhov and Riumin after completion of a 175-day space mission and monitoring of the physical state during the flight. The results show that the human organism is capable of adaptation to the space environment for six months, to function adequately under these conditions, and to readapt itself to the terrestrial environment. V.P.

A81-14743 Smooth pursuit eye movements in response to unpredictable target waveforms. A. T. Bahill (Carnegie-Mellon University, Pittsburgh, Pa.), M. J. Landolo (U.S. Veterans Administration, Medical Center, Pittsburgh, Pa.), and B. T. Troost (Pittsburgh, University, Pittsburgh, Pa.). *Vision Research*, vol. 20, no. 11, 1980, p. 923-931. 31 refs. Research supported by the U.S. Veterans Administration; NSF Grant No. ENG-77-22418; Grants No. NIH-1-R23-EY-02382; No. NIH-T32-GM-07477.

Humans track smoothly moving objects with a combination of saccadic and smooth pursuit eye movements, called dual mode tracking. A pseudo random ternary sequence was used to generate an unpredictable table target motion that had ramps of random velocity and duration. This aperiodic waveform eliminated the subject's ability to predict target motion. Saccades were removed from these records leaving only smooth pursuit eye movements, called single mode tracking. Transfer functions were computed for both single and dual mode tracking. The difference in the transfer functions between 0.7 and 1.0 Hz is an indication of the quality of the smooth pursuit tracking which decreases with increasing target waveform bandwidth and with fatigue. The coherence function provides another quantitative measure of smooth pursuit tracking. (Author)

A81-14744 Hyperacuity in the detection of absolute and differential displacements of random dot patterns. I. Hadani, M. Gur, A. Z. Meiri, and D. H. Fender (Technion - Israel Institute of Technology, Haifa, Israel). *Vision Research*, vol. 20, no. 11, 1980, p. 947-951. 18 refs. Research supported by the Technion - Israel Institute of Technology and Technion Research and Development Foundation.

Thresholds for absolute and differential displacements were found by using computer generated alternating random dot stereograms. Three human subjects tried to detect an absolute displacement of an apparently moving square or the differential displacement between two apparently moving squares. The absolute displacement thresholds ranged from 7 to 14 inches and the differential displacement thresholds from 2 to 6 inches. It was concluded that the visual system can detect the image shifts caused by involuntary eye movement and that these image shifts contain the necessary information for some level of monocular depth perception. (Author)

A81-14745 Angular selectivity of monocular rivalry - Experiment and computer simulation. M. A. Georgeson and R. Phillips (Bristol, University, Bristol, England). *Vision Research*, vol. 20, no. 11, 1980, p. 1007-1013. 21 refs.

The angular selectivity of monocular rivalry (MR) was re-examined with achromatic gratings (4 c/deg, 10% contrast). Various measures of rivalry rate and duration all gave the same result: MR increased linearly for angles up to 60 deg and was constant thereafter, but the duration of a bout of rivalry was invariant with angle. Absolute orientation (vertical vs oblique) had no effect. It is proposed that MR occurs when eye movements produce partial cancellations between the stimulus pattern and its negative after-image. Computer simulation shows that this model can account for almost all the results in the literature and therefore suggests that MR does not reveal the nature of visual pattern-analyzing mechanisms. (Author)

A81-14800 # Dynamic head displacement measuring system. H. T. Pheeny, J. E. Doerr, and T. J. Bozack (U.S. Naval Weapons Center, China Lake, Calif.). *American Institute of Aeronautics and Astronautics, Parachute and Balloon Testing Capabilities Workshop, Edwards AFB, Calif., Oct. 6, 7, 1980, Paper. 5 p.*

A research program has been designed to determine the motion (position, displacement, velocity, and linear acceleration) of the head in relation to a fixed point in the torso, the first thoracic (T-1) vertebra. Accurate determination of these parameters and the resultant accelerations will allow the calculation of the maximum permissible riser force pattern that may be imposed on an aircrew-member during parachute deployment. To measure head motion, a small high-speed 16-mm camera (500 frames per second) is mounted on a test parachutist between the reserve parachute and the subject's abdominal area, and a pair of fiber optic lightguides connect the camera to a pair of stereo lenses that sit on a mount over the first T-1 area, located at the base of the neck. B.J.

A81-15161 Human sleep - Its duration and organization depend on its circadian phase. C. A. Czeisler (Montefiore Hospital, Bronx, N.Y.; Stanford University, Stanford, Calif.), E. D. Weitzman (Montefiore Hospital and Medical Center; Albert Einstein College of Medicine, Bronx, N.Y.), M. C. Moore-Ede (Harvard University, Boston, Mass.), J. C. Zimmerman, and R. S. Knauer (Montefiore Hospital and Medical Center, Bronx, N.Y.). *Science*, vol. 210, Dec. 12, 1980, p. 1264-1267. 19 refs. Grants No. NIH-MH-28460; No. NIH-AG-00792; Contract No. N00012-76-C-1071.

Results in free-running subjects show that the circadian phase of the body temperature, rather than the duration of prior wakefulness, is the major determinant of the length of sleep. Twelve male subjects were polygraphically recorded during sleep while living on a self-scheduled routine. The subjects developed free-running, non-24-hour sleep-wake, body temperature, and neuroendocrine cycles. The rate of rapid eye movement (REM) sleep accumulation, REM latency, bedtime selection, and self-rated alertness assessments are also correlated with the body temperature rhythm. R.C.

A81-15162 Clinical relevance of exercise-induced S-T segment elevation. G. L. Stiles, R. A. Rosati, and A. G. Wallace (Duke University, Medical Center, Durham, N.C.). *American Journal of Cardiology*, vol. 46, Dec. 1, 1980, p. 931-936. 18 refs. Research supported by the Prudential Insurance Company of America and Kaiser Family Foundation; Grants No. PHS-HRA-230-76-0300; No. PHS-H5-03834; No. NIH-HL-17670.

Patients with exercise-induced S-T elevation or S-T depression were evaluated with demographic, treadmill and angiographic data. When 541 patients with S-T depression were compared with 109 patients with S-T elevation, a greater proportion of the former had chest pain (71 versus 58%) and a normal-size ventricle (86 versus 61%) with normal wall motion (54 versus 30%). A greater proportion of patients with S-T elevation had had a previous myocardial infarction (61 versus 33%). Among patients without prior infarction (360 with S-T depression and 42 with S-T elevation), these differences disappeared. In this group of 42 patients with S-T elevation, 83% had a normal-sized ventricle, 64% had normal contractility and none had a ventricular aneurysm; the severity of coronary disease and ventricular dysfunction did not differ from the severity in patients with S-T depression. Thus, in patients without prior myocardial infarction, the cause of the development of S-T elevation or S-T depression during exercise does not appear to be related to the severity of the coronary lesions, ventricular function or wall abnormalities at rest. In patients with prior myocardial infarction, exercise-induced S-T elevation appears to be a marker of depressed left ventricular function. (Author)

A81-15163 Comparison of multigated radionuclide angiography with ultrasonic sonomicrometry over a wide range of ventricular function in the conscious dog. J. L. Swain, K. G. Morris, F. P. Bruno, and F. R. Cobb (Duke University, Medical Center; U.S. Veterans Administration, Medical Center, Durham, N.C.). *American*

Journal of Cardiology, vol. 46, Dec. 1, 1980, p. 976-982. 12 refs. Research supported by the U.S. Veterans Administration; Grants No. PHS-HL-18537; No. HHH-HL-17670.

A comparative investigation of the noninvasive assessment of left ventricular function with radionuclide angiography with ultrasonic sonomicrometry is presented. Six dogs were prepared with epicardial crystals across the major and minor axes of the left ventricle, paired transmural wall thickness crystals, and a left ventricular catheter. The left ventricular volume was computed from the ultrasonic sonomicrometric dimensions and the equation for a prolate ellipsoid; ventricular ejection was calculated from the stroke volume and ejection time. A wide range of ventricular function was produced with sequential infusion of isoproterenol, phenylephrine, and sodium thiamylal; regression analyses indicated a close correlation between the simultaneous measurements of ejection fraction and the ventricular ejection. These results show that noninvasive multigated radionuclide angiography accurately estimates changes in ejection fraction and ventricular ejection over a wide range of ventricular function. A.T.

A81-15248 Is myosin in the cochlea a basis for active motility. J. C. Macartney, S. D. Comis, and J. O. Pickles (Birmingham, University, Birmingham, England). *Nature*, vol. 288, Dec. 4, 1980, p. 491, 492. 9 refs.

The detection of myosin in cochlear hair cells is reported, and implications of the presence of both actin and myosin for hair cell motility are considered. Myosin was detected along the length of the stereocilia and in the cuticular plate at the apex of the hair cells in the organ of Corti of the guinea pig by means of indirect immunofluorescence using an antiserum against human smooth muscle myosin. The results obtained, combined with previous evidence for the presence of actin filaments in the stereocilia, may thus account for the production of sound by the cochlear transducer, changes in the mechanical properties of the cochlea after death or sound-induced damage, the relative flexibility of the stereocilia under physiological conditions, the sensitivity of the mechanical properties of the hair cells to Ca^{2+} ions, the nonlinear increase of basilar membrane movement with stimulus intensity, and the effects of the fibers of the olivocochlear bundle on hair cell mechanical properties. A.L.W.

A81-15426 Problems of the physiology of motions (Problemy fiziologii dvizhenii). Edited by V. S. Gurfinkel'. Leningrad, Izdatel'stvo Nauka, 1980. 216 p. In Russian.

Papers are presented on neural control of motor activity, on the coding of motor receptor information, and on the properties of muscles viewed as objects of motor control. Particular consideration is given to the dependence of the human startle reflex on attention, the discharge frequency of individual motor units under voluntary control of isometric muscular tension in man, information conversion in spinal-level muscle control systems, and a mechanical stimulator for testing proprioception reflexes. Mechanical transformations in the muscle/muscle spindle system, sensitivity of muscle receptors to changes of stationary muscle length, a functional model of skeletal muscle, and conduction velocity in fibers of motor units of skeletal muscle are also examined. P.T.H.

A81-15427 # Neural control of motor activity (Nervnaia reguliatsiia dvigatel'noi aktivnosti). N. A. Rokotova. In: Problems of the physiology of motions. Leningrad, Izdatel'stvo Nauka, 1980, p. 5-25. 26 refs. In Russian.

The theory of information processing in muscle receptors is reviewed with reference to Bernstein's hypothesis (1974) of receptor/motor neuron closed-loop control. This hypothesis involves the coding of information about muscle length, rates of change of muscle length, and the initiation and termination of tension relative to discharge frequencies of various muscle afferents. It is shown that the effects of muscle receptors in the segmentary control loop have a 'rougher' and more general character than supraspinal effects. Bernstein's hypothesis is related to the results of Merton (1964),

Granit (1970), and Brooks and Asanuma (1965) on motor-neuron activity. A variety of experimental data on the neural control of motor activity is examined. P.T.H.

A81-15428 # Programming and feedback in the control of rhythmic motions stimulated by external signals (Programmirovanie i obratnaia svyaz' v reguliatsii ritmicheskikh dvizhenii, zadavaemykh vneshnimi signalami). N. A. Rokotova, N. P. Anisimova, E. S. Rogovenko, and Iu. T. Shapkov. In: Problems of the physiology of motions. Leningrad, Izdatel'stvo Nauka, 1980, p. 25-48. 19 refs. In Russian.

Experiments were performed to test the hypothesis of Brooks and Stoney (1971) concerning the role of the pyramidal system in motor control. According to this hypothesis, there are three separate subsystems for the control of the amplitude, speed, and force of voluntary motion. It follows that these characteristics are subject to separate programming: feedback signals in the separate subsystems should correct - at different speeds - deviations of characteristics from the prescribed values. The experiments focused on the tracking motions and tensions of muscles in the isometric regime. Results indirectly demonstrate the existence of separate subsystems for the control of the amplitude, speed, and force of voluntary motions. P.T.H.

A81-15429 # The nonspecific motor activation reflex in man /the startle reflex/ and its dependence on the state of attention (Reaktsiia nespetsificheskoi motornoi aktivatsii u cheloveka /startlreaktsiia/ i ee zavisimost' ot sostoianiia vnimaniia). I. N. Krylov, N. A. Rokotova, and N. F. Suvorov. In: Problems of the physiology of motions. Leningrad, Izdatel'stvo Nauka, 1980, p. 69-84. 26 refs. In Russian.

Experiments were conducted on 40 healthy subjects to study the manifestation of the startle reflex under acoustic and visual stimuli of moderate intensity; the reflex was investigated as a function of the level of attention. The following indices of the startle reflex were examined: the blink reflex, the pontomesencephalographic level, changes of the monosynaptic H-reflex, the spinal level, and the EEG vertex potential. Results show that the startle reflex in man is subject to effective cortical control: it is significantly reduced by mechanisms of selective attention directed at the external stimulus. Thus, the unidirectionality of changes of the indices of the state of neural levels of this reflex is viewed as evidence of its corticifugal inhibition. P.T.H.

A81-15430 # Discharge frequency of individual motor units under voluntary control of the isometric tension of human muscles (Chastota impul'satsii otdel'nykh dvigatel'nykh edinits pri proizvol'nom upravlenii izometricheskimi napriazheniem myshts cheloveka). D. Kozarov, N. A. Rokotova, Iu. T. Shapkov, and N. P. Anisimova. In: Problems of the physiology of motions. Leningrad, Izdatel'stvo Nauka, 1980, p. 84-91. 8 refs. In Russian.

The theory of pyramidal systems of motor control is investigated which posits separate subsystems for the control of the force, length, and contraction rate of muscles. Experiments were performed to evaluate the degree of independence of the control of the rate of muscle tension and the magnitude of muscle force, as well as the contribution of individual motor units to the entire motor act. The discharge frequencies of individual motor units were studied for the case of the maximum voluntary tension of m. biceps brachii at four different speeds. The magnitude of inter-impulse intervals of the first four discharges and the speed of tension development are found to be only weakly correlated. This result bears out the theory of the separate control of key muscle parameters. P.T.H.

A81-15431 # Information conversion in the neuron structure of a model of the spinal level of muscle-contraction control (Preobrazovanie informatsii v neuronnoi strukture modeli spinal'nogo urovnia upravleniia myshechnym sokrashcheniem). S. P. Romanov. In: Problems of the physiology of motions. Leningrad, Izdatel'stvo Nauka, 1980, p. 104-122. 5 refs. In Russian.

The paper presents a real-time neural model that makes it

possible to reproduce impulse-stream conversion characteristics of different types of neuron cells at the spinal level. The modeling process consists of the following stages: transition from the transmitted action potential in the presynaptic membrane region to the discharge of the mediator into the synaptic gap; change of the properties of the postsynaptic membrane as a result of the action of the mediator; the formation of local postsynaptic potentials; the formation of intracellular potentials owing to the summation of postsynaptic potentials arising on dendrites or soma low-threshold zone; and generation of a pulse at the neuron output and the transmission of action potential along the axon. An analysis of the inter-impulse intervals of individual neurons makes it possible to identify the presence of direct and closed-loop coupling between them. P.T.H.

A81-15432 # A method for the investigation of proprioception reflexes in man (Metodika issledovaniia propriotseptivnykh reflektsov u cheloveka). Iu. P. Gerasimenko and S. P. Romanov. In: Problems of the physiology of motions. Leningrad, Izdatel'stvo Nauka, 1980, p. 136-147. 11 refs. In Russian.

A loading-unloading mechanical stimulator has been developed for testing the muscle silent period and reciprocal inhibition in man as well as muscle spindle activity produced by shortening and lengthening conditions. It is shown that the same stimulus, but effected for different postures and motions, evokes different EMG patterns of tested muscles. The proposed loading-unloading method makes it possible to investigate the EMG of tested muscles as a function of the duration and intensity of the stimulus. It is assumed that different phases of motion are protected in different ways by correction mechanisms switched-on by muscular tension-receptors. There exists a minimum stimulus intensity which produces the disruption of programmed motion. P.T.H.

A81-15433 # A functional model of skeletal muscle (Funktsional'naia model' skeletnoi myshtsy). S. P. Romanov. In: Problems of the physiology of motions. Leningrad, Izdatel'stvo Nauka, 1980, p. 172-190. 13 refs. In Russian.

The paper presents an analog model of skeletal muscle, which is represented as a complex structure that not only executes motor functions, but also has its own receptor apparatus. The model takes into account the nonlinear characteristics of the length and tension conversion, changes of elastic and viscoelastic properties of muscle fibers in contraction, and the formation of receptor potentials in muscle spindles and Golgi tendon organs. The proposed muscle-model represents an object of control in the investigation of neural mechanisms of muscular-contraction control. P.T.H.

A81-15434 # Volume conduction of action potentials and propagation velocity of excitation in fibers of motor units of skeletal muscles in man (Ob'emnoe provedenie potentsialov deistviia i skorost' rasprostraneniia vzbuzhdeniia po voloknam dvigatel'nykh edinit skeletnykh myshts cheloveka). G. Dimitrov, N. Tankov, and Iu. T. Shapkov. In: Problems of the physiology of motions. Leningrad, Izdatel'stvo Nauka, 1980, p. 190-198. 19 refs. In Russian.

Tests were performed on eight subjects (ages 20 to 45) to study the volume conduction of action potentials in skeletal muscles; measurements involved the recording of action potentials of individual motor units at various distances from myoneural synapses. The extracellular recording of the action potentials of motor units of m. biceps brachii and m. flexor carpi ulnaris showed a nonuniform conduction velocity in muscle fibers in a motor unit. The largest velocity values were recorded in myoneural synapses, which is explained by the nature of conduction in a volume conductor. However, this cannot explain different velocities in proximal and distal directions. P.T.H.

A81-15475 * The assembly and properties of protobiological structures - The beginnings of cellular peptide synthesis. S. W. Fox and T. Nakashima (Miami, University, Coral Gables, Fla.).

BioSystems, vol. 12, 1980, p. 155-166. 62 refs. Grant No. NGR-10-007-008.

New data indicate that lysine-rich proteinoids have the ability to catalyze the synthesis of peptide bonds from a variety of amino acids and ATP. This capacity is evident in aqueous solution, in suspension of phase-separated complexes of lysine-rich proteinoid with acidic proteinoids, and in suspension of phase-separated particles composed of lysine-rich proteinoids with polynucleotides. Since the proteinoid complexes can contain other catalytic activities, including ability to catalyze internucleotide bond formation, it is inferred that the first protocells on earth already had a number of biological types of activity. (Author)

A81-15479 * Effect of chronic intracerebroventricular angiotensin II infusion on vasopressin release in rats. G. H. Sterling, O. Chee, R. V. Riggs, and L. C. Keil (NASA, Ames Research Center, Biomedical Research Div., Moffett Field, Calif.). *Neuroendocrinology*, vol. 31, 1980, p. 182-188. 25 refs.

The effects of the chronic infusion of angiotensin II into the lateral cerebral ventricle on the release of arginine vasopressin in rats are investigated. Rats were subjected to a continuous infusion of angiotensin at a rate of 1 microgram/h for five days, during which they were offered water, isotonic saline or hypertonic saline ad libitum or 40 ml water/day, and fluid intake, changes in body weight, plasma sodium ion concentrations and plasma and pituitary arginine vasopressin levels were measured. Angiotensin II is found to increase the fluid intake of rats given isotonic saline and decrease plasma sodium ion levels with no changes in plasma or pituitary arginine vasopressin in those given water or isotonic saline. However, in rats given hypertonic saline, plasma sodium concentrations remained at control levels while plasma vasopressin increased, and in water-restricted rats the effects of angiotensin II were intermediate. Results thus demonstrate that angiotensin II-stimulated arginine vasopressin release is reduced under conditions in which plasma sodium ion concentration becomes dilute, compatible with a central role of angiotensin in the regulation of salt and water balance. A.L.W.

A81-15483 * Subunit specificity of the two acetyl-CoA synthetases of yeast as revealed by an immunological approach. T. Satyanarayana (NASA, Ames Research Center, Extraterrestrial Research Div., Moffett Field, Calif.), C. H. Chervenka (Beckman Instruments, Inc., Palo Alto, Calif.), and H. P. Klein. *Biochimica et Biophysica Acta*, vol. 614, 1980, p. 601-606. 9 refs.

A81-15489 * Developmental changes in the algal coenocyte *Caulerpa prolifera* /siphonales/ after inversion with respect to gravity. W. P. Jacobs and J. Olson (Princeton University, Princeton, N.J.). *American Journal of Botany*, vol. 67, Feb. 1980, p. 141-146. 11 refs. Research supported by the Higgins Trust Fund, Whitehall Foundation and Hartford Foundation; Grant No. NsG-7280.

A81-15496 * Subcortical afferent connections of the amygdala in the monkey. W. R. Mehler (NASA, Ames Research Center, Biomedical Research Div., Moffett Field; California, University, San Francisco, Calif.). *Journal of Comparative Neurology*, vol. 190, 1980, p. 733-762. 117 refs. NASA Task 199-05-02-07.

The cells of origin of the afferent connections of the amygdala in the rhesus and squirrel monkeys are determined according to the retrograde axonal transport of the enzyme horseradish peroxidase injected into various quadrants of the amygdala. Analysis of the distribution of enzyme-labeled cells reveals afferent amygdalar connections with the ipsilateral halves of the midline nucleus paraventricularis thalami and both the parvo- and magnocellular parts of the nucleus subparafascicularis in the dorsal thalamus, all the subdivisions of the midline nucleus centralis complex, the nucleus reuniens ventralis and the nucleus interventralis. The largest populations of enzyme-labeled cells in the hypothalamus are found to lie in the middle and posterior parts of the ipsilateral, lateral hypothalamus and the ventromedial hypothalamic nucleus, with scattered cells in the supramammillary and dorsomedial nuclei and the posterior hypothalamic area, Tsai's ventral tegmental area, the rostral and

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caudal subdivisions of the nucleus linearis in the midbrain and the dorsal raphe nucleus. The most conspicuous subdiencephalic source of amygdalar afferent connections is observed to be the pars lateralis of the nucleus parabrachialis in the dorsolateral pontine tegmentum, with a few labeled cells differentiated from pigmented cells in the locus coeruleus. A.L.W.

A81-15625 # The functional state of pilots under conditions of a hot climate (Funktsional'noe sostoianie organizma letchikov v usloviakh zharkogo klimata). A. N. Azhaev, Iu. I. Priemskii, and M. V. Dvornikov. *Voenna-Meditsinskii Zhurnal*, Oct. 1980, p. 54-56. 8 refs. In Russian.

A81-15676 Aviation psychology. Edited by S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.). Ames, Iowa State University Press, 1980. 317 p. \$15.50.

Human factors in flight are surveyed with attention given to controls and displays, perceptual phenomena, aptitudes and performance, training, and research. Particular consideration is given to discrimination and manipulation in flight, integrated flight displays, visual judgments of size and distance, simulator cockpit motion, and the transfer of flight training, and computer-assisted flight training. Display-control synthesis, time-compressed displays for target detection, and manipulation and measurement of concurrent task performance are also examined. F.G.M.

A81-15677 Concepts and definitions. S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.). In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 3-10.

Concepts and definitions pertaining to aviation psychology and the behavioral engineering of aircraft are examined. Attention is given to the selection and training of flight and ground crews, behavioral engineering of operational flight procedures, function analysis and allocation, pilot task taxonomy, display and control design, procedure design, pilot performance prediction, synthetic flight training, performance assessment, and the refreshment of flying skills. The prospectus for aviation psychology is briefly discussed. F.G.M.

A81-15678 Discrimination and manipulation in flight. A. C. Williams, Jr. In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 11-30.

The information required by a pilot to fly is analyzed. The processes of discrimination and manipulation are examined, various forms of subgoals are considered, and requirements for an adequate cockpit display are discussed. The manipulation of direction and altitude subgoals is investigated, along with the coordination of controls. It is concluded that difficulties in manipulating altitude and direction arise because the controls used for manipulation are not suited to their purposes. F.G.M.

A81-15679 Information and control requirements. S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.), J. E. Eisele, and C. A. Bergman. In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 33-38.

Pilot information and control requirements are discussed with reference to the pilot's dependence on artificial devices for the sensing and display of information about aircraft performance and for the control of the aircraft in flight. The pilot's task hierarchy is examined, along with the processes of discrimination, transformation, and manipulation. It is suggested that an integrated display and control system should present the information necessary for the pilot to deal quickly and accurately with four major task clusters throughout a mission. F.G.M.

A81-15680 Flight performance control. S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.) and C. A.

Bergman. In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 39-47.

Problems of relevance to the manual control of aircraft are discussed. Function allocation is examined, along with the distribution of control authority and flight performance control. Some tests of a performance control system are briefly reviewed. F.G.M.

A81-15685 Visual judgments of size and distance. S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.). In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 97-107.

Studies on visual accommodation (the Mandelbaum effect) are reviewed: the possibility that shifts in apparent size are associated with shifts in visual accommodation distance was examined. The implications of visual accommodation for flight safety and pilot selection and training are considered. It is noted that the accommodation of the eye can be forced or misled by several phenomena that can occur in flight; when accommodation is so disturbed, relative to the true distances of external reference objects, both size and distance perception are distorted and the pilot's controlling responses can be correspondingly biased. The evidence presented suggests that dark focus, or resting accommodation distance, in addition to basic visual acuity and color vision, should be taken into account in pilot selection and assignment. P.T.H.

A81-15687 Prediction of pilot performance. S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.) and R. A. North. In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 127-133.

A new method was developed for measuring operator load and individual differences in basic performance capacity. The method incorporates adaptive techniques and on-line evaluation of subject performance with performance feedback to obtain quantitative descriptions of task demand and operator timesharing efficiency. Experiments have demonstrated consistent individual differences in performance capacity that can be divided into three main categories: (1) differences in the levels of single-task performance, (2) differences in the relative efficiency of performance in timesharing conditions, and (3) differences in adjustment to changing task demands. These differences have shown predictive validity for performance in flight, thereby indicating the advisability of continued investigation of the dimensions of attention-sharing capabilities in the prediction of flight performance. P.T.H.

A81-15688 Manipulation and measurement of concurrent-task performances. R. A. North, S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.), and D. Gopher. In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 134-144.

The use of divided-attention or dual-task tests has been advanced as a promising means of predicting future pilot effectiveness in flight situations involving high workloads, shifting priorities among subtasks, unexpected contingencies, and elevated danger. This paper describes the dual-task technique and reviews basic studies with attention given to factors affecting dual-task performance, task components in dual-task research, task backgrounds (e.g., immediate digit cancelling, delayed digit cancelling, classification, and tracking), and manipulation and measurement; particular consideration is given to the work of North (1977) and to the Gopher-North paradigm. It is concluded that the manipulation and measurement of concurrent-task performances through variations of automatically adaptive techniques may have wide applications beyond those for which they were originally developed. P.T.H.

A81-15689 Reliable, objective flight checks. S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.) and J. M. Childs. In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 145-158.

Approaches to the real-time scoring of pilot performance are described. It is suggested that a safe and practical scoring system for use in flight training can be based on the following strategy: (1)

establish explicit indices of desired performance for each training task; (2) observe and record a small number of critical variables at specified times or positions to avoid exceeding the instructor's attention capacity; (3) make public and easily understandable the acceptable limits of performance variability, or exit criteria, for each training task; and (4) establish and make public criterion-referenced learning curves as a data base for assessing instructors, programs, and training devices as well as students. Some applications of the real-time scoring of pilot performance are briefly discussed. P.T.H.

A81-15690 **Cockpit workload, residual attention, and pilot error.** S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.). In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 159-169.

An analysis of pilot performance measures shows that the measurement of residual attention in a standardized manner under specified flight conditions, whether in actual or simulated flight, provides a common basis for establishing the workload demand and blunder proneness of area navigation, vertical guidance, and other types of flight directing and control systems. As such, this measurement represents a potential method of demonstrating compliance with objective performance standards for airborne equipment certification. Further, it is argued that the notion of pilot error is fallacious if the frequency of blunders by pilots can be substantially reduced by procedural indoctrination and changes in control and display system design, as indicated by many experiments. P.T.H.

A81-15691 **Introduction to training systems.** S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.), R. S. Jensen, and V. J. Gawron. In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 173-181.

Pilot training systems are discussed with regard to a functional model of the pilot-aircraft system, training objectives, and the effectiveness of current pilot training programs. Training system development and evaluation are described with attention given to need assessment, behavioral objectives, instructor training, student selection, and training effectiveness. Finally, investigations that have demonstrated the positive transfer of training from flight simulator to aircraft are briefly described. P.T.H.

A81-15692 **Measurement of transfer of training.** S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.) and B. H. Williges. In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 182-193.

The paper considers the theory of the measurement of transfer of training with particular reference to pilot training systems. Attention is given to the transfer paradigm, the percentage of transfer, and transfer effectiveness. The incremental transfer effectiveness function is established; it can be used to determine how much time is saved in one training situation as a consequence of each successive increment of training in another, generally less costly, situation. It is suggested that the negatively decelerated nature of incremental transfer effectiveness applies to the relationships among all learning experiences, whether they exhibit positive or negative transfer. The single most useful measure for the educational strategist in pilot training is found to be the cost effectiveness of the educational experience. P.T.H.

A81-15694 **Simulator cockpit motion and the transfer of flight training.** R. S. Jacobs and S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.). In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 204-216.

The relationship between cockpit motion and transfer is discussed with regard to: (1) whether simulator cockpit motion facilitates transfer of basic flight skills during initial pilot training and (2) whether cockpit motion cues play a directing or merely an alerting role in training student pilots to cope with the visual and vestibular cue conflicts encountered in flight. This relation-

ship is clarified with attention given to errors in simulator training, transfer to the aircraft, perceptual equivalence, overall savings and transfer effectiveness, cost effectiveness, and optimization of simulator use. It is concluded that complex cockpit motion has so little effect on training transfer that its contribution is difficult to measure at all. P.T.H.

A81-15697 **Adaptive perceptualmotor training.** G. Lintern and S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.). In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 239-250.

Adaptive training (AT) is a flight-training procedure in which the training schedule is individualized by varying task characteristics through a graded series of steps at a rate that is related to the trainee's speed of learning; a demanding task is initially simplified in some manner, and performance is monitored so that task difficulty or complexity can be increased gradually as the trainee develops proficiency. The paper reviews the field of AT with regard to transfer of training, system and forcing-function adaptations, augmented-feedback adaptations, adaptive logic and incremental transfer, programmed instruction, and the role of the instructor. In particular, AT is compared with the fixed-task technique. P.T.H.

A81-15698 **Computer-assisted flight training.** S. R. Trollip and S. N. Roscoe (New Mexico State University, Las Cruces, N. Mex.). In: *Aviation psychology*. Ames, Iowa State University Press, 1980, p. 251-256.

Large-scale computer-assisted instruction (CAI) systems allow the researcher to develop and evaluate methods of instruction other than the traditional ground school; the real potential of such systems consists in providing the student with a learning environment beyond the capabilities of the teacher. CAI applications are reviewed, with attention given to the operation of the VOR navigation system, preflight planning, holding patterns, teaching decision making, ground school, and testing. It is concluded that the development of further CAI programs to supplement ground school classes, as well as more advanced programs for procedural and decisional instruction, offers a potentially cost-effective alternative to traditional instruction methods. P.T.H.

A81-15788 **Motion and vision. III - Stabilized pattern adaptation.** D. H. Kelly and C. A. Burbeck (SRI International, Menlo Park, Calif.). *Optical Society of America, Journal*, vol. 70, Nov. 1980, p. 1283-1289. 22 refs. Grant No. NIH-EY-01128.

It has been suggested that local variations of retinal sensitivity may be responsible for elevating the threshold in pattern-adaptation experiments of the Blakemore-Campbell type. Subjects are unable to scan high-contrast gratings uniformly enough to eliminate this possibility; to control this effect, grating-adaptation experiments were performed under stabilized-image conditions, while both adapting and test targets were moved at retinal velocities determined by the experimenter. Varying the spatial frequency and velocity of the adapting stimulus, the spatial and temporal properties of the principal mechanism that contributes to the afterimage was determined. The Blakemore-Campbell effect persists at adapting velocities that are fast enough to rule out local variations of retinal sensitivity. By manipulating the image velocity, it was possible to shift the spatial frequencies of some threshold-elevation curves, but these shifts were not great enough to suggest that velocity tuning is important in pattern adaptation. (Author)

A81-15789 **Visual responses to changing size and to sideways motion for different directions of motion in depth - Linearization of visual responses.** D. Regan and K. I. Beverley (Dalhousie University, Halifax, Nova Scotia, Canada). *Optical Society of America, Journal*, vol. 70, Nov. 1980, p. 1289-1296. 27 refs. Natural Sciences and Engineering Research Council of Canada Grant No. A-0323; Grant No. AF-AFOSR-78-3711.

A psychophysical investigation proposes that the changing-size channels precisely calculate the algebraic difference between the velocities of opposite edges of a target so that the computation is

independent of the motion component $V(x)$ parallel to the front parallel plane over a wide range of motion component ratios. It is shown that the oscillations of the edges of the stimulus square are equivalent to the oscillation of the square along one of the 11 trajectories in depth. Threshold elevations for the z-direction test were the same for the 11 trajectories, with the greatest departure from constancy of 30% occurring when two edges of the adapting stimulus were stationary.

A.T.

STAR ENTRIES

N81-12719*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

GENESIS OF BREATH SOUNDS-PRELIMINARY VERIFICATION OF THEORY

John L. Patterson (Medical Coll. of Virginia, Richmond), Jay C. Hardin, and John M. Seiner Oct. 1980 18 p refs Presented at the 5th Intern. Lung Sounds Conf., London, 15-16 Sep. 1980

(NASA-TM-81897) Avail: NTIS HC A02/MF A01 CSCL 06P

Experimental results are presented which tend to validate a previously developed theory of sound production in the human lung over a particular Reynolds number range. In addition, a new, presently nonunderstood, phenomenon was observed at higher Reynolds number. These results, which show how sound generation in the lung depends upon the physiologically important variables of volume flow rate and bronchial diameter, have potentially important application in noninvasive lung examination and the diagnosis of lung disease. Author

N81-12720# Army Mobility Equipment Command, Fort Belvoir, Va.

EFFECTS OF LOW POWER MICROWAVES ON THE LOCAL CEREBRAL BLOOD FLOW OF CONSCIOUS RATS

Kenneth J. Oscar Jun. 1980 10 p refs (AD-A090426) Avail: NTIS HC A02/MF A01 CSCL 06/18

A decoy and deception concept presently being considered is to remotely create the perception of noise in the heads of personnel by exposing them to low power, pulsed microwaves. When people are illuminated with properly modulated low power microwaves the sensation is reported as a buzzing, clicking, or hissing which seems to originate (regardless of the person's position in the field) within or just behind the head. The phenomena occurs at average power densities as low as microwatts per square centimeter with carrier frequencies from 0.4 to 3.0 GHz. By proper choice of pulse characteristics, intelligible speech may be created. Before this technique may be extended and used for military applications, an understanding of the basic principles must be developed. Such an understanding is not only required to optimize the use of the concept for camouflage, decoy and deception operations but is required to properly assess safety factors of such microwave exposure. GRA

N81-12721# Duke Univ., Durham, N. C. Dept. of Biochemistry.

MECHANISMS OF RECOMBINATION AND FUNCTION OF DNA IN BACTERIA Progress Report, 16 Aug. 1979 - 15 Aug. 1980

W. R. Guild 1980 5 p refs (Contract DE-AS05-76EV-03941)

(DOE/EV-03941/52) Avail: NTIS HC A02/MF A01

The process of plasmid transformation in pneumococcus was analyzed. Other efforts included the continued study of resistance determinants inserted in the chromosomes of clinical strains of pneumococcus and their transfer by conjugation, a novel phenomenon, discovered last year, and temperate phages of pneumococcus. DOE

N81-12722# Brookhaven National Lab., Upton, N. Y. Dept. of Biology.

SYNCHROTRON RADIATION SOURCES FOR PHOTOBIOLOGY AND ULTRAVIOLET, VISIBLE AND INFRARED SPECTROSCOPY

J. C. Sutherland 1980 9 p refs Presented at the 8th Intern. Congr. on Photo-Biology Strasbourg, France, 20-25 Jul. 1980

(Contract DE-AC02-76CH-00016)
(BNL-28149; CONF-800762-1)

Avail: NTIS

HC A02/MF A01

The advantages of synchrotron radiation in several types of spectroscopy, microscopy and diffraction studies were examined. The availability of synchrotron radiation will expand rapidly in the early 1980's as experimental programs start at the new generation of dedicated storage rings. Sources for synchrotron radiation are discussed. DOE

N81-12724*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ACOUSTIC TOOTH CLEANER Patent Application

Joseph S. Heyman, inventor (to NASA) Filed 14 Aug. 1980 13 p

(NASA-Case-LAR-12471-1; US-Patent-Appl-SN-178193) Avail: NTIS HC A02/MF A01 CSCL 06B

An acoustic oral hygiene unit that uses acoustic energy to oscillate mild abrasive particles in a water suspension which is then directed in a low pressure stream onto the teeth is described. The oscillating abrasives scrub the teeth clean removing food particles, plaque, calculus, and other foreign material from tooth surfaces, interproximal areas, and tooth gingiva interface more effectively than any previous technique. The relatively low power output and the basic design make the invention safe and convenient for everyday use in the home without special training. This invention replaces all former means of home dental prophylaxis, and requires no augmentation to fulfill all requirements for daily oral hygienic care. NASA

N81-12725*# Wisconsin Univ., Madison. Biomedical Applications Team.

DEFINITION OF PROBLEMS OF PERSONS IN SHELTERED CARE ENVIRONMENTS Project Extension Report, Jan. - Dec. 1978

W. N. Fetzner 15 Jan. 1979 56 p refs

(Contract NAS5-23500)

(NASA-CR-160050) Avail: NTIS HC A04/MF A01 CSCL 06E

Innovations in health care using aerospace technologies are described. Voice synthesizer and voice recognition technologies were used in developing voice controlled wheel chairs and optacons. Telephone interface modules are also described. T.M.

N81-12726# Boeing Aerospace Co., Seattle, Wash. Data Processing Technology.

PERIPHERAL CUES AND COLOR IN VISUAL SIMULATION Final Report, Dec. 1978 - Mar. 1980

Conrad L. Kraft, Charles D. Anderson, and Charles L. Elworth Mar. 1980 166 p refs

(Contract F49620-79-C-0030; AF Proj. 2313)

(AD-A089837; D180-25945-1; AFOSR-80-0873TR) Avail: NTIS HC A08/MF A01 CSCL 06/16

In the future, combat readiness must depend on flight crew training with simulators to train a sufficient number of pilots and maintain a high degree of readiness. With simulators this may be done without consuming large amounts of fuel and speeding up the aging of very expensive aircraft. On the surface this sounds like an easy solution. It becomes expensive when one sees the complexity of the simulators and their visual systems. The real danger does not lie in costs however, but in the possibility that the validity of the training and its transfer to flight performance may not reach the assumed levels. The Viet Nam situation pointed out the high probability of loss of a pilot in the first ten hours of his combat flying. The solution is to conduct the proper amount of research to economically establish: (a) the reliability, validity and transfer of training from simulation to operational combat flying; (b) the essential content of the external visual scenes required for such training; (c) the quantity and type of motion cues that are essential for each combat task; (d) the cue coordination that facilitates simulator training and transfer of such training and (e) what quantity of initial recurrent and specific aircraft training is necessary to maintain combat readiness. GRA

N81-12727# Walter Reed Army Inst. of Research, Washington, D.C.

RAPID TRANSMERIDIAN DEPLOYMENT: COGNITIVE PERFORMANCE AND CHRONOBIOLOGIC PROPHYLAXIS FOR CIRCADIAN DYSCHRONISM

R. Curtis Graeber, Bruce N. Cuthbert, Helen C. Sing, Robert J. Schneider, and G. Rufus Sessions Jun. 1980 15 p refs (AD-A090393) Avail: NTIS HC A02/MF A01 CSCL 06/19

Rapid deployment of combat units to overseas locations is a primary concern of today's strategic planners. Such movements require the airlifting of units across multiple time zones. Numerous studies have documented the adverse physiological and behavioral consequences accompanying the rapid crossing of three or more time zones. These effects result from the requirement that the body must adjust its circadian rhythms to the new local time. Under normal conditions, these daily cycles are synchronized by the external Zeitgebers (i.e., time-givers) of the local environment. The sudden shifting of these Zeitgebers causes the shifting at different rates of the body's physiological, biochemical, and behavioral rhythms. While some circadian rhythms adjust quite rapidly, others adjust very slowly. Consequently, the passenger's circadian system is not only out of synchrony with the environment but is also internally desynchronized. It is the latter condition, circadian dyschronism, which is particularly responsible for the fatigue and malaise typically reported as 'jet lag' during the first several days following rapid transmeridian flight. GRA

N81-12728# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.

PARAMETER IDENTIFICATION TECHNIQUES FOR PHYSIOLOGICAL CONTROL SYSTEMS Interim Report

H. T. Banks Jul. 1980 48 p refs (Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; NSF MCS-79-05774; AF Proj. 2304) (AD-A090547; AFOSR-80-1001TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

Parameter identification techniques for problems involving functional and partial differential equation models are discussed. The methods presented combine standard ordinary differential equation algorithms with Ritz-Galerkin ideas in reducing problems for infinite dimensional state systems to finite dimensional state problems. GRA

N81-12729# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

XDC-2 DIGITAL DECOMPRESSION COMPUTER: ASSESSMENT OF DECOMPRESSION PROFILES BY ULTRASONIC MONITORING, PHASE 1, 36-54 MSW

R. Y. Nishi, K. E. Kisman, I. P. Buckingham, B. C. Eatock, and G. Masurel Jul. 1980 49 p refs (AD-A090467; DCIEM-80-R-32) Avail: NTIS HC A03/MF A01 CSCL 06/11

Decompression from experimental, operational, and training dives at the Defence and Civil Institute of Environmental Medicine (DCIEM) has been carried out for many years under control of decompression computers rather than by means of published decompression tables. The XDC-2 digital decompression computer and dive monitor is presently in use at DCIEM. An evaluation program for determining and defining the operational limiting bottom times for different depths and the safety of using the computer by following exactly the displayed safe ascent during decompression has been started. In this report, the results of Phase I of the evaluation program, covering the depth range 36 to 54 meters of seawater (msw), are presented. Seventeen chamber dives, consisting of 102 man-dives, were conducted using 9 different profiles. In order to assist in the evaluation of the XDC-2 profiles, two Doppler ultrasonic bubble detectors were used to monitor bubbles in the diving subjects for at least 3 hours and, in some cases, up to 7 hours after the start of decompression. GRA

N81-12730# Army Aeromedical Research Lab., Fort Rucker, Ala. Field Research and Biomedical Applications Div.

EVALUATION OF ARMY AVIATOR HUMAN FACTORS,

FATIGUE, IN A HIGH THREAT ENVIRONMENT Final Report

Chester E. Duncan, Michael G. Sanders, and Kent A. Kimball Sep. 1980 70 p refs (DA Proj. 3E1-62773-A-819) (AD-A090751; USAARL-80-8) Avail: NTIS HC A04/MF A01 CSCL 01/2

Questionnaire data received from student and instructor pilots indicate significant levels of fatigue when flying in different flight altitudes and profiles; the lower the altitude flown, the more rapidly pilots experience fatigue. These data suggest night standard flight is 1.4 times as fatiguing as day standard flight; day terrain flight is 1.3 times as fatiguing as day standard flight; and night terrain flight, the most difficult flight profile examined, is 1.97 times as fatiguing as day standard flight. Army Regulation 95-1, 1 January 1980, sets a maximum of 140 hours per month per aviator of day flight in a combat environment. Existing doctrine emphasizes nap-of-the-Earth techniques, and if so accomplished for 140 hours could possibly result in an unsafe and severely fatigued helicopter pilot. Field commanders utilizing the guidelines presented in this report may organize and more effectively continue their mission in Army aviation. GRA

N81-12731# Vanderbilt Univ., Nashville, Tenn. Biomedical Computing Technology Information Center.

CAMIRD 3: COMPUTER ASSISTED MEDICAL INTERNAL RADIATION DOSIMETRY, FORTRAN IV VERSION

C. Riccardo Bellina and Riccardo Guzzardi 1980 113 p refs Prepared in cooperation with CNR, Pisa, Italy (Contract DE-AS05-80EV-10343) (DOE/EV-10303/5) Avail: NTIS HC A06/MF A01

The FORTRAN IV version of the CAMIRD/II Package (1) revised is described. In addition another FORTRAN IV program named TILDY (2), which determines the cumulated activity, was revised, and modified to be used as a subroutine of CAMIRD's main program. With such an organization all the calculation involved in dose computation becomes easier and quicker. DOE

N81-12732# Rochester Univ., N. Y. Dept. of Radiation Biology Biophysics.

EFFECT OF IONIZING RADIATIONS ON CONNECTIVE TISSUE

K. I. Altman and G. B. Gerber 1980 137 p Prepared in cooperation with Centre d'Etude de l'Energie Nucleaire, Mol, Belgium (Contracts DE-AC02-76EV-03490; B232-76-18108) (UR-3490-1900) Avail: NTIS HC A07/MF A01

The effects of ionizing radiations on connective tissue in lung, heart, vasculature, kidney, skin, and skeletal tissues are reviewed. Special emphasis is given to the effect of ionizing radiations on vasculo connective tissue and fibrotic changes following radiation induced injury to organs and tissues. The general biochemistry physiology, and pathology of connective tissue is reviewed together with the participation of connective tissue in disease. DOE

N81-12733# Battelle Pacific Northwest Labs., Richland, Wash. **EVALUATION OF SEVERAL METHODS FOR ASSESSING THE EFFECTS OF OCCUPATIONAL EXPOSURE TO RADIATION**

Ethel S. Gilbert May 1980 28 p refs Presented at the Amer. Statist. Soc. Meeting, Houston, Tex., 11-14 Aug. 1980 (Contract DE-AC06-76RL-01830) (PNL-SA-8438; CONF-800820-1) Avail: NTIS HC A03/MF A01

Several methods of analysis are presented and evaluated. Questions of interest include whether or not to utilize an external control, and how to handle the highly skewed exposure data most effectively. Expressions for the power of various procedures are used not only to compare methods but also to evaluate the potential for detecting effects in occupationally exposed populations. DOE

N81-12734# Royal Aircraft Establishment, Farnborough (England).

SOME FURTHER THOUGHTS ON TEMPORARY THRESHOLD SHIFT

K. R. Maslen London HMSO Jun. 1980 11 p refs
(RAE-TM-FS-338; BR75056) Avail: NTIS HC A02/MF A01

Data on threshold shift of hearing in an individual due to intermittent noise exposure were compared with pressure theory for continuous exposure. The ultimate shifts due to alternating exposure to equal short periods of one kind of noise at different levels are calculated and presented graphically. The probable errors due to lapse of time between the cessation of the noise exposure and measurement of the threshold are discussed, and it is suggested that such errors are well within probable experimental errors. Author (ESA)

N81-12735# National Technical Information Service, Springfield, Va.

HYPERBARIC OXYGENATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980

Elizabeth A. Harrison Aug. 1980 165 p Supersedes NTIS/PS-79/0744; NTIS/PS-78/0676
(PB80-813769; NTIS/PS-79/0744; NTIS/PS-78/0676) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 06S

Microbiology, respiratory infections, oxygen toxicity, diving, decompression sickness and metabolism as applied to hyperbaric oxygenation are covered in approximately 160 citations. GRA

N81-12736# National Technical Information Service, Springfield, Va.

ANTHROPOMETRY: BASIC STUDIES AND APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Jul. 1980

Edith Kenton Aug. 1980 143 p Supersedes NTIS/PS-79/0935; NTIS/PS-78/0866
(PB80-813645; NTIS/PS-79/0935; NTIS/PS-78/0866) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 06N

Studies on design and anthropometric fit tests of military clothing, protective clothing and equipment; anthropometric and human factors engineering design of aircraft seats and cabins, cockpits, ejection seats, automobile interiors, safety belts and devices, life jackets, flotation devices, and other safety equipment are presented. Studies on simulation models to model the human body in crash research and to model limb or whole body motion as well are also covered. In addition, references on anthropometric surveys and anthropometric and human factors engineering aspects of workspace configuration and instrument panel design for boots, aircraft and the like are cited. GRA

N81-12737# Royal Aircraft Establishment, Farnborough (England).

THE RECORDING AND PRELIMINARY ANALYSIS OF A DATA BASE FOR THE ASSESSMENT OF STRAIN IN AIR TRAFFIC CONTROLLERS, USING SPEECH

J. B. Peckham London HMSO Jun. 1980 13 p refs
(RAE-TM-FS-334; BR75080) Avail: NTIS HC A02/MF A01

A data base of air traffic controllers verbal communications during periods of high and low activity was tape recorded during the Farnborough International Airshow in 1978. A description of the data base was obtained to provide a means of testing the hypothesis that the speech signal can be used to assess strain or the effects of increasing stress in work. Preliminary statistical analysis of the voice pitch of one of the controllers has shown that periods of high and low activity may be readily discriminated using several 20 second segments of voiced speech. Author (ESA)

N81-12738# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

PERFORMANCE OF THE SCOTT AVIOX EMERGENCY OXYGEN SYSTEM AFTER EXPOSURE TO NORMAL, HOT AND COLD STORAGE CONDITIONS

Jun. 1980 31 p refs
(AD-A090572; DCIEM-80-R-28) Avail: NTIS HC A03/MF A01 CSCL 01/3

With the advent of the Long Range Patrol Aircraft (LRPA)

the CP-140 Aurora, the Canadian Forces will not only be acquiring a new aircraft but a new supplemental oxygen system as well. This system is the Scott Aviox which is a solid state system that utilizes a chemical composition for oxygen production versus more conventional methods of stored liquid or gaseous oxygen. Although this type of system is not new in the aviation world, it is only now being adopted for use in the CF. Because of the novelty of this system in the CF, this evaluation study was conducted to determine the units ability to meet criteria established in regards to reliability, production and ability to operate after being exposed to temperature extremes. GRA

N81-12739# Letterman Army Inst. of Research, San Francisco, Calif.

LABORATORY INVESTIGATIONS OF BIOMEDICAL FACTORS INFLUENCING LASER DESIGNATOR OPERATOR PERFORMANCE

Peter A. Omara, David A. Stamper, Edwin S. Beatrice, and David J. Lund Jun. 1980 14 p

(AD-A090425) Avail: NTIS HC A02/MF A01 CSCL 05/9

A field simulation laboratory has been constructed which will facilitate the controlled investigation of factors which may influence laser designator operations. The primary objectives in developing this laboratory were to obtain accurate low-cost on-line assessment of pursuit tracking performance under conditions where experimental variables could be precisely controlled. The results of the preliminary studies indicate that the tracking performance data obtained with the use of the laboratory laser designator simulator are consistent with those obtained under field conditions in which prototype viscous-mounted laser designator devices are used. The methods and results outlined in this report demonstrate the feasibility of using relatively inexpensive microcomputer, laser, and video electronic systems to study human tracking performance in a laboratory situation where biomedical variables which influence soldier performance may be monitored under precisely controlled conditions. The data obtained through use of the simulator will be of value during the selection and training of designator operators and will provide information for use in developing means of protecting the operator from the effects of hazardous environments. GRA

N81-12740# Army Aeromedical Research Lab., Fort Rucker, Ala. Human Tolerance and Survivability Div.

SPH-4 HELMET DAMAGE AND HEAD INJURY CORRELATION Final Report, Apr. 1975 - Jun. 1979

Bruce A. Slobodnik Sep. 1980 26 p refs
(DA Proj. 3E1-62773-A-819)
(AD-A090750; USAARL-80-7) Avail: NTIS HC A03/MF A01 CSCL 01/2

Human tolerance to head impact was assessed by correlating the force levels required to duplicate damage seen in 12 SH-4 aviator helmets retrieved from US Army helicopter crashes with resulting head injury. Head injury occurred at peak acceleration levels far below 400 G, which is the value currently used by the US Army as the pass-fail criterion in evaluating the impact attenuation performance of prospective aircrew helmets. Concussive head injuries occurred below Severity Index values of 1500 and below Head Injury Criterion values of 1000. These are considered concussive threshold values by the National Operating Committee on Standards for Athletic Equipment and by the Department of Transportation, respectively. GRA

N81-12741# Cincinnati Univ., Ohio. Dept. of Mechanical and Industrial Engineering.

ON PARACHUTIST DYNAMICS Technical Report, 1 Oct. 1978 - 30 Sep. 1980

Ronald L. Huston and James W. Kamman 1 Oct. 1980 56 p refs

(Contract N00014-76-C-0139)
(AD-A090335; UC-MIE-100180-10-ONR) Avail: NTIS HC A04/MF A01 CSCL 05/5

The dynamics of a parachutist is discussed. Results of a computer simulation and a parameter study are presented. A variety of initial parachutist configurations prior to 'opening shock' are considered and the relative effects upon the parachutist's dynamics-particularly, the head/neck system dynamics are studied.

Optimal initial (pre-opening) configurations which minimize the subsequent force and moment pulses experienced by the head/neck system, are identified and discussed. Application in parachute design and in developing jumping strategies are also discussed. GRA

N81-12742# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

MATHEMATICAL MODELS OF PILOT-HELICOPTER SYSTEMS

P. H. Wewerinke 27 Jun. 1979 22 p refs Presented at 5th European Rotocraft and Powered Lift Aircraft Forum, Amsterdam, 4-7 Sep. 1979

(NLR-MP-79026-U) Avail: NTIS HC A02/MF A01

A theoretical framework in terms of state space optimization, estimation and decision theory is presented, to allow the description of meaningful (relevant with respect to overall system reliability) pilot functional characteristics. This involves continuous information processing both of display indicators and of the outside world resulting in an internal representation of the task. In the case of control tasks this information processing model is combined with a control response model. This is known as the optimal control model. Preliminary attempts to model pilot monitoring and decision making are described. The resulting integrated model of the man machine system provides measures of pilot workload and system performance. It is shown that the model is a useful tool to deal with many design and operational problems of pilot-helicopter systems. Author (ESA)

N81-12743# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

VISUAL SCENE PERCEPTION IN MANUAL CONTROL

P. H. Wewerinke 23 Jan. 1980 28 p refs Submitted for publication

(NLR-MP-79045-U) Avail: NTIS HC A03/MF A01

Based on an inventory of the most important visual scene characteristics, the visual perception process is described on the basis of the linear perspective geometry and cues related to the relative movement of the observer with respect to the outside world. This involves mathematical relationships between these visual cues and the vehicle state variables. The visual scene provides a variety of perspective geometrical and relative motion cues. Experimental results support the hypothesis that these characteristics can be considered as separate cues among which the human operator must divide his attention. No interference was found between tasks. The visual scene perception model is shown capable of providing a general framework for dealing quantitatively with the important visual scene characteristics. Integrating this model with the optimal control model of human control behavior allows a detailed description of the visual perception process involved in the visual approach task. Author (ESA)

N81-13616*# National Aeronautics and Space Administration, Washington, D. C.

ULTRASTRUCTURAL STUDIES OF THE MITOCHONDRIAE IN THE STRIATED MUSCLES OF BIRDS WITH REGARD TO EXPERIMENTAL HYPOKINESIS

M. Belak, J. Kocisova, and K. Boda Jul. 1980 14 p refs Transl. into ENGLISH from Arch. Exp. Veterinaarmed. (Leipzig), v. 31, 4 Jul. 1977 p 537-546 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76283) Avail: NTIS HC A02/MF A01 CSCL 06C

Electron microscopic studies were carried out on the mitochondria of the transversely striated muscles with regard to experimental hypokinesia. As compared to the central group the mitochondria of m. pectoralis thoracicus and the m. iliobtibialis posterior in hypokinetic birds reveal marked changes. In filamentous and ovoid mitochondria, vacuoles can be observed which in some cases produced larger light formations with following disappearance of the cristae and destruction of mitochondria. Fat particles located at the poles of the altered mitochondria, sporadically occurring also laterally, presented

another finding. The Z-lines of the sarcomere did not form a continuous line, but were somewhat shifted. Author

N81-13617*# National Aeronautics and Space Administration, Washington, D. C.

COMPARATIVE STUDY OF CHOLERETIC AGENTS IN ANESTHETIZED RATS AS WELL AS IN RESTRAINED AND UNRESTRAINED RATS, WITH OR WITHOUT COMPENSATION FOR BILIARY LOSS

C. Labrid (Center for Marxist Study and Research, France), G. Dureng (Center for Marxist Study and Research, France), J. Tachon (Center for Marxist Study and Research, France), and P. Duchene-Marullaz Jun. 1980 7 p ref Transl. into ENGLISH from Compt. Rend. Soc. Biol. (Paris), v. 165, no. 4, 1971 p 842-844 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-76178) Avail: NTIS HC A02/MF A01 CSCL 06C

Tests were conducted on Wistar rats by using 3 control choleretic agents: 1-phenyl-1-hydroxy n-pentane, dehydrocholic acid, and phenyl-dimethylacetic acid. The effects of these agents were compared in different experimental conditions. The comparative study of choleretic agents in anesthetized rats, in restrained and unrestrained rats, with or without compensation for biliary loss by the biliary secretion of restrained or unrestrained rats does not show, in systematic pharmacodynamic investigations, an obvious superiority over the methods based on the simple technique. Author

N81-13618# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Deputy for Development Planning.

ACQUISITION STRATEGY IMPLICATIONS OF A LONG RANGE COMBAT AIRCRAFT (LRCA) Final Report, Feb. - Jun. 1980

Jerome P. Sutton Jul. 1980 84 p (AD-A091109; ASD/XRM-TR-80-5044) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report contains a discussion of the acquisition implications of the Long Range Combat Aircraft (LRCA) to include: affordability, availability, logistics, and SALT II aspects. Assessment of the LRCA concept involved consideration of two alternative program schedules, Milestone II 1981, and Milestone II - 1985, and thus, consideration of a near term and mid-term technology level. Since the LRCA is in a pre-Milestone 0 status, no firm conclusions regarding an ultimate program can be reached; results of this assessment would support some preliminary implications. For the LRCA to be affordable requires that substantive reprogramming of the budget be undertaken. More importantly, the priority of the program must be sustained throughout the acquisition cycle. The availability of resources to support the LRCA requires planning and management and does not present insurmountable difficulties. The initial operational capability (IOC) may, depending on the exigency of the need, not be when one may wish it. Full capability is most likely not possible prior to the mid-1990s. The final design of the LRCA and its weapons complement are dependent upon consideration of the Strategic Arms Limitation Treaty (SALT II) as ratified. GRA

N81-13619# Sandia Labs., Albuquerque, N. Mex.

EFFECTIVENESS OF IRRADIATION IN KILLING PATHOGENS

J. Gary Yeager (BDM Corp., Albuquerque, N. Mex.) and Richard L. Ward 1980 29 p refs Presented at the Natl. Symp. on the User of Cesium-137 to Process Sludge for Further Reduction of Pathogens, Denver, 3 Sep. 1980

(Contracts DE-AC04-76DP-00789; E(29-2)-3536;

EPA-IAG-D6-0675)

(SAND-80-7124C; CONF-800964-2) Avail: NTIS HC A03/MF A01

United States Environmental Protection Agency regulations include gamma ray irradiation of sludge as an approved process to further reduce pathogens (PFRP) prior to land application. It is shown that the 1 Mrad PFRP dose is capable, by itself, of eliminating bacterial, fungal, and parasitic pathogens from sludge. Gamma irradiation of sludge in conjunction with the required

processes to significantly reduce pathogens should also eliminate the viral hazard from wastewater sludges. DOE

N81-13620# National Academy of Sciences - National Research Council, Washington, D. C. Inst. of Lab. Animal Resources.

ANIMAL FACILITIES AND RESOURCES SUPPORTING BIOMEDICAL RESEARCH IN THE UNITED STATES IN FISCAL YEAR 1978 Final Report

Mar. 1980 84 p refs
(Contract N01-RR-7-2114; NIH Proj. DRR-77-5)
(PB80-210636; NIH/DRR-77-5) Avail: NTIS
HC A05/MF A01 CSCL 06C

Survey questionnaires were distributed to 2,637 known users of laboratory animals in the United States, and 1,902 (72%) were returned. Of these, the responses of 1,252 organizations fulfilled the Committee's criteria for inclusion in the response, population for aggregate analysis. The report is divided into six sections: dimensions of survey population, animal use and sources, facility administration and personnel, facilities and equipment, costs of animal care, and appendix. GRA

N81-13621 Illinois Univ. at Urbana-Champaign.
SYNTHESIS, CHARACTERIZATION AND REACTIVITY OF ELECTRON RICH TRANSITION METAL ORGANOMETALLIC COMPLEXES Ph.D. Thesis

James Joseph Welter 1980 97 p
Avail: Univ. Microfilms Order No. 8026618

A study of the reaction of bis(cyclopentadienyl) tantalum trihydride with n-butyllithium in the presence of 1,1,4,7,7-pentamethyldiethylenetriamine is presented. It was found from a deuteration study of the amine chelated tantalum-lithium reagent that the metalation indeed occurs at the tantalum atom by abstraction of a hydrogen atom. This metalation was not specific to either of the two sets of non-equivalent hydride positions of the tantalum hydride. The amine chelated tantalum lithium reagent was also reacted with ethyl bromide to yield an apparently alkylated product. Dissert. Abstr.

N81-13622* National Aeronautics and Space Administration, Washington, D. C.

NASA TO STUDY EFFECTS OF JET LAG ON PILOT PERFORMANCE

24 Dec. 1980 4 p
(NASA-News-Release-80-197; P80-10204) Avail: NASA
Scientific and Technical Information Facility, P.O. Box 8757, B.W.I.
Airport, Md. 21240 CSCL 06P

Existing scientific literature on circadian rhythm was translated into lay terms and disseminated to the aviation community. The effects of rest, sleep, dietary, and drug use patterns of commercial airline crews were investigated. T.M.

N81-13623 Indiana Univ., Bloomington.
THE PHYSIOLOGICAL AND BIOMECHANICAL EFFECTS OF ISOTONIC AND ISOKINETIC STRENGTH TRAINING PROGRAMS ON COLLEGIATE SOCCER PLAYERS Ph.D. Thesis

Helmi Hussen Mahmoud 1980 279 p
Avail: Univ. Microfilms Order No. 8020033

The changes which take place in the body composition, anthropometric measurements, cardiovascular endurance, power, muscular endurance, muscular strength, and soccer neuromuscular skills of male soccer players were studied. Twenty five soccer players were randomly assigned to either isotonic or isokinetic strength training programs. Their performance was recorded on two separate testing sessions, one before and the other after the 12 weeks strength training program. The training program included ten different strength exercises, practiced for three sets each with (6 RM) for isotonic, and (10 RM) for isokinetic group three days a week for 12 weeks. The Statistical Package for Social Science was used in the descriptive and inferential statistical analysis to test the significant changes between the two groups at alpha = 0.05. Dissert. Abstr.

N81-13624 Georgia Univ., Athens.
EFFECT OF ACTIVE AND PASSIVE RECOVERY ON SUBSEQUENT TREADMILL RUNNING PERFORMANCE

Ph.D. Thesis

Ung Dae Kong 1980 99 p
Avail: Univ. Microfilms Order No. 8029134

Physical characteristics were measured and a treadmill stress test was administered to assess the maximal oxygen uptake and selected other measures of metabolic and cardiorespiratory capacity. Physiological measurements obtained during the stress test included maximal ventilation, oxygen uptake, respiratory exchange ratio, heart rate and blood lactic acid concentration. All subjects completed two all-out treadmill runs to exhaustion at a speed estimated to elicit 110 percent of the subject's maximal oxygen uptake under two conditions: with 20 minutes of active recovery between runs and with 20 minutes of passive recovery between runs. Treadmill run performance following active recovery is significantly better than that following passive recovery. The better subsequent performance following active recovery appears related to lower post recovery levels of blood lactic acid. Dissert. Abstr.

N81-13625 Purdue Univ., Lafayette, Ind.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE OSCILLOMETRIC METHOD OF INDIRECT BLOOD PRESSURE MEASUREMENT Ph.D. Thesis

Gregory William Mauck 1980 281 p
Avail: Univ. Microfilms Order No. 8027302

Employing several simplifying assumptions the complex system of blood pressure cuff, arm tissues and artery is reduced to a simplified experimental model consisting of a collapsible elastic vessel enclosed within a rigid compression chamber filled with liquid and air. A one dimensional theoretical model based upon the experimental model is also derived. Employing the experimental and theoretical models, the effects of system parameters are examined. The accuracy of the oscillometric method in predicting direct mean arterial pressure for the model was found to be most dependent upon the ratio of compression chamber air volume to unstressed arterial volume with a decrease in accuracy as the volume ratio increases. The existence of an optimal value for the ratio of compression chamber air volume to unstressed arterial volume is both suggested experimentally and shown to exist theoretically. The effects of arterial distensibility on the oscillometric method were examined using the theoretical model and shown to have a minimal effect on the prediction of mean arterial pressure. Dissert. Abstr.

N81-13626*# National Aeronautics and Space Administration, Washington, D. C.

DECLINING INTERSTITIAL TRANSSUDATION IN MAN

P. deMarchin (Liege Univ., Belgium), D. Lagneaux (Liege Univ., Belgium), and J. Lecomte (Liege Univ., Belgium) Sep. 1980
8 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (Paris), v. 173, no. 1, 1979 p 165-168

(Contract NASw-3199)
(NASA-TM-75858) Avail: NTIS HC A02/MF A01 CSCL 06P

Results and methodology of experimentation dealing with declining interstitial transsudation are discussed. Concepts of the formation of interstitial fluids are in agreement with measurements of calf volume in normal young women, in horizontal recumbency or after horizontal immersion. The volume of the calf is reduced when the hydrostatic pressure of the blood column is diminished under the phlebostatic level and when the external pressure is increased by the hydrostatic pressure of a water bath. M.G.

N81-13627*# National Aeronautics and Space Administration, Washington, D. C.
CYCLIC AMP SYSTEM IN MUSCLE TISSUE DURING PROLONGED HYPOKINESIA

Ye. A. Antipenko, Yu. A. Bubeyev, B. F. Korovkin, and N. P. Mikhaleva Jun. 1980 7 p refs Transl. into ENGLISH from Vop. Med. Khim. (USSR), v. 24, no. 6, 1978 p 765-768 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Kirov Military Medical Academy, Leningrad

(Contract NASw-3199)
(NASA-TM-76186) Avail: NTIS HC A02/MF A01 CSCL 06S

Components of the cyclic Adenosine-cyclic-35-monophosphate (AMP) system in the muscle tissue of white rats were studied during 70-75 days of hypokinesia, created by placing the animals in small booths which restricted their movements, and during the readaptation period. In the initial period, cyclic AMP levels and the activities of phosphodiesterase and adenylate cyclase in muscle tissue were increased. The values for these indices were roughly equal for controls and experimental animals during the adaptation period, but on the 70th day of the experiment cAMP levels dropped, phosphodiesterase activity increased, and the stimulative effect of epinephrine on the activity of adenylate cyclase decreased. The indices under study normalized during the readaptation period. Author

N81-13628*# National Aeronautics and Space Administration, Washington, D. C.

ROLE OF THE MIDDLE EAR MUSCLE APPARATUS IN MECHANISMS OF SPEECH SIGNAL DISCRIMINATION
B. S. Moroz, V. G. Bazarov, and S. V. Sachenko Oct. 1980 10 p refs Transl. into ENGLISH from Zh. Ushnykh. Nosovykh Gorlovkh Bolez (USSR), no. 5, Sep. - Oct. 1979 p 24-28 Translated by Kanner (Leo) Associates, Redwood City, Calif. (NASA-TM-76408) Avail: NTIS HC A02/MF A01 CSCL 06P

A method of impedance reflexometry was used to examine 101 students with hearing impairment in order to clarify the interrelation between speech discrimination and the state of the middle ear muscles. Ability to discriminate speech signals depends to some extent on the functional state of intraaural muscles. Speech discrimination was greatly impaired in the absence of stapedial muscle acoustic reflex, in the presence of low thresholds of stimulation and in very small values of reflex amplitude increase. Discrimination was not impeded in positive AR, high values of relative thresholds and normal increase of reflex amplitude in response to speech signals with augmenting intensity. Author

N81-13629# Connecticut Univ., Farmington. School of Medicine.

TOXICOLOGY AND METABOLISM OF NICKEL COMPOUNDS Progress Report, 1 Dec. 1979 - 30 Nov. 1980 F. William Sunderman, Jr. 15 Aug. 1980 15 p refs (Contract DE-AS02-76EV-03140) (DOE/EV-03140/5) Avail: NTIS HC A02/MF A01

Documentation that nickel carbonyl is teratogenic and embryotoxic in hamsters is presented. A new experimental model for chemical induction of ocular neoplasms in rats by intraocular injection of alpha Ni3S2 was developed. A reference method for analysis of nickel in serum and urine by electrothermal atomic absorption spectrophotometry was developed in order to monitor occupational and environmental exposures to nickel compounds. T.M.

N81-13630# California Univ., Davis. Lab. for Energy-Related Health Research.

DEPOSITION AND CLEARANCE OF INHALED AEROSOLS
Otto G. Raabe 1979 63 p refs (Contracts DE-AC03-76SF-00472; EY-76-C-03-0472) (UCD-472-503) Avail: NTIS HC A04/MF A01

The particle size distribution and chemical and physical composition of airborne particulate material require special attention in evaluation of respiratory toxicology since a wide variability of physico-chemical properties may be encountered in both experimental and actual inhalation exposures. The essential features of the main factors affecting the mechanism of aerosol deposition and clearance are summarized. Selected references to available published works were chosen to illustrate these factors rather than to serve as a complete bibliography. Although some supportive data from studies with experimental animals were cited to illustrate basic phenomena, the emphasis is on deposition and clearance of potentially toxic particulate materials inhaled by people. DOE

N81-13631# Sandia Labs., Albuquerque, N. Mex. Fuel Cycle Risk Analysis Div.

RADIATION PROTECTION: AN ANALYSIS OF THYROID BLOCKING

David C. Aldrich and Roger M. Blond 1980 15 p refs Presented at the Intern. Conf. on Current Nucl. Power Plant Safety Issues, Stockholm, 20-24 Oct. 1980 Prepared in cooperation with the Nuclear Regulatory Commission, Washington, D.C. (SAND-80-2148C; CONF-801056-5; IAEA-CN-39/102) Avail: NTIS HC A02/MF A01

An analysis was performed to provide guidance to policy makers concerning the effectiveness of potassium iodide (KI) as a thyroid blocking agent in potential reactor accident situations, the distance to which (or area within which) it should be distributed, and its relative effectiveness compared to other available protective measures. The analysis was performed using the Reactor Safety Study (WASH-1400) consequence model. Four categories of accidents were addressed: gap activity release accident (GAP), GAP without containment isolation, core melt with a melt through release, and core melt with an atmospheric release. Cost benefit ratios (US \$/thyroid nodule prevented) are given that no other protective measures are taken. Uncertainties due to health effects parameters, accident probabilities and costs are assessed. The effects of other potential protective measures, such as evacuation and sheltering, and the impact on children (critical population) are evaluated. Finally, risk benefit considerations are briefly discussed. Author

N81-13632# California Univ., San Diego, La Jolla. Dept. of Medicine.

RESPIRATORY FUNCTION AT EXTREME ALTITUDES Final Report, 1 Apr. 1976 - 31 Mar. 1980

John B. West Aug. 1980 9 p refs (Contract N01-HR-6-2915) (PB80-213010; NIH-N01-HR-6-2915-F) Avail: NTIS HC A02/MF A01 CSCL 06S

Considerable progress was made in defining the experimental techniques for obtaining data under extremely arduous conditions. Design of some of the equipment was completed. A plan was formulated of mounting a primarily scientific expedition to Mt. Everest. GRA

N81-13633# National Telecommunications and Information Administration, Washington, D.C.

NONIONIZING ELECTROMAGNETIC RADIATION SAFETY: A PROGRAM OF COORDINATED FEDERAL ACTIVITIES RELATED TO BIOLOGICAL EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION (0-300 GHz)

Dec. 1979 90 p (PB80-211212; NTIA-SP-80-7) Avail: NTIS HC A05/MF A01 CSCL 06R

A program for coordinated Federal activities on nonionizing electromagnetic radiation safety is described. The program seeks to develop a better understanding of biological effects and interactions of NER through identification of several program objectives: determine population exposure (environmental, occupational, consumer and medical); determine energy absorbed; determine biological consequences of exposure; develop instrumentation and exposure systems; conduct assessments of risk and impact; and recommend control measures. GRA

N81-13634 California Univ., Davis.
STUDIES ON THE EFFECTS OF RADIATION ON HUMAN LYMPHOCYTES

Susan Jane Knox 1980 163 p Avail: Univ. Microfilms Order No. 8027064

Hematopoietic progenitor populations were found to be sensitive biosimeters of hematopoietic radiation injury using in vitro cloning of lymphocytes and the lymphocyte simulation test (LST). A technique was developed for the selective growth

of human T lymphocyte colonies from whole blood in a single phase semisolid culture system following stimulation with phytohemagglutinin-P (PHA-P), Concanavalin-A (Con-A), or purified protein derivative of *Mycobacterium tuberculosis* (PPD). Radiation dose response effects were studied using both whole blood and density gradient separated mononuclear cells in the LST and colony formation assay with PHA-P, Con-A, pokeweed mitogen protein from *Staphylococcus aureus*, PPD and allogeneic mixed lymphocyte stimulation. Generally, assays using whole blood in place of gradient separated cells were capable of detecting radiation effects at lower dose levels. Dissert. Abstr.

N81-13635*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

HEAD-UP TRANSITION BEHAVIOR OF PILOTS WITH AND WITHOUT HEAD-UP DISPLAY IN SIMULATED LOW-VISIBILITY APPROACHES

Richard F. Haines, Edith Fischer, and Toni A. Price Dec. 1980 37 p refs Prepared in cooperation with San Jose Univ. Foundation, Calif.

(NASA-TP-1720; A-8296; HUD-10) Avail: NTIS HC A03/MF A01 CSCL 05H

To quantify head-up transition behavior with and without a flightpath type head-up display, eight rated B-727 pilots each flew 31 manual and coupled approaches in a simulator with B-727 dynamics and collimated model board external scene. Data were also obtained on the roll played by the head-up display in the coupled-to-manual transition. Various wind shears, low visibilities, and ceilings were tested along with unexpected misalignment between the runway and head-up display symbology. The symbolic format used was a conformal scene. Every pilot except one stayed head-up, flying with the display after descending below the ceiling. Without the display and as altitude decreased, the number of lookups from the instrument panel decreased and the duration of each one increased. No large differences in mean number or duration of transitions up or down were found during the head-up display runs comparing the no-misalignment with the lateral instrument landing system offset misalignment runs. The head-up display led to fewer transitions after the pilot made a decision to land or execute a missed approach. Without the display, pilots generally waited until they had descended below the ceiling to look outside the first time, but with it several pilots looked down at their panel at relatively high altitudes (if they looked down at all). Manual takeover of control was rapid and smooth both with and without the display which permitted smoother engine power changes.

E.D.K.

N81-13636*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

COGNITIVE ISSUES IN HEAD-UP DISPLAYS

Edith Fischer and Richard F. Haines (San Jose State Univ., Calif.) Dec. 1980 32 p refs

(NASA-TP-1711; A-8246) Avail: NTIS HC A03/MF A01 CSCL 01D

The ability of pilots to recognize and act upon unexpected information, presented in either the outside world or in a head-up display (HUD), was evaluated. Eight commercial airline pilots flew 18 approaches with a flightpath-type HUD and 13 approaches with conventional instruments in a fixed-base 727 simulator. The approaches were flown under conditions of low visibility, turbulence, and wind shear. Vertical and lateral flight performance was measured for five cognitive variables: an unexpected obstacle on runway; vertical and lateral boresight-type offset of the HUD; lateral ILS beam bend-type offset; and no anomaly. Mean response time to the runway obstacle was longer with HUD than without it (4.13 vs 1.75 sec.), and two of the pilots did not see the obstacle at all with the HUD. None of the offsets caused any deterioration in lateral flight performance, but all caused some change in vertical tracking; all offsets seemed to magnify the environmental effects. In all conditions, both vertical and lateral tracking was better with the HUD than with the conventional instruments. Author

N81-13637# Man Factors, Inc., San Diego, Calif.

HUMAN ENGINEERING DESIGN CRITERIA FOR MODERN

CONTROL/DISPLAY COMPONENTS AND STANDARD PARTS Final Report, 16 May 1979 - 16 May 1980

W. E. Woodson and C. Coburn May 1980 43 p refs

(Contract DAAK40-79-C-0145)

(AD-A091191; AD-E950044; MFI-80-101-R;

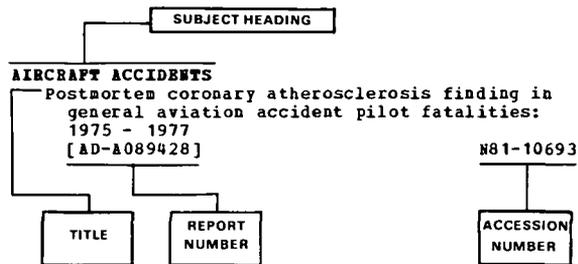
DRSMI/RS-CR-80-2) Avail: NTIS HC A03/MF A01 CSCL 05/5

Review and analysis of control-display requirements in MIL-STD-1472B for the purpose of updating to reflect contemporary hardware component use in military system, equipment and component products. In addition to detailed modifications, general recommendations are made for future standard revision.

GRA

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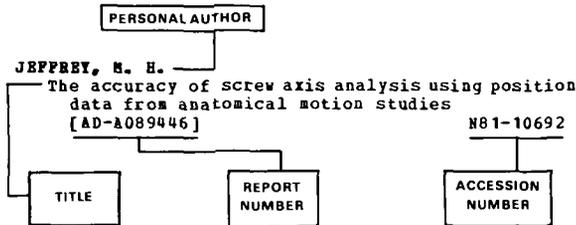
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1. Report No. NASA SP-7011(217)	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle AEROSPACE MEDICINE AND BIOLOGY A Continuing Bibliography (Supplement 217)		5. Report Date March 1981	
		6. Performing Organization Code	
7. Author(s)		8. Performing Organization Report No.	
		10. Work Unit No.	
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, D.C. 20546		11. Contract or Grant No.	
		13. Type of Report and Period Covered	
12. Sponsoring Agency Name and Address		14. Sponsoring Agency Code	
		15. Supplementary Notes	
16. Abstract <p style="text-align: center;">This bibliography lists 130 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1981.</p>			
17. Key Words (Suggested by Author(s)) Aerospace Medicine Bibliographies Biological Effects		18. Distribution Statement Unclassified - Unlimited	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 50	22. Price* \$7.00 HC

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