



Aerospace Medicine
and Biology
A Continuing
Bibliography
with Indexes

NASA SP-7011 (200)
December 1979

National Aeronautics and
Space Administration

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ACCESSION NUMBER RANGES

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

STAR (N-10000 Series) N79-30138 – N79-32149

IAA (A-10000 Series) A79-46968 – A79-51015

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY
WITH INDEXES

(Supplement 200)

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 November 1979 in

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



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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* (NASA SP-7011) lists 204 reports, articles and other documents announced during November 1979 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.

Two indexes -- subject and personal author -- are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1979 Supplements.

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TYPICAL CITATION AND ABSTRACT FROM STAR

NASA SPONSORED DOCUMENT		AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER	N79-10741*#	
TITLE	McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.	CORPORATE SOURCE
AUTHOR	GENERALIZED ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM COMPUTER PROGRAM (G1894), PHASE 3 Final Report	
REPORT NUMBER	R. E. McEnulty Sep. 1978 23 p refs (Contract NAS9-14877)	PUBLICATION DATE
COSATI CODE	(NASA-CR-151836; MDC-G7699) Avail: NTIS HC A02/MF A01 CSCL 06K	CONTRACT OR GRANT
	The work performed during Phase 3 of the Generalized Environmental Control Life Support System (ECLSS) Computer Program is reported. Phase 3 of this program covered the period from December 1977 to September 1978. The computerized simulation of the Shuttle Orbiter ECLSS was upgraded in the following areas: (1) the payload loop of the Shuttle simulation was completely recoded and checked out; (2) the Shuttle simulation water and freon loop initialization logic was simplified to permit easier program input for the user; (3) the computerized simulation was modified to accept the WASP subroutine, which is a subroutine to evaluate thermal properties of water and freon; (4) the 1108 operating system was upgraded by LEC; (5) the Shuttle simulation was modified to permit failure cases which simulate zero component flow values; and (6) the Shuttle SEPS version was modified and secure files were setup on the 1108 and 1110 systems to permit simulation runs to be made from remote terminals.	AVAILABILITY SOURCE
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TYPICAL CITATION AND ABSTRACT FROM IAA

NASA SPONSORED DOCUMENT		
AIAA ACCESSION NUMBER	A79-12869 *	TITLE
AUTHOR'S AFFILIATION	Studies on the erythron and the ferrokinetic responses in beagles adapted to hypergravity. D. A. Beckman, J. W. Evans (California, University, Davis, Calif.), and J. Oyama (NASA, Ames Research Center, Biomedical Research Div., Moffett Field; California, University, Davis, Calif.).	AUTHORS
PUBLICATION DATE	<i>Aviation, Space, and Environmental Medicine</i> , vol. 49, Nov. 1978, p. 1331-1336. 23 refs. Grant No. NCA2-OR180-505.	TITLE OF PERIODICAL
	Red cell survival, ferrokinetics, and hematologic parameters were investigated in beagle dogs exposed to chronic hypergravity (2.6 Gx). Ineffective erythropoiesis, red cell mass, plasma volume, and Cr-51-elution were significantly increased; maximum Fe-59 incorporation was decreased; and there was no change in the mean erythrocyte life span following autologous injection of Cr-51-labeled red cells and Fe-59-labeled transferrin. Red cell count, F(cells), total body hemoglobin (Hb), susceptibility to osmotic lysis, and differential reticulocyte count were increased. White blood cell count, venous blood %Hb, mean cell volume, mean cell Hb, mean cell Hb concentration, and serum iron were decreased. No changes were observed for body mass, mg Fe per g Hb, iron binding capacity, percent saturation of iron-carrying capacity, or the electrophoretic mobility of purified Hb. This study indicated that chronic exposure to hypergravity induced changes in red cell size, volume, total mass, and membrane permeability.	CONTRACT, GRANT OR SPONSORSHIP
	(Author)	

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 200)

DECEMBER 1979

IAA ENTRIES

A79-47115 **Spatial summation in human vision - Simple reaction time measurements.** T. Ueno (Osaka City University, Osaka, Japan). *Optical Society of America, Journal*, vol. 69, July 1979, p. 1023-1028. 16 refs.

The reaction-time technique was applied to examine spatial summation or area-intensity reciprocity at suprathreshold levels in the fovea. A family of reaction time vs luminance curves was measured in two experiments, and the luminance required to produce a criterion reaction time was computed from these curves to estimate the extent of summation. The first experiment showed that the upper level of spatial summation, the Ricco area, defined for constant reaction time increases with decreasing luminance level and that the upper limit of temporal summation is independent of the change in target size. The second indicated that the Ricco area decreases with increasing pulse duration up to 20-30 ms and then remains constant. (Author)

A79-47116 **Using color substitution pupil response to expose chromatic mechanisms.** V. D. Saini and G. H. Cohen (Rochester, University, Rochester, N.Y.). *Optical Society of America, Journal*, vol. 69, July 1979, p. 1029-1035. 12 refs. Grant No. NIH-EY-01319.

A model which identifies chromatic mechanisms using color substitution pupil response is presented. It is known that pupillary threshold shows a scotopic spectral behavior, even for foveal stimuli, but when two scotopically balanced fields at different wavelengths are alternated, the pupil shows a constriction response at each transition, exposing innervation from chromatic mechanisms. Using a model for pupillary innervation, this substitution response is studied for different wavelengths and radiant power levels to yield spectral threshold curves for the chromatic mechanism as indicated by the pupil. Mechanisms with peak sensitivities near 450, 525, 580, and 495 microns were identified, and it is proposed that these represent the blue, green, red, and scotopic mechanisms as manifested before the level of the lateral geniculate body. A.T.

A79-47118 **Direction-selective adaptation with very slow motion.** C. F. Stromeyer, III, J. C. Madsen (Harvard University, Cambridge, Mass.), and S. Klein (California Institute of Technology, Pasadena; Claremont College, Claremont, Calif.). *Optical Society of America, Journal*, vol. 69, July 1979, p. 1039-1041. 12 refs.

A vertical, sinusoidal adapting grating of 0.4 cycle/degree that moved laterally at 3 Hz produced a considerably greater threshold rise for a subsequently viewed test grating that moved in the same direction as the adapting grating than in the opposite direction. The test grating moved at 0.25 or 0.12 Hz. The result shows that very slowly moving test patterns that move in the direction opposite to the adapting pattern are detected in part by direction-selective mechanisms. (Author)

A79-47326 * **Effects of regional hemoconcentration during LBNP on plasma volume determinations.** J. A. Loeppky, Y. Kobayashi, M. D. Venters, and U. C. Luft (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.). *Aviation,*

Space, and Environmental Medicine, vol. 50, Aug. 1979, p. 763-767. 16 refs. Contract No. NAS9-15483.

Blood samples were obtained from forearm vein or artery with indwelling cannula (1) before, (2) during the last min, and (3) about 2 min after lower body negative pressure (LBNP) in 16 experiments to determine whether plasma volume (PV) estimates were affected by regional hemoconcentration in the lower body. Total hemoglobin (THb) was estimated with the CO method prior to LBNP. Hemoglobin (Hb) and hematocrit (Hct) values from (2) gave only a 3% (87 ml) loss in PV due to LBNP, assuming no change in THb. However, Hb and Hct values from (3) showed an 11% loss in PV (313 ml). This 72% underestimation of PV loss with (2) must have resulted from the sequestration of blood and subsequent hemoconcentration in the lower body during LBNP. The effects of LBNP on PV should be estimated 1-3 min after exposure, after mixing but before extravascular fluid returns to the circulation. (Author)

A79-47327 * **The use of Na-22 as a tracer for long-term bone mineral turnover studies.** H. E. Palmer, G. A. Rieksts, R. F. Palmer, and M. F. Gillis (Battelle Pacific Northwest Laboratories, Richland, Wash.). *Aviation, Space, and Environment Medicine*, vol. 50, Aug. 1979, p. 768-773. 14 refs. Contracts No. NAS9-14248; No. NAS9-15544.

Sodium-22 has been studied as a tracer for bone mineral metabolism in rats and dogs. When incorporated into bone during growth from birth to adulthood, the bone becomes uniformly tagged with Na-22, which is released through the metabolic turnover of the bone. The Na-22 not incorporated in the bone matrix is rapidly excreted within a few days when animals are fed high, but nontoxic levels of NaCl. The Na-22 tracer can be used to measure bone mineral loss in animals during space flight and in research on bone disease. (Author)

A79-47328 **Blood pressure variability of the individual in orthostatic testing.** R. A. Wolthuis, D. H. Hull, J. R. Fischer, D. A. McAfoose, and J. T. Curtis (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 774-777. 14 refs.

Within subject blood pressure (BP) variability was investigated in the context of orthostatic testing. Nineteen healthy men volunteered for biweekly orthostatic testing. BPs were taken on alternative minutes during 5 min of supine rest and a subsequent 5 min of quiet standing. Within-subject variance was computed for systole and diastole by protocol condition. Respective variances were then pooled across subjects. The within-subject estimate of variance for a single BP reading in either position was about 6 torr. This variance estimate was reduced by averaging additional BP readings from the same visit and more so by averaging BP readings from multiple visits. B.J.

A79-47329 **Thermal conduction effects in human skin.** A. M. Stoll, M. A. Chianta, and J. R. Piergallini (U.S. Naval Material Command, Naval Air Development Center, Warminster, Pa.). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 778-787. 11 refs. Research supported by the U.S. Consumer Product Safety Commission and U.S. Navy.

To determine the maximum permissible temperature any material may attain without causing pain or burn on contact with bare skin, over 2000 observations were made of pain threshold during contact with materials at elevated temperatures. Six materials were used representing the full range of thermal properties from good

conductors to good insulators. Time to pain threshold was converted to time to threshold blister on the basis of the relationship between pain and burn established earlier for radiant and for convective heating. Calculated times to blister were used to predict the material temperatures causative of touch-burn. Experimentally produced threshold blisters at the predicted temperature-times verified the predictions. Graphs and equations were generated for determining safe temperatures for any material in contact with bare skin for 1-5 s solely from a knowledge of its thermal properties. Conversely, the thermal inertia of the optimal material for a specific use and skin contact can be predicted from a knowledge of the maximum material temperature and length of contact time anticipated. (Author)

A79-47330 **Suprathreshold retinal damage due to single 6 picosecond 1060 nm laser light pulses.** R. E. Schmidt, J. Taboada, and W. I. Butcher (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 788-791. 9 refs.

The retinas of rhesus monkeys were exposed to 6-ps laser light pulses at 1060 nm at 62 and 95 microjoules. Lesions were examined by light, transmission and scanning electron microscopy. Evidence of damage was seen in all retinal layers, being most severe in the photoreceptor inner and outer segments. In addition to damage mechanisms previously proposed, it is suggested that the peak power flux density achieved with extremely short pulses may lead to some absorbance by inner retinal layers. (Author)

A79-47331 **Responses of retinal and visual pathway potentials of the guinea pig to nitrogen and helium at high pressure.** F. G. Hempel, S. P. Burns, and P. G. Kaufmann (Duke University, Medical Center, Durham, N.C.). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 792-798. 28 refs. Grant No. NIH-HL-07896.

Electroretinographic, optic chiasm, and visual cortex potentials were monitored in the awake guinea pig as nitrogen pressures were raised to 16 ATA and held for 30 min. Pressurization to 90 ATA with helium in 10-ATA increments followed. It was attempted to (a) quantify the depressant effect of nitrogen on the retina as compared to the central visual pathway, and (b) test for pressure reversibility. The electroretinogram was reduced approximately 15%, the chiasm potential by 15%, and the cortical response by 32% in 16 ATA nitrogen, and latent periods for the three signals increased an average of 5-8%. Helium at pressure did not restore the amplitude of the electroretinogram or optic chiasm response, but the visual cortex potential returned to control levels near 90 ATA total pressure. Reversal of the nitrogen-induced latency increases by helium was partially effective up to 40 ATA. Control latent periods were not reached. Further attenuation of the electroretinogram and chiasm response amplitudes, and increased latencies of all signals were observed at 50-90 ATA. (Author)

A79-47332 **Heat and exercise-induced hyperthermia - Effects on high-energy phosphates.** R. Francesconi and M. Mager (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 799-802. 22 refs.

To assess the role of high-energy phosphate compounds in the etiology of heat injury with respect to the release of intracellular constituents, the susceptibility of selected tissues to heat injury, and the shock-like demise of the animals, rats were exercised on a treadmill in a hot environment (34.5-35 C) to a rectal temperature of 42.5-43 C. In the heart, kidney, left lateral lobe of the liver, and gastrocnemius muscle excised from animals immediately upon termination of the treadmill run, levels of glucose-6-phosphate (G-6-P), adenosine triphosphate (ATP), and creatine phosphate (CP) were unchanged when compared with sedentary controls. In animals which had been resuscitated by infusion of isotonic saline into a jugular catheter, levels of CP were significantly elevated in gastrocnemius muscle. In rats which were unconscious and succumbing to the effects of hyperthermic injury, levels of hepatic G-6-P and ATP were significantly reduced. These results indicate that the combina-

tion of exhaustive exercise/heat injury had the most deleterious effects upon hepatic metabolism. Hyperthermic exhaustion and the concomitant efflux of cellular constituents cannot be attributed to a depletion or even a decrement of high-energy phosphates in vital tissues. (Author)

A79-47333 **Scanning and transmission electron microscopy of the blood-bubble interface in decompressed rats.** V. P. Lehto (Helsinki, University, Helsinki, Finland) and L. A. Laitinen (Finnish Navy, Medical Office, Helsinki, Finland). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 803-807. 21 refs.

A79-47334 **Cockpit thermal stress and aircrew thermal strain during routine Jaguar operations.** T. M. Gibson, L. A. Cochran, M. H. Harrison, and P. W. Rigden (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 808-812. 11 refs.

Thermal data have been obtained from Jaguar aircraft flying routine, warm-weather operations in Sardinia. These data have been analyzed in terms of the ambient and cockpit wet bulb globe temperatures (WBGT) and the mean body temperature (T_b) of the pilot. In contrast to similar data previously obtained from Harrier and Buccaneer aircraft, no interrelationships could be demonstrated between ambient WBGT at ground level and either cockpit WBGT or pilot T_b. Relationships which could be described by equations of negative slope were obtained between T_b and sortie time and between cockpit WBGT and sortie time. A model has been derived for predicting aircrew thermal strain in the Jaguar from cockpit temperature and sortie time. (Author)

A79-47335 **Increased survival in experimental dog heatstroke after reduction of gut flora.** G. Bynum, J. Brown, D. Dubose, M. Marsili, M. Hamlet, M. LeMaire, B. Caleb (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.), I. Leav (U.S. Army, Research Institute of Environmental Medicine, Natick; Tufts University, Boston, Mass.), and T. G. Pistole (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.; New Hampshire University, Durham, N.H.). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 816-819. 27 refs.

A study was undertaken to determine if gut flora contribute to the pathophysiology of experimental canine heatstroke. Fifty animals in four groups were anesthetized with sodium pentobarbital intravenously. An air temperature of 42-46 C was maintained adjacent to the dog with a water-heated blanket for approximately 2 h until rectal temperatures rose to 43.5 + or - 0.4 C. Animals were then cooled passively in room air (28 C, 20% RH) until death or until 18 h elapsed, and were euthanized. Reduction of intestine stool and bacterial contents with antibiotics, cathartics, and enemas prior to heatstroke increased the incidence of 18-h survival from 20.0% to 70.6%; antibiotics administered after heatstroke did not alter the incidence of survival over control values. These data suggest that gut flora, presumably through endotoxemia, contributes to the evolution of heatstroke pathophysiology. (Author)

A79-47336 **Evaluation of assisted positive-pressure breathing on +Gz tolerance.** R. M. Shaffstall and R. R. Burton (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 820-824. 12 refs.

The effect of both assisted and unassisted positive pressure breathing (PPB) on +Gz tolerance was evaluated. A GOR (gradual onset rate = 0.1 G/s) acceleration profile was used to evaluate five different experimental conditions: (1) G-suit-only, (2) G suit + unassisted PPB, (3) G suit + PPB assisted by the English jerkin, (4) G suit + PPB assisted by the Canadian waistcoat, and (5) the Swedish counterpressure garment G suit combination. Acceleration tolerances

for these experimental conditions (excluding the Swedish garment) with the subjects performing M-1 maneuvers were measured using an exhaustive ACM (Aerial Combat Maneuvers) acceleration profile. GOR tolerances were similar for both assisted and unassisted PPB with the pressure breathing experimental conditions providing a significant GOR tolerance increase over the G suit only condition. Assisted PPB increased ACM tolerances over both unassisted PPB and G suit only conditions. It appears that assisted PPB may offer a practical method for reducing the fatigue associated with exposure to high G. (Author)

A79-47337 **Reproducibility of +Gz tolerance testing.** J. E. Whinnery and W. G. Jackson, Jr. (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 825-828.

The study describes the response of completely healthy centrifuge acceleration panel members to successive exposures of the medical +Gz tolerance (GZT) test protocol (four profiles). All 17 test subjects fully understood that the purpose of the series was to reproduce each GZT test as closely as possible. The results suggest that knowledge of the variability associated with each test profile will allow a more accurate definition of an individual GZT when only a single centrifuge test protocol can be performed. Being able to define high GZT is of prime importance both for selecting acceleration panel members and for investigating the factors resulting in an individual having high GZT. These factors are important for possible future high-performance fighter pilot selection criteria. S.D.

A79-47338 **Ejection problems and injuries - Their causes, effects and treatments, and suggestions for preventive measures.** C. Fleming (Israel Air Force, Aeromedical Centre, Tel Aviv, Israel). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 829-833.

A relatively brief discussion of the problems of combat ejections in the I.A.F. is presented, including the injuries found and their prevention where possible; some problems that are known to exist and to some of which no clear-cut solutions are known. Some indications are given of what to expect when confronted with a man immediately after he has ejected from his aircraft. (Author)

A79-47339 **An improved method for inducing hypothermia and rewarming.** A. V. Beran and D. R. Sperling (California, University, Irvine, Calif.). *Aviation, Space, and Environmental Medicine*, vol. 50, Aug. 1979, p. 844-846. Grant No. NIH-HL-18201-01-A1.

A79-47398 * **The importance of light, postural and social cues in the regulation of the plasma cortisol rhythm in man.** J. Vernikos-Danellis and C. M. Winget (NASA, Ames Research Center, Biomedical Research Div., Moffett Field, Calif.). In: *Chronopharmacology; Proceedings of the Satellite Symposium*, Paris, France, July 21-24, 1978. Oxford, Pergamon Press, Ltd., 1979, p. 101-106. 16 refs.

A series of experiments was conducted to assess the role of photoperiodic postural and social cues in the regulation of the plasma cortisol rhythm in normal human subjects. Young healthy adult male volunteers, aged 20-25, were used as the test subjects and were selected following extensive physical and psychological examinations. The time at which peak plasma cortisol concentration occurred was calculated from harmonic curves fitted to each set of 24-hr data from each subject. The findings suggest that the plasma cortisol rhythm is not affected appreciably by the absence of postural change, whereas light and social interaction affect this rhythm profoundly. S.D.

A79-47429 **Eye movements and visual perception (Dvizhenie glaz i zritel'noe vospriiatie).** Edited by B. F. Lomov, N. Iu. Bergiles, and A. A. Mit'kin. Moscow, Izdatel'stvo Nauka, 1978. 278 p. In Russian.

The interactions of the sensory and motor components of vision are examined. The early ontogeny of visual sensorimotor functions is

considered, including the structure and function of the visual anatomy, pursuit and saccadic eye movements, the field of view, optokinetic nystagmus and voluntary and autonomic eye movements. Studies of the mechanisms of eye movement regulation under conditions of manipulated visual feedback are discussed, and eye movements in space and motion perception are examined. Finally, psychopathological aspects of eye movements are considered in the case of involuntary eye movements in the absence of cognition.

A.L.W.

A79-47765 **The relative effects of multiple factors on target acquisition.** J. D. Grossman and H. O. Whitehurst (U.S. Naval Weapons Center, China Lake, Calif.). *Human Factors*, vol. 21, Aug. 1979, p. 423-432.

Two laboratory experiments were conducted to assess the usefulness of visual acuity as a personnel selection criterion. In the first experiment a screening technique (fractional factorial) was employed to determine the relative effects of eleven factors on target acquisition performance. The factors and first-order interactions were ranked by the percent of the variance in the data for which each accounted. Slant range, far visual acuity, masking, and target type were among the highest ranked factors. Search times and detection probabilities were measured in the second experiment as far visual acuity, slant range to the target, masking, and observer experience were varied in a full factorial design. Masking accounted for most of the variation in the data followed by slant range and visual acuity. (Author)

A79-47766 **The relationship between flight simulator motion and training requirements.** P. W. Caro (Seville Research Corp., Pensacola, Fla.). *Human Factors*, vol. 21, Aug. 1979, p. 493-501. 17 refs. Contract No. F49620-77-C-0112.

Flight simulator motion has been demonstrated to affect performance in the simulator, but recent transfer of training studies have failed to demonstrate an effect upon in-flight performance. However, these transfer studies examined the effects of motion in experimental designs that did not permit a dependency relationship to be established between the characteristics of the motion simulated and the training objectives or the performance measured. Another investigator has suggested that motion cues which occur in flight can be dichotomized as maneuver and disturbance cues, i.e., as resulting from pilot control action or from external forces. This paper examines each type cue and relates it analytically to training requirements. The need to establish such relationships in simulator design is emphasized. Future transfer studies should examine specific training objectives that can be expected to be effected by motion. (Author)

A79-47848 * **Studies on the bioassayable growth hormone-like activity of plasma.** S. Ellis, M. A. Vodian, and R. E. Grindeland (NASA, Ames Research Center, Biomedical Research Div., Moffett Field, Calif.). In: *Recent progress in hormone research*. Volume 34. New York, Academic Press, Inc., 1978, p. 213-234; Discussion, p. 234-238. 33 refs.

Evidence supporting the existence of bioassayable growth hormone-like activity in blood plasma distinct from the growth hormone measurable by radioimmunoassay and from somatomedin is presented. Tibial assays of the growth-hormone-like activity of injected, concentrated normal human and rat plasma in hypophysectomized rats reveal 200- and 50-fold activity excesses, respectively, with respect to the amount of growth hormone detected by radioimmunoassay. The origin of this bioassayable plasma hormone has been localized to the region of the pituitary, the origin of growth hormone, a distribution not followed by somatomedin C. Purification of the bioassayable agent indicates that it has a molecular weight of between 60,000 and 80,000, in contrast to that of growth hormone (20,000), and that the bioassayable activity is distinct from that of somatomedin C. Growth hormone-like activity detected in Cohn fraction IV as well as plasma activity, are found to be

collectable on Dowex 50 resin, in contrast to somatomedin C and nonsuppressible insulin-like activity. The formation of bioassayable growth hormone-activity agents from radioimmunoassayable growth hormone and directly in the pituitary is suggested. A.L.W.

A79-47849 * **Gating effects in Halobacterium halobium membrane transport.** J. K. Lanyi and M. P. Silverman (NASA, Ames Research Center, Extraterrestrial Research Div., Moffett Field, Calif.). *Journal of Biological Chemistry*, vol. 254, June 10, 1979, p. 4750-4755. 32 refs.

The transport of Na(+) via an H(+)/Na(+) antiporter and of aspartate and serine via Na(+)/amino acid symport systems was studied in Halobacterium halobium cell envelope vesicles. Gradients for H(+) were produced by illuminating the bacteriorhodopsin-containing vesicles at different light intensities, and the rate and extent of Na(+) transport were followed as functions of the electrochemical potential difference for protons. The coupling of Na(+) and H(+) gradients suggested a translocation stoichiometry of 2H(+)/Na(+) for the antiporter. The rate of Na(+) transport increases steeply above a critical transmembrane electrochemical proton gradient, and since the electrical and the chemical potentials of H(+) at this threshold point vary with the experimental conditions, while the sum of these potentials is constant, it was concluded that the gating of the Na(+) transport is caused by the total electrochemical gradient. A.T.

A79-47851 **Absence of effects of hypoxia on small airway function in humans.** R. S. Goldstein, N. Zamel, and A. S. Rebeck (Toronto, University; Toronto General Hospital, Toronto, Canada). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Aug. 1979, p. 251-256. 33 refs. Medical Research Council of Canada Grant No. MA-5126.

The effects of sustained isocapnic hypoxia (P(A O₂) = 40-50 torr; P(A CO₂) = 38-42 torr) were measured on tests sensitive to small airway function in healthy human subjects. Maximum expiratory flow-volume curves on air, nitrogen-hypoxic, helium-normoxic, and helium-hypoxic mixtures as well as closing volumes while subjects breathed air and a hypoxic mixture were obtained. Total lung capacity (TLC) was measured both plethysmographically and by inert gas dilution, and the nonplethysmographic method was used to measure the effects of hypoxia on TLC. In none of these tests were there any statistically significant changes when values obtained during hypoxia were compared with those during normoxia. It is suggested that previous reports that indicated that TLC was increased by hypoxia might have arisen from a plethysmographic artifact.

(Author)

A79-47852 **Mechanical efficiency of fast- and slow-twitch muscle fibers in man during cycling.** Y. Suzuki. *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Aug. 1979, p. 263-267. 25 refs.

A79-47853 **Effect of rate of change in skin temperature on local sweating rate.** J. P. Libert, V. Candas, and J. J. Vogt (CNRS, Centre d'Etudes Bioclimatiques, Strasbourg, France). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Aug. 1979, p. 306-311. 23 refs.

The effects of positive and negative changes in skin temperature on the thermoregulatory sweating response is investigated. Four subjects were exposed to cyclic variations in the air and wall temperatures of a climatic chamber from 28 to 45 C, and sweating rate was measured based on the change in dew-point temperature of air flowing past an arm of the subject kept at a constant temperature. Sweat gland activity is observed to follow the alterations in mean skin temperature, periodically discharging when active at a rate of 2 peaks/min. The onset of sweating is found to depend on both the level and the rate of change of mean skin temperature, with a higher rate threshold for a response to heating than to cooling. It is concluded that peripheral rate components appear to play a leading role in thermoregulatory processes. A.L.W.

A79-47854 **Oxygen affinity of blood in altitude Sherpas.** M. Samaja, A. Veicsteinas, and P. Cerretelli (Milano, Università; CNR, Centro Studi di Fisiologia del Lavoro Muscolare, Milan, Italy). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Aug. 1979, p. 337-341. 25 refs.

The oxygen affinity of the blood of Sherpa natives residing at high altitudes is investigated in order to gain insight into the functional characteristics of the hemoglobin of high-altitude natives. Blood taken from 13 Sherpas residing at an altitude of 3850 m above sea level, as well as altitude-acclimated Caucasians, sea-level Caucasians and Sherpas residing at sea level, was analyzed within six hours of sampling. Red blood cell counts, hemoglobin, hematocrit and 2,3-diphosphoglyceric acid levels were found to be higher in both native Sherpas and acclimated Caucasians than in individuals of both groups living at sea level. No significant differences in the partial pressure of oxygen necessary for 50 percent hemoglobin saturation (P-50) were found among the various groups, however measurements of the Bohr effect in the blood of a native Sherpa reveal a greater log P-50/pH relation than for sea-level controls. It is concluded that the outstanding performances of high-altitude Sherpas cannot be explained in terms of improved blood oxygen affinity or overall maximal aerobic power. A.L.W.

A79-47855 **Cross-adaptive effects of cold, hypoxia, or physical training on decompression sickness in mice.** B. A. Rattner, S. P. Gruenau, and P. D. Altland (U.S. Naval Medical Research Institute; National Institutes of Health, National Institute of Arthritis, Metabolism, and Digestive Diseases, Bethesda, Md.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Aug. 1979, p. 412-417. 28 refs.

A79-47856 * **Recovery of skeletal muscle after 3 mo of hindlimb immobilization in rats.** F. W. Booth and M. J. Seider (Texas, University, Houston, Tex.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Aug. 1979, p. 435-439. 23 refs. Contract No. NAS9-15338.

During immobilization, skeletal muscle undergoes decreases in size and strength with concomitant atrophic and degenerative changes in slow-twitch muscle fibers. Currently there are no objective data in slow-twitch muscle demonstrating recovery of biochemical or physiological indices following termination of immobilization. The purpose of this study was to determine whether the soleus, a slow-twitch muscle, could recover normal biochemical or physiological levels following termination of immobilization. Adenosine triphosphate, glycogen, and protein concentration (mg/g wet wt) all significantly decreased following 90 days of hindlimb immobilization, but these three values returned to control levels by the 60th recovery day. Similarly, soleus muscle wet weight and protein content (mg protein/muscle) returned to control levels by the 14th recovery day. In contrast, maximal isometric tension did not return to normal until the 120th day. These results indicate that following muscular atrophy, which was achieved through 90 days of hindlimb immobilization, several biochemical and physiological values in skeletal muscle are recovered at various times after the end of immobilization. (Author)

A79-48011 **Application of pseudo random binary sequence input to identification of respiratory control dynamics.** S. Sohrab, P. Reischl, F. S. Grodins, and S. M. Yamashiro (Southern California, University, Los Angeles, Calif.). In: Symposium on Adaptive Processes, 17th, San Diego, Calif., January 10-12, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 1304-1308. 15 refs. Grant No. NIH-GM-23732.

A new method for studying the chemical control of breathing in man is described which uses a pseudo random binary sequence (PRBS) inhalation of CO₂. Impulse responses of end-tidal CO₂, minute ventilation, tidal volume, inspiratory and expiratory durations were estimated by cross-correlating outputs with the PRBS

input. Data collected in seven normal men suggest that impulse responses may be useful in isolating the contribution of peripheral chemoreceptors. Estimates of peripheral sensitivity to CO₂ based on PRBS show significantly smaller intrasubject variability than those based on sinusoidal test inputs. Application of a Nelder-Mead parameter estimation procedure demonstrated that a third order model is sufficient to explain impulse response dynamics. (Author)

A79-48012 Modeling human tracking performance in a high G-stress environment. J. Korn (Connecticut, University, Storrs, Conn.), H. S. Boal, and M. Vikmanis (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio). In: Symposium on Adaptive Processes, 17th, San Diego, Calif., January 10-12, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 1319-1326. 11 refs. Contract No. F33615-78-C-0517.

Simulated air-to-air compensatory tracking experiments, using both fixed and moving base simulations, have been conducted at the Aerospace Medical Research Laboratories (AMRL), Wright-Patterson Air Force Base (WPAFB), Ohio. The recorded data consisted of time-histories of longitudinal tracking error, pilot stick input, attained vertical acceleration, and other auxiliary variables. These data time-histories were averaged across repetitive runs to obtain first- and second-order ensemble statistics. In the present study, modeling efforts that would replicate the experimental data are attempted by applying the optimal control model (OCM) to the human operator (HO) under normal and high vertical acceleration stress conditions. (Author)

A79-48013 Adaptive estimation schemes for minimizing uncertainty in manual control tasks. P. K. Rao, D. L. Kleinman, and A. R. Ephrath (Connecticut, University, Storrs, Conn.). In: Symposium on Adaptive Processes, 17th, San Diego, Calif., January 10-12, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 1327-1334. 11 refs. Grant No. AF-AFOSR-77-3126.

The present research has sought to expand understanding of human information processing and control behavior in target-tracking tasks. Specifically, it has focused on the problem of quantifying the human's 'internal' model that characterizes his perception of short-term target motion, and on the development of concomitant adaptive schemes for generating estimates of target velocity and acceleration using these models. A combined experimental and analytic program has studied simulated target-tracking performance as modified by short periods (about 1 sec) of target blanking. The blankings occur at pseudo-random times during a flyby. During the blanking period, human operator performance is governed almost entirely by his internal model representation of the target's motion. Ensemble data from blanking experiments has been used to suitably refine the optimal control manual tracking model, including the target submodel. (Author)

A79-48014 Pilot workload during final approach in congested airspace. S. G. Hart (Tufts University, Medford, Mass.). In: Symposium on Adaptive Processes, 17th, San Diego, Calif., January 10-12, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 1345-1349. 5 refs.

Time estimation has been proposed as a measure of pilot workload and it appears that the production method provides a useful measure. The verbal estimation method has also been investigated and it appears that it does not provide as sensitive a measure of workload as does the production method. Verbal estimates are given with less precision and a series of verbal estimates tends to reflect a relative judgement of the duration of different intervals rather than an absolute judgement of the length of each interval. Overestimation may either reflect boredom during the interval, or the fact that a great deal of activity was performed during the interval that was remembered. Underestimation may either reflect a feeling that time passed quickly because interesting activities

were engaged in, or that so little activity was performed or remembered, that very little time passed. (Author)

A79-48015 Human operators in adversary tracking encounters. J. L. Speyer (Texas, University, Austin, Tex.), S. Samn, and R. A. Albanese (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). In: Symposium on Adaptive Processes, 17th, San Diego, Calif., January 10-12, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 1350-1356. 22 refs.

The question of the applicability of the results of passive compensatory tracking to encounters with a second intelligent operator is discussed using infinite-time, stochastic, zero-sum differential game theory. It is shown that conclusions based upon the passive encounter do not, generally, predict the active encounter. The tracking error variance and control effort calculated for the passive case are both smaller than that predicted by the active encounter. In practice this is due to the assumed lack of correlation of the input signal with the noise signatures in the passive tracking loop. If the input signal is properly correlated with the tracking loop, the measures of performance in the active and passive tracking loops are coincident. V.T.

A79-48018 Visually estimating workpiece pose in a robot hand using the feature points method. J. Birk, R. Kelley, and N. Chen (Rhode Island, University, Kingston, R.I.). In: Symposium on Adaptive Processes, 17th, San Diego, Calif., January 10-12, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 1407-1412. 7 refs.

An automatic method of visually estimating the pose of a workpiece in a robot hand has been developed. This method is not subject to the constraint that the workpiece have one of a finite number of states in the robot hand. Workpiece pose is estimated using the three dimensional locations of workpiece feature points. Workpiece features can be located in space by image feature tracking during a known arm motion and by using trigonometric relations. The correspondence to features on a model of the workpiece can be established by using transformations which verify interfeature distances and angles. The ability to estimate workpiece pose is necessary to enable robots to accomplish many industrial tasks. (Author)

A79-48019 Computer augmented manual control of remote manipulators. R. E. Shultz, D. Tesar, and K. L. Doty (Florida, University, Gainesville, Fla.). In: Symposium on Adaptive Processes, 17th, San Diego, Calif., January 10-12, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 1413-1417. 9 refs.

Tasks of a generalized computer interface between human operator and manipulator arm are discussed. A position control device known as a six degree of freedom joy stick is described. Also, the mathematics used by the computer to convert control device parameters into handgrip position and orientation are detailed. (Author)

A79-48020 An operator-aiding manipulator control system. S. V. Merjanian (Severe Environment Systems Co., Chatsworth, Calif.), A. Klinger, and J. Lyman (California, University, Los Angeles, Calif.). In: Symposium on Adaptive Processes, 17th, San Diego, Calif., January 10-12, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 1418-1422.

An object of the study is to minimize operator control in manipulator systems. The position information is designated by a multidimensional vector and the orientation information is designated by a finite set of prerecorded trajectories. A one-to-one correspondence is established between the categories of the position vectors and the orientation states. A controller model is organized in which the classification of an operator-supplied position vector effects an orientation state transfer. The controller is synthesized by

defining a pattern space, a discriminant function, and by developing a training/testing algorithm. The system was tested by programming a three-dimensional computer-controlled manipulator. V.T.

A79-48251 * **Particle deposition due to turbulent diffusion in the upper respiratory system.** P. Hamill (NASA, Ames Research Center, Moffett Field, Calif.; NASA, Langley Research Center, Hampton, Va.; Universidad Católica, Caracas, Venezuela). *Health Physics*, vol. 36, Mar. 1979, p. 355-369. 31 refs. Research supported by the Consejo Nacional de Investigaciones Científicas y Tecnológicas.

Aerosol deposition in the upper respiratory system (trachea to segmental bronchi) is considered and the importance of turbulent diffusion as a deposition mechanism is evaluated. It is demonstrated that for large particles (diameter greater than about 5 microns), turbulent diffusion is the dominant deposition mechanism in the trachea. Conditions under which turbulent diffusion may be important in successive generations of the pulmonary system are determined. The probability of particle deposition is compared with probabilities of deposition, as determined by the equations generally used in regional deposition models. The analysis is theoretical; no new experimental data is presented. (Author)

A79-48310 # **Evolution of the biosphere /2nd enlarged edition/ (Evolutsiia biosfery /2nd enlarged edition/).** M. M. Kamshilov. Moscow, Izdatel'stvo Nauka, 1979. 256 p. 184 refs. In Russian.

The book deals with the evolution of the biosphere and the pertinent aspects of this evolution. The genesis and evolutionary organization of the biosphere are examined, along with factors governing the evolution. Particular attention is given to the influence of man on the atmosphere. Extensive data are presented in the areas of paleontology, biocenology, genetics, and molecular biology. V.P.

A79-48816 **Texture contours can facilitate stereopsis by initiating vergence eye movements.** A. L. Kidd, J. P. Frisby, and J. E. W. Mayhew (Sheffield, University, Sheffield, England). *Nature*, vol. 280, Aug. 30, 1979, p. 829-832. 12 refs.

The theory predicts that in the case of a two-planar densely textured stereogram in which the disparity range exceeds the size appropriate for the lowest spatial frequency channels activated by the stereogram's texture, vergence eye movements should exhibit only a random-search structure. The paper reports an experimental test of this prediction which shows that vergence movements are not always random in specified stimulus circumstances. Rather, vergence can be guided by texture contours depicted by differences of texture orientation between regions of relatively high spatial frequency content for the disparity range incorporated in the stereogram. Moreover, it is found that such texture contours can facilitate stereopsis in a way consistent with the idea that they do so by initiating appropriate eye movements. S.D.

A79-49066 **Helicopter commands at the touch of a hand.** R. D. Gilson (Ohio State University, Columbus, Ohio), P. S. Sun (U.S. Army, Fort Monmouth, N.J.), and R. S. Dunn (U.S. Army, Air Mobility Research and Development Laboratory, Fort Eustis, Va.). In: American Helicopter Society, Annual National Forum, 35th, Washington, D.C., May 21-23, 1979, Proceedings. Washington, D.C., American Helicopter Society, 1979. 7 p. 8 refs. (AHS 79-13)

The feasibility and utility of Kinesthetic Tactual (K-T) displays to transmit command-type flight information to a pilot was demonstrated in simulated Army flight missions. K-T display indications were given by the relative motion between two basic components - a hollowed-out control handle and an embedded sliding display. Protrusion of the servo-controlled slide corresponded in direction and magnitude to unwanted tracking errors for either a landing task or a hover maneuver. Results from five subject pilots demonstrated that these precision maneuvers could be carried out successfully based solely on the K-T display information. Task performance with K-T displays is considered to be comparable to

performance with conventional visual displays; however, K-T displays can increase secondary visual workload capacity. V.T.

A79-49194 * **Light-driven solute transport in Halobacterium halobium.** J. K. Lanyi (NASA, Ames Research Center, Moffett Field, Calif.). In: Microbiology. Washington, D.C., American Society for Microbiology, 1979, p. 67-71. 29 refs.

The cell membrane of *Halobacterium halobium* exhibits differential regions which contain crystalline arrays of a single kind of protein, termed bacteriorhodopsin. This bacterial retinal-protein complex resembles the visual pigment and, after the absorption of protons, translocates H(+) across the cell membrane, leading to an electrochemical gradient for protons between the inside and the outside of the cell. Thus, light is an alternate source of energy in these bacteria, in addition to terminal oxidation. The paper deals with work on light-driven transport in *H. halobium* with cell envelope vesicles. The discussion covers light-driven movements of H(+), Na(+), and K(+); light-driven amino acid transport; and apparent allosteric control of amino acid transport. The scheme of energy coupling in *H. halobium* vesicles appears simple, its quantitative details are quite complex and reveal regulatory phenomena. More knowledge is required of the way the coupling components are regulated by the ion gradients present. S.D.

A79-49221 **Soviet civil aviation training programs.** L. L. Whetten and J. Waddell. *Interavia*, vol. 34, Sept. 1979, p. 829-834.

The paper examines the more formal network of higher and middle level Russian schools operated by the Minister of Civil Aviation. The admissions requirements and enrollment capacities as well as on-campus facilities are discussed for the Academy of Civil Aviation, the Kiev, Riga, and Moscow Institutes for civil aviation engineers. Detail is also given to the primary flight training and ground services schools, presenting data about graduate numbers and curriculum. C.F.W.

A79-49225 **Eye-ball control.** D. Boyle. *Interavia*, vol. 34, Sept. 1979, p. 874.

Designs for aiding the sight of aircraft pilots without restricting the movement of the helmet, by employing a helmet-mounted sight system, is presented. One design uses an electrooptical method of measuring the position of the helmet, with three light-emitting diodes mounted on the helmet and one or two tiny charge-coupled device television sensors mounted in the cockpit to provide position measurement. One model carries a cathode ray tube display mounted on the side of the helmet to give a TV-type, multi-function display, capable of presenting low light television, forward looking infrared, radar and sonar presentations, with sighting and control of remote sensors. The purpose of these new designs is to provide a link between the pilot's line of vision and the aircraft weapon or sensor system by employing his eyes as a direct control output. C.F.W.

A79-49480 **An analysis of the saccadic system by means of double step stimuli.** W. Becker and J. Jürgens (Ulm, Universität, Ulm, West Germany). *Vision Research*, vol. 19, no. 9, 1979, p. 967-983. 32 refs. Deutsche Forschungsgemeinschaft Contract No. SFB-70.

The characteristics of saccadic reactions to double steps of a target were analysed as a function of the time lapse between the second target step and the onset of the response. The analysis suggests that goal-directed saccades are prepared in two steps; first a decision as to their direction is taken which requires a randomly varying time, and subsequently their amplitude is calculated as a time average of the fixation error. In addition, the analysis demonstrates that the preparatory processes of two different saccades may overlap in time ('parallel programming') and that, although reacting in a discontinuous manner, the saccadic system continuously processes the afferent visual information. A conceptual model based on an

internal predictive feedback pathway and on a non-linear decision mechanism is proposed that accounts for the observed behaviour.

(Author)

A79-49481 Stereopsis in monkeys using random dot stereograms - The effect of viewing duration. R. S. Harwerth and R. L. Boltz (Houston, University, Houston, Tex.). *Vision Research*, vol. 19, no. 9, 1979, p. 985-991. 24 refs. Grants No. NIH-R01-EY-01139; No. NIH-K07-EY-00052.

The effect of viewing duration on the stereopsis of rhesus monkeys has been investigated by a behavioral method which is based on a two-alternative, forced-choice form discrimination task. The discriminative stimuli were produced in static random dot stereograms so that reliable discrimination could occur only if the disparity creating the form was above the subject's stereothreshold. 2 subjects showed similar form discrimination performance for both crossed and uncrossed disparities, but another four subjects showed higher discrimination performance for crossed than uncrossed disparities for brief viewing durations. A linear, inverse relationship between stereothreshold and viewing duration was found when both values were plotted on logarithmic coordinates. The implications of these results for neural stereodetector pools are discussed. (Author)

A79-49482 The peripheral critical flicker frequency. E. Hartmann, B. Lachenmayr, and H. Brettel (München, Universität, Munich, West Germany). *Vision Research*, vol. 19, no. 9, 1979, p. 1019-1023. 22 refs.

Measurements of critical flicker frequency (CFF) were taken in steps of 5 deg along the horizontal meridian in the nasal visual field under systematic variation of luminance, area and temporal modulation (ripple ratio) of the test stimulus. For photopic luminances CFF increases from the fovea to the periphery for about 5-15 c/sec, passes several maxima and minima and falls off again at greater values of eccentricity (individually different at 30-60 deg), showing that parts of the retinal periphery clearly surpass the fovea in the capability of processing temporal information. It is shown that the Ferry-Porter and Grant-Harper laws are only valid in the fovea and at several points in the periphery up to about 30 deg of eccentricity; for greater values of eccentricity deviations occur from a strongly logarithmic relationship. The nonmonotonic course of peripheral CFF is compared to Payne's (1966) measurements of reaction times to peripherally presented stimuli revealing a similar behaviour.

(Author)

A79-49483 Contrast sensation - A linear function of stimulus contrast. M. W. Cannon, Jr. (USAF, Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio). *Vision Research*, vol. 19, no. 9, 1979, p. 1045-1052. 13 refs.

The method of magnitude estimation was used to determine the relationship between stimulus contrast and contrast sensation for stimulus contrasts from 0.63% to 60% at spatial frequencies of 1, 2, 6.5, and 12 cycles per degree. The relationship between contrast sensation and stimulus contrast was found to be linear over the entire range of stimulus contrasts and spatial frequencies studied. A theoretical function for contrast sensation is proposed and the concept of a contrast sensation surface is introduced. Constant contrast sensation contours derived from this surface are shown to fit data from contrast matching experiments performed in other laboratories. (Author)

A79-49484 Pursuit after-nystagmus. R. Muratore and D. S. Zee (Johns Hopkins University, Baltimore, Md.). *Vision Research*, vol. 19, no. 9, 1979, p. 1057-1059. 7 refs. Grant No. H1H-EY-01849.

Optokinetic afternystagmus (OKAN) is a response in which a relatively long period of nystagmus occurs when the light is turned off after prolonged unidirectional optokinetic stimulation. Since OKAN is a prominent feature of the optokinetic system, target-tracking experiments are carried out on young adult subjects with

normal visual and ocular motor function with a view to determine whether prolonged unidirectional pursuit of a small target is also followed by afternystagmus. The optokinetic responses are elicited within a revolving optokinetic drum. In all tests, the subjects are seated with their head stabilized by a chin rest. The study demonstrates the existence of a previously unreported ocular motor phenomenon, viz pursuit after nystagmus (PAN). PAN is found in most subjects, and it occurred regardless of whether the target moved on a dark or high contrast patterned background. Comparison of OKAN and PAN in the same individual indicated that the initial slow phase velocity OKAN was usually greater but no significant difference in time constants was apparent. S.D.

A79-49699 # Dynamics of the catalase activity of the blood of athletes under the influence of local decompression (Dinamika katalaznoi aktivnosti krovi u sportsmenov pod vozdeistviem lokal'noi dekompressii). G. V. Taneeva, Iu. L. Kislitsin, N. A. Voloshko, and L. A. Smirnova (Kazakhskii Institut Fizicheskoi Kul'tury, Alma-Ata, Kazakh SSR). *Fiziologiya Cheloveka*, vol. 5, May-June 1979, p. 564-566. 16 refs. In Russian.

A79-49726 Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, December 15, 16, 1978, Proceedings. *Aviation Medicine*, vol. 23, June 1979. 79 p.

Papers relating to various types of hazards and spinal injuries under stressful flight conditions are discussed. The topics considered are aviation and radiation hazards; design, fabrication and utility of a flight-oriented performance test; assessment of burns in accident fatalities; delayed effects of alcohol ingestion on +Gz tolerance; and papers from a symposium on spine in aviation. Techniques for assessing spinal disabilities and test methods for evaluating pilot flight fitness are described. S.D.

A79-49727 # Aviation and radiation hazards. R. Ramanna. (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 5-9.

The paper discusses the subject of radiation hazards associated with aviation. Sources of ionizing radiation dose to man at ground level are cosmic radiations, terrestrial and airborne natural radioactive substances, radioactive fallout from atmospheric nuclear explosions, medical exposures, domestic and industrial uses of ionizing radiation sources. The only source of concern at higher-than-subsonic altitudes (over 10 km) is cosmic rays. Cosmic rays and high-energy particles present at high altitudes are due to galactic cosmic rays, solar cosmic rays and solar flares, and radiation belts around the earth. The characteristics and effects of the above sources on the human organism are discussed. The discussion provides a perspective on the possible effects of ionizing radiations and enlightens one on the most interesting phenomena associated with the interaction of cosmic rays in the atmosphere. S.D.

A79-49728 # Design, fabrication and utility of a flight oriented performance test. P. C. Chatterjee, V. Kumar, N. Ramachandran, J. K. Gupta (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), and K. R. Banerjee. (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 10-13. 8 refs.

Flying involves complex psychomotor task that requires optimal efficiency and peak performance. The danger of decrement of such performance under various stresses associated with flying conditions could jeopardize flight safety. The paper describes a new flight-oriented performance test (FOPT) developed to determine decrement in performance under stresses such as mild hypoxia, partial sleep deprivation, etc., commonly experienced by aircrew. The FOPT involves a complex psychomotor task with sensory inputs, visual and motor coordination, memory and reaction time as its components. The test subject performs a coordinated hand-foot control task similar to controlling the position of an aircraft. It is shown that the decrement in performance under mild hypoxia in a decompression chamber and under partial sleep deprivation is highly significant. S.D.

A79-49729 # Assessment of burns in accident fatalities. S. K. Adaval (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), R. N. Verma (Military Hospital, Bhopal, India), and G. N. Kunzru. (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 14-18. 14 refs.

A retrospective study is carried out on material pertaining to 305 autopsies conducted on aircrew who perished in aircraft accidents over the period 1962-1978. Autopsy reports, histopathological examination reports, and brief descriptions of accidents are perused. Burns were present in 125 fatalities and their corresponding histological slides are reviewed. An assessment is made, taking into account the criteria stressed by Mason (1962), and data are defined accordingly. Attention is directed at evaluating the investigative procedures available for differentiating between ante-mortem and post-mortem nature of burns. Various problems in aircrew accident fatalities are highlighted, and the importance of detailed autopsy and toxicological examination is discussed. S.D.

A79-49730 # Delayed effects of alcohol ingestion on +Gz tolerance. K. Rai, S. K. Adaval, G. N. Kunzru (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), and A. R. Choudhury (Air Force Hospital, Gorakhpur, India). (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 19-24. 16 refs.

The delayed effects of alcohol on tolerance to +Gz were assessed on twenty fully fit volunteer male pilot subjects (21-30 yr). The subjects were given medium doses, i.e. 180 ml of whisky/rum and their +Gz tolerance at 8 hr and 12 hr after drinking was compared with the basal values. It is found that there is significant reduction in tolerance to +Gz at 8 hr and 12 hr after ingestion of 180 ml of whisky/rum. The possible physiopathology of reduction in +Gz tolerance is discussed. S.D.

A79-49731 # Comparative study of hypoxia and other non-invasive stress tests for evaluation of ischaemic heart disease. M. Akhtar, B. K. Das (Army Hospital, New Delhi, India), P. C. Chatterjee (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), and J. C. Chatterji. (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 25-31. 12 refs.

A total of 167 cases subjected to the Master double two-step exercise under hypoxia are analyzed, and the ECGs are compared with the records of their submaximal and maximal treadmill exercise. The results of the hypoxic stress tests as compared to the other noninvasive stress tests are presented and discussed. In particular, 8% of ECG abnormality and 16.2% of vasoregulatory abnormality - as diagnosed by the various noninvasive stress tests - were confirmed to have ischaemic heart disease by the combined hypoxia-exercise test. S.D.

A79-49732 # Functional anatomy of vertebral column with reference to load bearing areas. G. Gurusiddappa (Indian Air Force, Institute of Aviation Medicine, Bangalore, India). (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 32-38.

In aviation, human spine is subjected to high-magnitude forces of varied profiles leading to different injury patterns. Changes due to aging process and lack of methods to detect minor damage complicate the predictability of injuries. The paper is concerned with the characteristic features of functional anatomy and physiology to understand the mechanics of spinal injuries. The discussion covers the vertebral column, pyramids of spine, spinal curves, range of movement, load bearing and weight transmission, functional anatomical units, osseous vertebral body with end plates, motor segment, intervertebral disk, annulus fibrosus, and nucleus pulposus. Functional anatomical aspects of human spine of prime importance in aviation are defined. Recommendations are made for further research work and reduction of spinal-injury incidence. S.D.

A79-49733 # Biodynamics of aviation stresses on the vertebral column. C. A. Verghese (Indian Air Force, Institute of Aviation

Medicine, Bangalore, India). (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 39, 40.

The vertebral column of a human body structurally consists of rigid bony vertebrae, cartilaginous intervertebral disks with ligament attachments, and forms an elastic system capable of dynamic response. The rate of onset of acceleration during the initial application of ejection force, together with the associated elastic properties of the human body can cause an acceleration overshoot. This sometimes increases the inertial loading of the spine, resulting in spinal compression and subsequent fracture. The ejection seat assembly also contributes to the dynamic overshoot of acceleration. The safety criteria for the ejection forces have to be based on the dynamic response of the human subject. The paper discusses the dynamic response index (DRI) and its determination, along with DRI criteria for repeated shocks. Information presented in graphical form (shock data and proposed limits) can be used for assessment of spinal injury and discomfort in case of aviation stresses. S.D.

A79-49734 # Spinal injury pattern due to ejections. K. Rai and G. Gurusiddappa (Indian Air Force, Institute of Aviation Medicine, Bangalore, India). (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 41-47. 21 refs.

Spinal injuries are usually associated with emergencies in flight, either emergency escape by ejection or crash landing. The paper presents data with regard to the aircraft used in the Indian Air Force (IAF) and compares them with available information for other air forces. It is shown that incidence of spinal injury in successful ejections in IAF is higher than in other air forces. Factors contributing to the incidence of spinal injury are identified and highlighted. The incidence of spinal injury in crash landings is not very high because of the few successful crash landings possible with modern aircraft. S.D.

A79-49735 # Radiological diagnosis of spinal injuries and deformities. P. N. Bhargava (Indian Air Force, Command Hospital, Bangalore, India). (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 48-54.

Radiological techniques of diagnosing and assessing spinal injuries are discussed. All vertebral fractures can be demonstrated by adequate examination and technique. In most cases the radiological examination can be done at the earliest opportunity, although caution must be exercised in the handling of the injured. Injury to the intervertebral disks and ligaments cannot be recognized with complete accuracy immediately, but observation and later myelography can provide a proper diagnosis. X-rays of the spine at the time of entry into IAF are considered essential to eliminate persons with spinal abnormalities who are prone to injuries during high-G conditions associated with ejection seats. S.D.

A79-49736 # Assessment of spinal disabilities in relation to flying. J. K. Gupta, A. P. Jeswani (Indian Air Force, Institute of Aviation Medicine, Bangalore, India), and R. R. Kapur (Indian Air Force, Command Hospital, Bangalore, India). (*Aero Medical Society of India, Annual Meeting, 21st, Bangalore, India, Dec. 15, 16, 1978.*) *Aviation Medicine*, vol. 23, June 1979, p. 55-61. 8 refs.

The human spine is subjected to undue stress and strain in flying. Accelerations during maneuvers, low-frequency vibrations, ejections and forced landings can contribute to spinal discomfort and damage. Association of certain spinal defects or anomalies magnify the problem because some of these biologically imperfect spines might fail under ejection accelerations. Recently a study was undertaken to assess the extent and type of spinal disabilities in IAF pilots or fresh candidates who reported to the Institute of Aviation Medicine for their medical boards. The paper discusses a synthesis of the problem as found in the study, along with a brief review of the literature. S.D.

A79-49879 # Stabilization of a biped walking machine with incomplete information on its phase coordinates (Stabilizatsiia dvnunogogo shagaiushchego apparata pri nepolnoi informatsii o ego fazovykh koordinatakh). V. B. Larin (Akademii Nauk Ukrainsoi SSR, Institut Matematiki, Kiev, Ukrainian SSR). *Matematicheskai Fizika*, no. 25, 1979, p. 38-49. 5 refs. In Russian.

A solution is obtained to the stochastic problem involving control-system synthesis for the horizontal motion of a biped machine within a linear quadratic Gaussian framework. The asymptotic stability of closed loop systems of the type plant/filter/controller is demonstrated. The results are illustrated by the particular case of the horizontal-motion control of a biped machine, ideally represented as an upside-down pendulum with a foot. B.J.

A79-49984 Effects of congener and noncongener alcoholic beverages on a clinical ataxia test battery. D. J. Schroeder (U.S. Veterans Administration Hospital, Topeka, Kan.) and W. E. Collins (FAA, Civil Aeromedical Institute, Oklahoma City, Okla.). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 879-887. 23 refs.

The present study of alcohol effects was designed to investigate differences in performance of subjects on a more recent quantitative ataxia test battery developed by Fregly and Graybiel (1968). The variables assessed were (1) the drinking habits of the subjects (heavy vs. light), (2) the injection of a high-congener alcoholic beverage (bourbon) vs. a relatively congener-free alcoholic beverage (vodka), and (3) assessments made up to 32 h after drinking. The results indicate that normally heavy drinkers tend to display less ataxia following drinking than do normally light drinkers. No significant differential effects are found between the low- and high-congener alcoholic beverages. Moreover, there are no indications of any significant impairment on ataxia tests during the hangover period. S.D.

A79-49985 * Deconditioning-induced exercise responses as influenced by heat acclimation. E. Shvartz, A. Bhattacharya, S. J. Sperinde, P. J. Brock, D. Sciaraffa, R. F. Haines, and J. E. Greenleaf (NASA, Ames Research Center, Biomedical Research and Man-Vehicle Systems Research Divs., Moffett Field, Calif.). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 893-897. 29 refs.

A study to determine the effect of heat acclimation and physical training in temperate conditions on changes in exercise tolerance following water-immersion deconditioning is presented. Five young men were tested on a bicycle ergometer before and after heat acclimation and after water immersion. The subjects and the experimental procedure, heat acclimation and exercise training, water immersion, and exercise tolerance are discussed. Heat acclimation resulted in the usual decreases in exercise heart rate and rectal temperature and an increase in sweat rate. Water immersion resulted in substantial diuresis despite water consumed. The results show that heat acclimation provides an effective method of preventing the adverse effects of water-immersion deconditioning on exercise tolerance. A.T.

A79-49986 In-flight measures of stress reduction due to wearing expandable foam earplugs. H. Wichman, M. McIntyre, and E. Accomazzo (Claremont Men's College, Claremont, Calif.). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 898-900. 7 refs. Research supported by the Haynes Foundation and Claremont Men's College.

Ten low-time pilots (less than 150 h) who did not normally use earplugs flew three flights each in Cessna-152 training planes. The flight routines were all the same, lasting about 45 minutes. Each pilot flew one flight while adapting to earplugs, another flight with earplugs, and a third flight without earplugs. Pilot's breathing rate was the measure of autonomic arousal. A baseline rate was measured before each flight and in-flight scores were expressed as changes from baseline. Half the pilots flew their flights in the order, with-without earplugs and half flew in the order without-with-with. Results showed a mean increase in breathing rate above preflight

baseline of 30% without earplugs and an increase of only 21% with earplugs (data taken from second flight with earplugs) for a significant savings of 9% (p less than 0.025, Wilcoxon matched-pairs signed-ranks test, one tailed). (Author)

A79-49987 Pulmonary function and maximum exercise responses following acute ozone exposure. S. M. Horvath, J. A. Gliner, and J. A. Matsen-Twisdale (California, University, Santa Barbara, Calif.). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 901-905. 12 refs. Research supported by the California Air Resources Board; Grant No. NIH-ES-01143.

A79-49988 Auditory and visual sustained attention during ozone exposure. J. A. Gliner, J. A. Matsen-Twisdale, and S. M. Horvath (California, University, Santa Barbara, Calif.). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 906-910. 15 refs. Research supported by the California Air Resources Board; Grant No. NIH-ES-01143.

A79-49989 Prediction of body temperatures during exercise in flying clothing. A. J. Belyavin, T. M. Gibson, D. J. Anton, and P. Truswell (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 911-916. 15 refs.

A mathematical model has been used to describe experimental results for core and skin temperatures in subjects undergoing a rest/activity cycle in two aircrew clothing assemblies at two environmental temperatures (wet bulb, globe temperature (WBGT) indices of 25.9 and 28.9 C). The model presented compares well with published data for subjects in standard aircrew equipment assemblies. Aircrew flying at a WBGT of 28.9 C in chemical defense clothing may reach an unacceptable level of mean body temperature within 40 min and deep body temperature will rise at 1 C/hr. To prevent deterioration in flying performance during repeated sorties, an alteration in the work/rest activity pattern or the introduction of effective cabin or personal conditioning systems may be required. (Author)

A79-49990 Estimated body rotation as a predictor of motion sickness susceptibility. A. J. Gundry (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 917-920. 14 refs.

A total of 36 blindfolded subjects were rotated in yaw between 30 and 135 deg and asked to estimate the angular displacement they had experienced. An index of a subject's 'receptivity' was obtained by calculating the slope of the line relating perceived to actual displacement; his susceptibility to motion sickness was determined by a questionnaire. The product moment correlation between these two measures was not significant, a result which conflicts with the receptivity hypothesis. It is suggested that 'adaptability' rather than 'receptivity' may be the more important determinant of susceptibility to motion sickness. (Author)

A79-49991 New inventory for the assessment of symptom occurrence and severity at high altitude. J. L. Kobrick and J. B. Sampson (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 925-929. 22 refs.

A new inventory, called the Environmental Symptoms Questionnaire (ESQ), was devised to provide improved assessment of symptoms occurring during exposure to high altitude. The ESQ was field tested with 12 subjects exposed to 4300 m altitude for 4 d, and was compared with responses to the General High Altitude Questionnaire (GHAQ). Both instruments reflected significant symptom occurrence, but the ESQ was more sensitive on certain items focal to altitude conditions, and showed significant responses to items not contained in the GHAQ. Based on this test, the ESQ was judged

easier to use, more sensitive, and more comprehensive for assessing medical symptoms at altitude. (Author)

A79-49992 Ultrasonic investigations of the soleus muscle after space flight on the Biosputnik 936. S. Baranski, W. Baranska, M. Marciniak, and E. I. Il'ina-Kakueva (Institute of Aviation Medicine; Akademia Medyczna, Warsaw, Poland; Ministerstvo Zdravookhraneniia SSSR, Institut Mediko-Biologicheskikh Problem, Moscow, USSR). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 930-934. 22 refs.

The study was aimed at quantitative and qualitative evaluation of the muscle fibers and the axonal endings of the neuromuscular junctions in the soleus muscle of rats after a space flight on Biosputnik 936. Ultrastructural morphometric studies of the muscle fibers demonstrated diminished volume of sarcomer and accumulation of glycogen granules. The mean number of mitochondrial profiles decreased. The investigations of the axonal endings of the neuromuscular junctions in the soleus muscle showed diminution of the mean number of synaptic vesicles and swelling of the mitochondria. This change in the fibers and axonal endings can be interpreted as the first step of degeneration. (Author)

A79-49993 Effect on performance of cycling deep body temperature between 37.0 and 37.6 C. T. M. Gibson and J. R. Allan (RAF, Institute of Aviation Medicine, Farnborough, Hants., England). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 935-938. 5 refs.

Previous experiments (Allan and Gibson, 1979; Allan et al., 1979) showed that performance of a pursuit rotor task is worse during heating than during cooling at deep body temperatures of 37.9-38.5 C. Performance of the same task and of a manikin task has now been studied in a similar experiment while core temperature was cycled between 37.0 and 37.6 C. No change in performance was observed between heating and cooling. It is concluded that decrements in performance during heating only develop above a critical absolute level of deep body temperature. The critical level of deep body temperature, above which performance of the rotary pursuit task is degraded, is 37.6-37.9 C, and this can be related to affective thermal sensation. (Author)

A79-49994 Molecular sieve oxygen generating system - The argon question /A brief review/. K. G. Ikels and J. D. Adams (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 939-942. 21 refs.

The molecular sieve oxygen generating system (MSOG) is currently being considered as a replacement for liquid and gaseous stores on aircraft for the supply of aviator's breathing oxygen. Incorporation of onboard oxygen generation in aircraft not only increases system safety but also minimizes logistic requirements. However, a unique characteristic of the MSOG is that it concentrates not only oxygen but also argon in the process of removing nitrogen from engine bleed air. Maximum concentrations produced by present systems are in the order of 95% oxygen and 5% argon. These results have precipitated numerous questions relating to the physiological effects of argon in the product breathing gas. This report reviews the current literature concerning argon as a minor constituent (less than 10%) in gas breathing systems and recommends studies prior to human compatibility testing of the molecular sieve oxygen generating systems. (Author)

A79-49996 Spinal injuries in the F/FB-111 crew escape system. L. E. Kazarian, K. Beers, and J. Hernandez (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 948-957. AF Project 22290000; AF Project 72310656.

During the years 1970-75, a larger than expected number of aircrewmembers, forced to use the F/FB-111 crew escape module, experienced acute spinal trauma during otherwise uneventful ejection.

This trend in the incidence and severity of F/FB-111 aircrew spinal injuries attracted considerable attention and stimulated extensive inquiry concerning the ethiology of the trauma in order to implement appropriate corrective measures. In response to the expressed concerns, an investigation was initiated to analyze the biodynamic pathogenetic mechanism associated with ejection in the F/FB-111 crew escape module. The purpose of this retrospective investigation is to identify the frequency and severity of spinal trauma in the F/FB-111 crew escape module and to shed additional light on the patterns and severity along with the orthopaedic biomechanics of spinal injury. (Author)

A79-49997 * Determination of muscle mass changes in legs from K-40 measurements. H. E. Palmer and G. A. Rieksts (Battelle Pacific Northwest Laboratories, Richland, Wash.). *Aviation, Space, and Environmental Medicine*, vol. 50, Sept. 1979, p. 961-963. Contract No. NAS9-14248.

The K-40 content of the upper legs was periodically measured in several subjects whose injured legs had been in a cast for 6 weeks or more. As the subjects began using the leg again, the K-40 content increased as the muscle tissue was replaced. A 25% increase in K-40 content in 6 months is typical for a normal leg use and recovery. This is equivalent to an original muscle mass loss of 20%. By measuring specific body regions, such as arms or legs, with a high-efficiency detector system, muscle mass changes which exceed a few percent can be measured. These methods could be used in space flight and bedrest studies, and in studying nutritional deficiencies due to disease or diet. (Author)

A79-50107 Magnetocardiography - An overview. D. B. Geselowitz (Pennsylvania State University, University Park, Pa.). *IEEE Transactions on Biomedical Engineering*, vol. BME-26, Sept. 1979, p. 497-504. 30 refs. NSF Grant No. GK-36608; Grant No. NIH-HL-21283.

Since 1963 when recording of the human magnetocardiogram (MCG) was first reported, the number of clinical studies has been limited. High-quality tracings can now be easily obtained in special shielded chambers, but problems remain if records are to be made in hospitals without such chambers. Measurement techniques, theory of the MCG, and model studies are discussed. Configuration of the MCG waveform is much the same as that of the electrocardiogram (ECG). Measurements of dc currents of injury in dogs by means of the MCG have been reported, and are potentially of great clinical interest. Effects of magnetic susceptibility changes in the torso associated with blood movement may contribute to variations in the external field. The questions of what new diagnostic information is available in the MCG and what lead systems are most appropriate remain to be answered. (Author)

A79-50108 A catheter flow probe for measurement of left ventricular source parameters. B.-G. Min (Rutgers University, New Brunswick; New Jersey, College of Medicine and Dentistry, Newark, N.J.), J. B. Kostis (Rutgers University, New Brunswick; New Jersey, College of Medicine and Dentistry, Newark; Raritan Valley Hospital, Greenbrook, N.J.), W. Welkowitz, and S. Fich (Rutgers University, New Brunswick, N.J.). *IEEE Transactions on Biomedical Engineering*, vol. BME-26, Sept. 1979, p. 509-512. 8 refs.

A79-50205 * A simple technique for evaluation of vitality loss in aging mice, by testing their muscular coordination and vigor. J. Miquel and M. Blasco (NASA, Ames Research Center, Moffett Field, Calif.). *Experimental Gerontology*, vol. 13, 1978, p. 389-391, 393-396. 20 refs.

A79-50230 * Polyglutaraldehyde - A new reagent for coupling proteins to microspheres and for labeling cell-surface receptors. A. Rembaum (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), J. Levy (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California, Univer-

sity, Los Angeles, Calif.), and S. Margel. *Journal of Immunological Methods*, vol. 24, 1978, p. 239-250. 17 refs. Grant No. NIH-1-R01-CA-20668-01.

Glutaraldehyde polymerized in basic aqueous solutions was found to react with low molecular weight amines, immunoglobulins and hemoglobin. The polyglutaraldehyde was covalently bound to hydrophilic microspheres. The rate of addition of proteins to the polyglutaraldehyde-derivatized microspheres was investigated spectrophotometrically as a function of pH and temperature. The reaction of polyglutaraldehyde was found to be faster than that of the monomer. The findings led to successful labeling of human lymphocyte subpopulations. (Author)

A79-50232 * Synaptosomal uptake of hypothalamic monoamines and recovery of pituitary-adrenal activity following medial forebrain bundle lesions in rats. J. P. Heybach, P. A. Brown, and J. Vernikos-Danellis (NASA, Ames Research Center, Biomedical Research Div., Moffett Field, Calif.). *Neuroendocrinology*, vol. 28, 1979, p. 273-280. 22 refs.

A79-50234 * Design of polymeric immunomicrospheres for cell labelling and cell separation. A. Rembaum and S. Margel (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *British Polymer Journal*, vol. 10, Dec. 1978, p. 275-280. 37 refs. Contract No. NAS7-100; Grant No. NIH-1-R01-CA-20668-01.

Synthesis of several classes of hydrophilic microspheres applied to cell labeling and cell separation is described. Five classes of cross-linked microspheres with functional groups such as carboxyl, hydroxyl, amide and/or pyridine groups were synthesized. These functional groups were used to bind covalently antibodies and other proteins to the surface of the microspheres. To optimize the derivatization technique, polyglutaraldehyde immunomicrospheres were prepared and utilized. Specific populations of human and murine lymphocytes were labelled with microspheres synthesized by the emulsion of the ionizing radiation technique. The labelling of the cells by means of microspheres containing an iron core produced successful separation of B from T lymphocytes by means of a magnetic field. A.T.

A79-50261 # Investigation of blood subjected to volume tension (Issledovanie krovi pri vozdeistvii ob'emnogo rastiazheniia). Ia. A. Brauns and B. A. Purinia (Akademiia Nauk Latvinskoi SSR, Institut Mekhaniki Polimerov, Riga, Latvian SSR). *Mekhanika Kompozitnykh Materialov*, Jan.-Feb. 1979, p. 132-135. 8 refs. In Russian.

The conditions under which cavities may form in the human blood stream due to decompression or mechanical effects are analyzed. The critical tensile stresses in quasi-static loading are determined experimentally as 1.0 to 2.5 kgf/sq cm. V.P.

A79-50287 # Problem of modeling the mechanism of heart contraction (K voprosu o modelirovanii mekhanizma sokrashcheniia serdtsa). H.-J. Bartsch and P. Eckermann (Rostock, Universität, Rostock, East Germany). (*Sovetsko-Amerikanskii Simpozium po Razrusheniiu Kompozitnykh Materialov, Riga, Latvian SSR, Sept. 1978.*) *Mekhanika Kompozitnykh Materialov*, Mar.-Apr. 1979, p. 365-368. 5 refs. In Russian.

A79-50334 * Computer aided control of a mechanical arm. W. L. DeRocher, Jr. and R. O. Zermuehlen (Martin Marietta Aerospace, Bethesda, Md.). In: Learning to use our environment; Proceedings of the Twenty-fifth Annual Technical Meeting, Seattle, Wash., April 30-May 2, 1979. Mount Prospect, Ill., Institute of Environmental Sciences, 1979, p. 58-62. 5 refs. Contract No. NAS8-30820.

A method for computer-aided remote control of a six-degree-of-freedom manipulator arm involved in the on-orbit servicing of a spacecraft is presented. The control configuration features a supervisory type of control in which each of the segments of a module exchange trajectory is controlled automatically under human super-

vision, with manual commands to proceed to the next step and in the event of a failure or undesirable outcome. The implementation of the supervisory system is discussed in terms of necessary onboard and ground- or Orbiter-based hardware and software, and a one-g demonstration system built to allow further investigation of system operation is described. Possible applications of the system include the construction of satellite solar power systems, environmental testing and the control of heliostat solar power stations. A.L.W.

A79-50372 # Man and automation (Czlowiek i automatyzacja). T. Smolicz (Polskie Towarzystwo Astronautyczne, Warsaw, Poland). (*Symposium na Temat Problemy Nawigacji Kosmicznej, Lodz, Poland, Dec. 19, 1977.*) *Postepy Astronautyki*, vol. 12, no. 2, 1979, p. 53-63. 6 refs. In Polish.

A model of information flow and decision making is constructed on the basis of an analysis of the human spatial orientation system. Modes of decision generation in man and in automatic devices are compared and the comparison is applied to the study of human pilot/automatic pilot interactions. B.J.

A79-50447 # Goal-directed mechanics of controlled manipulators (Tselenapravleniia mekhanika upravliaemykh manipulatorov). G. V. Korenev. Moscow, Izdatel'stvo Nauka, 1979. 448 p. In Russian.

Methods of goal-directed (or controlled-body) mechanics are applied to the operational motions of manipulators with artificial intelligence. The general theory of such manipulators is developed on the basis of tensor analysis and an orthogonal transformation approach. Consideration is then given to the theory of programmed motion of manipulators, involving a mathematical formulation of the goals of motion; the motion is programmed in free space as well as in space with obstacles. Finally, the theoretical analysis is devoted to the examination of both the uncontrolled (natural) and controlled (goal-directed) motions of manipulators. A.T.

A79-50473 Mutual repulsion between moving visual targets. W. Marshak and R. Sekuler (Northwestern University, Evanston, Ill.). *Science*, vol. 205, Sept. 28, 1979, p. 1399-1401. 18 refs. NSF Grant No. BNS-77-1858.

When two spatially intermingled sets of random dots move in different directions, the direction of each set may be misperceived. Observers report that each set of dots appears to move in a direction displaced by as much as 20 deg from the direction of its companion set. Probably the result of inhibitory interactions, this mutual repulsion occurs at a central site in the visual system and may normally enhance discrimination of direction. (Author)

A79-50474 Ecological physiology of animals. I - General ecological physiology and physiology of adaptations (Ekologicheskaia fiziologiiia zhivotnykh. I - Obshchaia ekologicheskaiia fiziologiiia i fiziologiiia adaptatsii). Edited by A. D. Slonim. Leningrad, Izdatel'stvo Nauka, 1979. 440 p. In Russian.

The book presents available literature and experimental information in relation to problems in general ecological physiology. General problems and the present status of this branch of physiology are discussed, with special emphasis on the theory of physiological adaptations. The discussion covers the effect of the natural factors of the environment on the body, and to problems of hibernation. Also discussed are torpid states of the body, along with the physiology of populations. S.D.

A79-50496 # Effect of microwave radiation on the resistance of rats to transverse acceleration loading (Vliianie mikrovolnovogo oblucheniia na ustoiichivost' krysk k poperechno-napravlennym peregruzkam). V. S. Tikhonchuk. *Kosmicheskie Issledovaniia*, vol. 17, July-Aug. 1979, p. 636-638. 6 refs. In Russian.

A79-50550 Synthetic training and evaluation - Some current issues. R. C. Bartel (International Civil Aviation Organization, Montreal, Canada). *SAFE Journal*, vol. 9, Fall 1979, p. 17-19. 7 refs.

The motivations for synthetic training are discussed in light of the objectives for the development of or improvement in abilities, skills, and proficiencies. It is suggested that, within certain ranges of training complexity and job discretion, risk assessment and decision making are biased by the isolation of a synthetic setting and the lack of the real consequences of failures. A hypothesis for future discussion and research is offered: 'Training in a synthetic setting will result in improvements in certain skills and proficiencies; however, within certain ranges of complexity and prescription, the resulting bias of risk assessment and decision processing may result in a net increase in hazard.' (Author)

A79-50651 # Mechanism for the regulation of human posture during movements of the foot (O mekhanizme regulatsii vertikal'noi pozy cheloveka pri dvizheniakh stopy). M. A. Alekseev, I. S. Dobronravova, A. V. Naidel', and B. N. Smetanin (Akademiia Nauk SSSR, Institut Problem Peredachi Informatsii, Moscow, USSR). *Fiziologiya Cheloveka*, vol. 5, July-Aug. 1979, p. 579-588. 25 refs. In Russian.

Results are presented for a comparative study of postural changes arising during involuntary and voluntary movements in a standing man. The involuntary movement concerns foot flexion induced by the contraction of the triceps muscle of the leg in response to stimulating the tibial nerve by a single electrical stimulus. The test subject is placed in a soundproof chamber in a comfortable standing position. It is found that involuntary flexion of the foot activates the anterior muscle groups of the legs and thighs, as well as the dorsoflexor muscle groups. These muscle responses are considered to be a unified coordination complex, viz. synergistic stabilization of the vertical posture. The factor activating such a synergy is imbalance in the sagittal plane, caused by the movement of the foot. S.D.

A79-50652 # Biomechanical properties of muscles and the efficiency of movement (Biomekhanicheskie svoistva myshts i effektivnost' dvizheniia). A. S. Aruin, B. I. Prilutskii, L. M. Raitsin, and I. A. Savel'ev (Gosudarstvennyi Tsentral'nyi Institut Fizicheskoi Kul'tury; Moskovskii Institut Elektronnoy Mashinostroeniia, Moscow, USSR). *Fiziologiya Cheloveka*, vol. 5, July-Aug. 1979, p. 589-599. 14 refs. In Russian.

Experiments are conducted on five well-trained male weight lifters (18-22 yr) to demonstrate an increase in the efficiency factor (ratio of mechanical work done to total energy expenditure) of muscular activity with increasing amplitude of movement and external load, as well as during transition from a negative movement phase to a positive one. Data are presented on the stored and expended energy of elastic deformation of muscles during squatting exercises. Biomechanical properties of the muscles are found to be an important factor for increased efficiency of movement. S.D.

A79-50653 # Characteristics of somatic and autonomic regulation during work of small muscle groups as a function of loading regime (Osobennosti somaticheskoi i vegetativnoi regulatsii pri rabote mal'nykh grupp myshts v zavisimosti ot rezhima nagruzki). V. A. Buzunov (Nauchno-Issledovatel'skii Institut Gigieny Truda i Profzabolevanii, Kiev, Ukrainian SSR). *Fiziologiya Cheloveka*, vol. 5, July-Aug. 1979, p. 607-613. 20 refs. In Russian.

Wrist ergography is used to assess the characteristics of changes in the indices of autonomic regulation in different phases of changes in muscular work capacity, and the effect of work-induced fatigue on work capacity and exercise. It is shown that during activity of small muscle groups, a decrease in work capacity is initially reflected by changes in the autonomic regulation, and is characterized by enhancement of sympathetic effects and subsequent readjustment of the cardiovascular system and respiration on a higher level of stressed activity. Both severe and light fatigue may inhibit the continuation of exercise. S.D.

A79-50654 # Elicited acoustic responses to meaningful and meaningless verbal stimuli (Slukhovyie vyzvannyye otvety na smyslovyye i bessmyslennyye verbal'nyye stimuly). S. Popov and L. Mavlov (B'lgarska Akademiia na Naukite, Tsentralna Laboratoriia za Izuchavane na Moz'ka, Sofia, Bulgaria). *Fiziologiya Cheloveka*, vol. 5, July-Aug. 1979, p. 634-640. 8 refs. In Russian.

Results are presented for an investigation of elicited potentials recorded in the central and midtemporal areas of the brain in response to meaningful and meaningless verbal stimuli. It is shown that during the presentation of these stimuli, elicited potentials with a negative late component (latency 350-600 microsec) occur regularly. This component is more pronounced for both meaningless stimuli and semantically different stimuli that require stimulation of brain activity. The observed component is considered to reflect nonspecific activation of the cerebral cortex during perception of verbal stimuli and is connected with active-attention processes related to decision making. S.D.

A79-50655 # Electrophysiological investigation of sleep during work-shift regime and production-induced emotional stress (Elektrofiziologicheskoe issledovanie sna pri smennom rezhime raboty i proizvodstvenno obuslovlennom emotsional'nom napriazhenii). A. M. Goncharenko (Ministerstvo Putei Soobshcheniia Vsesoiuznyi Nauchno-Issledovatel'skii Institut Zheleznodorozhnoi Gigieny, Moscow, USSR). *Fiziologiya Cheloveka*, vol. 5, July-Aug. 1979, p. 641-649. 33 refs. In Russian.

A79-50656 # Dynamical characteristics of visual functions (Dinamicheskie kharakteristiki zritel'nykh funktsii). V. V. Kolbanov and V. I. Medvedev (Voenno-Meditsinskaiia Akademiia, Leningrad, USSR). *Fiziologiya Cheloveka*, vol. 5, July-Aug. 1979, p. 687-693. 51 refs. In Russian.

The paper discusses the set of physical parameters of adequate optical stimulus, which determine the state of the basic indices in human vision. On the basis of analysis of data available in the literature, fundamental concepts of dynamical visual functions are presented, and information on the dynamical characteristics of visual acuity, far vision, light and color sensitivity, and critical frequency of flicker fusion is systematized. A tentative short classification of visual functions is presented. S.D.

A79-50657 # Forms of oculomotor activity under conditions of positive visual feedback (Formy glazodvigatel'noi aktivnosti v usloviakh polozhitel'noi zritel'noi obratnoi svyazi). V. A. Barabanshchikov (Akademiia Nauk SSSR, Institut Psikhologii, Moscow, USSR). *Fiziologiya Cheloveka*, vol. 5, July-Aug. 1979, p. 694-701. 17 refs. In Russian.

Results are presented for an experimental study in which a central suction device with a miniature prism was attached to the eye of the test subject in order to invert the projection of objects of perception onto the retina. Five stable forms of oculomotor activity were observed: (1) inversion nystagmus; (2) paranystagmus; (3) smooth sinusoidal oscillations with 50-60-deg amplitude and 0.2-0.8-Hz frequency; (4) nonperiodic slow oscillations with an amplitude of 50-60 deg and a velocity of 1-20 deg/sec; and (5) separate saccades with an amplitude up to 20-25 deg. Voluntary control of individual parameters and forms of oculomotor activity was possible. S.D.

A79-50658 # Possibility of quantitative evaluation of the heart's mechanical activity from seismocardiograms (O vozmozhnosti kolichestvennoi otsenki mekhanicheskoi aktivnosti serdtsa po seismokardiosignalam). Iu. V. Beletskii, V. A. Antonets, V. A. Ivkovich, and A. K. Labutskii (Ministerstvo Zdravookhraneniia SSSR, Vsesoiuznyi Nauchno-Issledovatel'skii Institut Klinicheskoi i Eksperimental'noi Khirurgii, Moscow; Akademiia Nauk SSSR, Institut Prikladnoi Fiziki, Gorki, USSR). *Fiziologiya Cheloveka*, vol. 5, July-Aug. 1979, p. 719-726. 23 refs. In Russian.

The paper develops a methodology of quantitative analysis of the heart's mechanical activity. The seismocardiographic method

involves piezoelectric measurements of oscillatory processes arising from the motion of heart, lungs, and blood vessels in the heart area. Techniques for attaching the piezoelectric sensor to the body of the subject are examined and definite relationships between seismocardiograms and heart hemodynamics are demonstrated. B.J.

A79-50659 # Auditory evoked potentials during short-term auditory stimulation (Slukhovyie vyzvannye potentsialy pri kratkovremennom zvukovom razdrzhenii). Z. Sh. Kevanishvili and O. A. Khachidze (Tbilisskii Gosudarstvennyi Institut Uovershenstvovaniia Vrachei, Tiflis, Georgian SSR). *Fiziologiya Cheloveka*, vol. 5, July-Aug. 1979, p. 742-745. 5 refs. In Russian.

A79-50694 Time parameter in microwave irradiation. B. I. Davydov, V. V. Antipov, and V. S. Tikhonchuk. (*Kosmicheskie Issledovaniia*, vol. 17, Jan.-Feb. 1979, p. 151-158.) *Cosmic Research*, vol. 17, no. 1, July 1979, p. 126-132. 19 refs. Translation.

The time factor of radiation damage and recovery is studied in tests with 3080 mice and 604 rats, and the results of exposure to microwave and ionizing radiation are compared. The comparison points to the existence of numerous common traits of these two types of radiation, particularly in recovery, cumulation (adaptation), and evaluation of the damage as a function of the dose. V.P.

A79-50901 * Cardiopulmonary readjustments in passive tilt. S. V. Matalon and L. E. Farhi (New York, State University, Buffalo, N.Y.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Sept. 1979, p. 503-507. 20 refs. Grant No. NsG-9028.

The readjustment of cardiopulmonary variables in human volunteers at various tilt angles on a tilt board is studied. Five healthy subjects (18-31 yr) with thorough knowledge of the experimental protocol are tested, passively tilted from the supine to the upright position in 15-deg increments in random sequence. The parameters measured are cardiac output (Q), heart rate (HR), stroke volume (SV), minute and alveolar ventilation $V(E)$ and $V(A)/V(E)$, functional residual capacity (FRC), and arterial-end-tidal $P(CO_2)$ pressure difference. It is found that changes in Q and FRC are linearly related to the sine of the tilt angle, indicating that either reflexes are absent or their net effect is proportional to the effects of gravity. This is clearly not the case for other variables /HR, SV, $V(E)$, $V(A)/V(E)$, where it is possible to demonstrate threshold values for the appearance of secondary changes. S.D.

A79-50902 Composition of cerebral fluids in goats adapted to high altitude. V. Fencl (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.), R. A. Gabel (Peter Bent Brigham Hospital, Boston, Mass.), and D. Wolfe (Harvard University, Boston, Mass.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Sept. 1979, p. 508-513. 27 refs. Grant No. NIH-GM-15904.

Experiments were conducted to explore the relationship between the ionic composition of CSF and that of the cerebral interstitial fluid in six unanesthetized goats adapted to a simulated altitude of 4300 m. By perfusing the ventriculocisternal system with artificial CSF of variable ionic composition, net transepithelial fluxes were derived for HCO_3^- , Cl^- , and lactate. The results indicate that in goats acclimatized to high altitude, H^+ concentration in the fluid surrounding the central chemoreceptors is different from that observed in the cisternal CSF, and appears to be acidotic enough to account for the hyperventilation observed in the acclimatized animals. S.D.

A79-50903 Effects of glycogen depletion and work load on postexercise O_2 consumption and blood lactate. S. S. Segal and G. A. Brooks (California, University, Berkeley, Calif.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physi-*

ology, vol. 47, Sept. 1979, p. 514-521. 28 refs. Grant No. NIH-AM-19577.

A79-50904 Responses of conscious rabbits to CO_2 at ambient temperatures of 5, 20, and 35 C. M. Maskrey and S. C. Nicol (Tasmania, University, Hobart, Australia). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Sept. 1979, p. 522-531. 16 refs. Grant No. NIH-HL-07060.

A79-50905 Lung inflation and longitudinal distribution of pulmonary vascular resistance during hypoxia. C. A. Dawson (U.S. Veterans Administration, Medical Center, Wood, Wis.), D. J. Grimm (Wisconsin, Medical College, Milwaukee, Wis.), and J. H. Linehan (Marquette University, Milwaukee, Wis.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Sept. 1979, p. 532-536. 15 refs. Research supported by the U.S. Veterans Administration; Grant No. NIH-HL-19298.

Using the low-viscosity bolus method, the influence of lung inflation on the longitudinal distribution of vascular resistance during hypoxia in isolated cat lungs is examined. During hypoxia, increasing transpulmonary pressure decreased vascular resistance but did not change the volume into the lung at which the maximum local resistance was located. This was in contrast to the normoxic situation in which inflation caused an increase in resistance over much of the transpulmonary pressure range studied and moved the maximum local resistance downstream. These results indicate that during hypoxia the major increase in resistance was in extra-alveolar vessels and that distension of these vessels by lung inflation decreased the magnitude of the pressor response. The increase in resistance in alveolar vessels, which occurred on inflation, was similar during control and hypoxic conditions but was a smaller part of the total resistance during hypoxia because of the much larger extra-alveolar vessel resistance. (Author)

A79-50906 The lung as a filter for microbubbles. B. D. Butler and B. A. Hills (Texas, University, Galveston, Tex.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Sept. 1979, p. 537-543. 28 refs. Contract No. N00014-75-C-1035.

A noninvasive ultrasonic Doppler probe is used over the femoral artery of anesthetized dogs to demonstrate its capability of detecting carefully calibrated microbubbles 14-189 microns in diameter when these are infused directly into the aorta. Also, the same noninvasive technique is used to detect any bubbles escaping into the arterial system when gas is infused into the venous system. The results indicate that the lungs are an efficient filter for bubbles under normal conditions, and that the cutoff diameter is less than 22 microns. Changes in respiration profile indicate that they may provide a useful index of the degree of venous embolization, so that during decompression or vascular surgery this index could provide a possible warning of potential overload leading to arterial gas embolism. S.D.

A79-50907 Role of skin temperature in the control of sweating. T. V. McCaffrey, R. D. Wurster, H. K. Jacobs, D. E. Euler, and G. S. Geis (Loyola University, Maywood, Ill.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Sept. 1979, p. 591-597. 17 refs. Grant No. NIH-HL-08682.

In five male subjects tympanic membrane temperature $T(ty)$, rectal temperature, and skin temperatures at 12 sites were simultaneously recorded. Local sweating rate was measured at six sites using resistance hygrometry. After steady-state sweating was established, the lower body was heated at ambient temperatures of 50, 60, 70, and 80 C or cooled at an ambient temperature of 29 C while the upper body remained at a constant ambient temperature. During lower body heating or cooling, $T(ty)$ was maintained constant by the drinking of cold (10 C) or warm (45 C) water. Sweating rate on both upper and lower body surfaces was proportional to lower body skin temperature. The regression coefficients for sweating rate versus

A79-50908

mean lower body skin temperature varied from 0.03 to 0.09 mg/sq cm min C between subjects, but were not significantly different from each other (P less than 0.05). This study demonstrates an influence of cutaneous thermoreceptors on sweating rate under steady-state conditions. (Author)

A79-50908 **Modification of cardiac function by synchronized oscillating acceleration.** A. Bhattacharya, C. F. Knapp, E. P. McCutcheon, and J. M. Evans (Kentucky, University, Lexington, Ky.). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, vol. 47, Sept. 1979, p. 612-620. 25 refs. Contract No. NIH-N01-HT-3-2928.

Whole-body oscillating acceleration may have potential diagnostic and therapeutic applications as a stress test, a substitute for exercise, or a noninvasive technique for providing circulatory assistance in the presence of cardiac failure. A particular cardiovascular (CV) response can be sustained by synchronizing the heart beat with the whole-body acceleration stimulus. The paper is concerned with quantitative evaluation of the sensitivity of selected CV responses to synchronization of sinusoidal whole-body acceleration with events of the cardiac cycle in the chronically instrumented dog. Such information is essential to explore and standardize the ranges of synchronization times or assist type CV responses. The capability of this synchronized-oscillating-acceleration technique to interstitial fluid in six unanesthetized goats adapted to a simulated altitude of 4300 m. By perfusing the ventriculocisternal system with artificial CSF of variable ionic composition, net transepithelial fluxes were derived for HCO₃⁻, Cl⁻, and lactate. The results indicate that in goats acclimatized to high altitude, H(+) concentration in the fluid surrounding the central chemoreceptors is different from that observed in the cisternal CSF, and appears to be acidotic enough to account for the hyperventilation observed in the acclimatized animals. S.D.

A79-50974 **Thermally induced retina injury due to high doses of optical radiation.** V. Pollak (Saskatchewan, University, Saskatoon, Canada). *Canadian Journal of Physics*, vol. 57, Sept. 1979, p. 1444-1454. 11 refs.

The paper reviews data on thermally induced lesions of the retina caused by high-intensity optical radiation from both CW and pulsed sources. Attention is given to results relating to power-temperature relationships, spectral considerations, source-object distance, the size of the irradiated spot, and the thermal time constant of the retina. A few numerical examples are discussed including the case of a welding accident. B.J.

A79-50986 **Motion and vision. I - Stabilized images of stationary gratings.** D. H. Kelly (SRI International, Menlo Park, Calif.). *Optical Society of America, Journal*, vol. 69, Sept. 1979, p. 1266-1274. 33 refs. Grant No. NIH-EY-01128.

To demonstrate that eye movements have profound effects on the sine-wave contrast threshold, the author uses a new method of stabilizing the retinal image, in which the Purkinje reflections from the eye move the stimulus pattern displayed on a CRT screen. Calibration of this compensatory motion is very critical; a gain error greater than 1% may produce significant destabilization. Under optimum conditions, image stabilization elevates the subject's contrast threshold by a factor of about 20; it also produces after-images with resolution greater than 12 c/deg. These results compare favorably with those obtained by other methods. (Author)

A79-50987 **Latency of peripheral saccades.** Y. Y. Zeevi and E. Peli (Technion - Israel Institute of Technology, Haifa, Israel). *Optical Society of America, Journal*, vol. 69, Sept. 1979, p. 1274-1279. 19 refs. Research supported by the Julius Silver Institute; U.S.-Israel Binational Science Foundation Grant No. 1435.

Displaying the point of gaze to the observer in addition to a point target provides a secondary visual feedback (2VFB). Eccentric fixation is achieved using a biased 2VFB to yield an experimentally imposed 'eccentric fovea'. The target is suddenly moved to a new position and the task is to regain it, in the 'eccentric fovea'. It is found that the pattern of eye-movement response consistently starts with saccadic foveal exploration of the target, but its latency has twice the duration of a regular voluntary saccade. Practice, however, makes for the shortened latency tending asymptotically to the regular saccadi duration. (Author)

A79-51015 **An empirical formula for broad-band SAR calculations of prolate spheroidal models of humans and animals.** C. H. Durney, M. F. Iskander, H. Massoudi (Utah, University, Salt Lake City, Utah), and C. C. Johnson. *IEEE Transactions on Microwave Theory and Techniques*, vol. MTT-27, Aug. 1979, p. 758-763. 7 refs. Contract No. F41609-76-C-0025.

An empirical relation for calculating approximate values of the average specific absorption rate (SAR) over a broad-frequency range for any prolate spheroidal model is derived for E-polarized incident plane waves. This formula provides a simple and inexpensive method for calculating the SAR for human and animal models, which otherwise requires complicated and expensive methods of calculation. The formula satisfies the f-squared SAR behavior at lower frequencies, the resonance characteristic at intermediate frequencies, the 1/f behavior past resonance, and the dependence on the dielectric constant at the geometrical optics limits. An expression for the resonance frequency in terms of the dimensions of the model is also derived. The unknown expansion coefficients were determined by curve-fitting all the data available in the second edition of the Radiofrequency Radiation Dosimetry Handbook. Numerical results obtained from the empirical relations are generally in good agreement with those calculated by other methods. Limitations of the formula and suggestions for its improvement are also discussed. (Author)

STAR ENTRIES

N79-30913*# Houston Univ., Tex.
EFFECTS OF GRAVITY ON CONTRACTILE PROTEINS
Final Report, 1 Jun. 1978 - 31 May 1979
 H. R. Henney, Jr. May 1979 35 p refs
 (Contract NAS9-14857)
 (NASA-CR-160303) Avail: NTIS HC A03/MF A01 CSCL
 06C

A method was established for the isolation and purification of nuclei in high yield from the microplasmodia of *Physarum flavicomum*. Purified nuclei were resistant to breakage by methods commonly employed for isolated plant and animal nuclei. Several methods for the extraction of nuclear protein were compared. Incubation of nuclear lysates with either 2 M NaCl, with or without 5 M urea, or 1 M CaCl₂ resulted in the extraction of nuclear action together with histones. The histones were chemically fractionated into the 5 basic groups common to other eucaryotic tissue. Amino acid analyses of the total histone were also performed. Nuclear actin was found to have a molecular weight of 41,000 ± 4,000 daltons as determined by SDS polyacrylamide gel electrophoresis. The amino acid composition of the nuclear action was established. Author

N79-30914# Rice Univ., Houston, Tex. Dept. of Physics.
STUDYING THE STATE OF CELLULAR METAL IONS BY
THE EXTENDED X-RAY ABSORPTION FINE STRUCTURE
Final Report, 1 Apr. 1977 - 31 Mar. 1979
 H. W. Huang 1 Jun. 1979 17 p refs
 (Contract N00014-77-C-0239)
 (AD-A069799) Avail: NTIS HC A02/MF A01 CSCL 07/2

The edge spectrum is a sensitive probe of local chemistry. Each chemical environment measured here gives a unique edge spectrum. Hydrated potassium also has a unique spectrum which is insensitive to counterions. Comparing spectra we find that the chemical state of potassium in cells differs appreciably from that in aqueous solutions. GRA

N79-30915# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
A SUBHUMAN PRIMATE RESTRAINT SYSTEM
 Clarence M. Oloff and William L. Finch Dec. 1978 57 p refs
 (AF Proj. 7222)
 (AD-A069607; AMRL-TR-78-88) Avail: NTIS
 HC A04/MF A01 CSCL 14/2

The illustrations presented here are of a subhuman primate restraint system that is a novel method of limiting conscious animal movement during experiments. This system is especially useful during acceleration and maintains its structural integrity and usefulness after exposure to high acceleration on a centrifuge. GRA

N79-30916# Tracor Jitco, Inc., Rockville, Md.
REPORT OF THE WORKSHOP ON BIOLOGICAL SCREEN-
ING TESTS Final Report
 Charles A. Bicking Jan. 1979 52 p refs Workshop held at
 Las Vegas, Nevada, 12-14 Sep. 1977
 (Contract EPA-CB-7-0913-B)
 (PB-294303/3; EPA-600/9-79-004) Avail: NTIS
 HC A04/MF A01 CSCL 06T

The report contains recommendations for selecting substantially predictive biological screening tests. The large number of chemicals which can potentially impact human health and the environment precludes the complete testing of each substance. In order to effect preliminary chemical hazard ranking, initial

tests must be standardized and validated and the necessary quality control practices and techniques developed and implemented. Recommendations for selecting substantially predictive biological screening tests upon which the Agency's quality assurance resources may be initially concentrated are included. GRA

N79-30917 British Library Lending Div., Boston Spa (England).
UNCOMMON HYPERSENSITIVITY TO CONTACTING COLD
WATER AND COLD AIR WITH PROPAGATED REFLEX-LIKE
ERYTHEMA DEVELOPMENT

J. Petres and I. Kunick May 1979 11 p Transl. into ENGLISH from Hautarzt (Austria), v. 29, no. 8, 1978 p 420-424
 (BLL-RTS-11644) Avail: British Library Lending Div., Boston Spa, Engl.

A variant to the currently known atypical forms of cold urticaria is described. Laboratory tests were intercompared with both cold water and cold air contacting in order to study the physical triggering mechanisms of cold urticaria. R.E.S.

N79-30918 British Library Lending Div., Boston Spa (England).
POSSIBILITY OF IMPROVING ASSESSMENT OF CARDIO-
PULMONARY FUNCTION BY SUBMAXIMAL EXERCISE ON
A BICYCLE ERGOMETER

L. Nachnev May 1979 8 p refs Transl. into ENGLISH from Pneumologiya i Ftiziatrya (Bulgaria), v. 14, no. 2, 1977 p 64-68
 (BLL-RTS-11657) Avail: British Library Lending Div., Boston Spa, Engl.

The reference values of the three indices test for young males is presented as well as an experiment to obtain arbitrary indices with a view to improving the diagnostic value of the test qualitatively and quantitatively. M.M.M.

N79-30920# Royal Aircraft Establishment, Farnborough (England).

ULTRASONIC DOPPLER DIRECTIONAL BLOOD FLOW
VELOCITY METER

V. S. Postnikov, L. I. Yakimenkov, Yu. N. Gusev, and P. M. Zykov Oct. 1978 8 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Priborostr. (USSR), v. 19 no. 4, 1976 p 5-8
 (RAE-Lib-Trans-1918; BR67948) Avail: NTIS
 HC A02/MF A01

A principle for detecting the sense of the velocity of a blood flow using ultrasonic Doppler (USD) meters was investigated. The USD meter operates in single frequency, continuous signal conditions with a combined piezoelectric sender/receiver. R.E.S.

N79-30921*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SPINE IMMOBILIZATION METHOD AND APPARATUS
Patent Application

Kenneth H. Lambson (Lambson, Kenneth and Assoc., San Diego, Calif.) and Hubert C. Vykukal, inventors (to NASA) Filed 13 Jul. 1979 16 p
 (NASA-Case-ARC-11167-1; US-Patent-Appl-SN-057526) Avail: NTIS HC A02/MF A01 CSCL 06B

A spine immobilization apparatus which uses a normally flat, flexible bladder filled with beads or microballoons is described. The beads form a rigid mass when the pressure within the bladder is decreased below ambient through the use of a suction pump. The bladder can be conformed to the victim's torso to provide the desired restraint. It is strapped to the victim prior to being rigidified by an arrangement of straps which avoid the stomach area. The bladder is adapted to be secured to a rigid support, i.e., a rescue chair, so as to enable removal of a victim after the bladder has been made rigid. A double sealing connector is used to connect the bladder to the suction pump and a control valve is employed to vary the pressure within the bladder so as to soften and harden the bladder as desired. NASA

N79-30922*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIAGNOSIS OF CUTANEOUS THERMAL BURN INJURIES
BY MULTISPECTRAL IMAGING ANALYSIS

Victor J. Anselmo and Bruce E. Zawacki (Univ. of Southern California Medical Center) 1 Sep. 1978 70 p refs Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-162103; JPL-Pub-79-34) Avail: NTIS HC A04/MF A01 CSCL 06E

Special photographic or television image analysis is shown to be a potentially useful technique to assist the physician in the early diagnosis of thermal burn injury. A background on the medical and physiological problems of burns is presented. The proposed methodology for burns diagnosis from both the theoretical and clinical points of view is discussed. The television/computer system constructed to accomplish this analysis is described, and the clinical results are discussed. G.Y.

N79-30923# Oak Ridge National Lab., Tenn.
MUTAGENIC COMPONENTS OF ALTERNATE ENERGY SOURCES

James L. Epler and M. R. Guerin 1978 13 p refs Presented at 71st Air Pollution Assoc. Meeting, Houston, Tex., 25 Jun. 1978

(Contract W-7405-eng-26)
(CONF-780636-8) Avail: NTIS HC A02/MF A01

The use of short term mutagenicity assays to predict the potential biohazard of various crude and complex test materials was examined in a coupled chemical and biological approach. Preliminary chemical characterization and preparation for bioassay, followed by testing in the histidine reversion assay was emphasized. The mutagenicity tests are intended to act as predictors of profound long range health effects such as mutagenesis and/or carcinogenesis, act as a mechanism to rapidly isolate and identify a hazardous biological agent in a complex mixture, and function as a measure of biological activity correlating base line data with changes in process conditions. Mutagenicity tests can also aid in identifying the specific hazardous compounds involved and in establishing priorities for further validative testing, testing in whole animals, and more definitive chemical analysis and monitoring. DOE

N79-30924# California Univ., Berkeley. Lawrence Berkeley Lab.

DEVELOPMENT AND APPLICATION OF RESISTIVE PULSE SPECTROSCOPY: STUDIES ON THE SIZE, FORM AND DEFORMABILITY OF RED BLOOD CELLS Ph.D. Thesis

James P. Yee Jan. 1979 181 p refs

(Contract W-7405-eng-48)
(LBL-8640) Avail: NTIS HC A09/MF A01

The following studies were conducted using the resistive pulse spectroscopy (RPS) technique: cumulative spectra and individual pulse forms for rigid latex polymer spheres; acquisition and analysis of RPS spectral data by means of special computer program; interaction of red blood cells with glutaraldehyde; membrane properties of erythrocytes undergoing abrupt osmotic hemolysis; reversible effects of the binding of chlorpromazine HCl at the red cell membrane surface; effects of high cholesterol diet on erythrocytes of guinea pigs; and multipopulation analysis for a mixture of fetal and maternal red cells. DOE

N79-30925# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

COMPATIBILITY TEST OF OXYGEN EXPOSURES IN THE RANGE OF 2.2 TO 2.8 BAR ABSOLUTE

Horst Krekeler, Pierre Cabarrou, and Hans-Dietrich Fust Feb. 1978 32 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-566)
(DLR-FB-78-10) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 13,10

Decompression tests in the range of 100 to 200 m were performed in a pressure chamber. In the course of decompression helium/oxygen mixtures with a maximal O₂-partial pressure of 2.5 bar are respired. In a special series of experiments the effect of oxygen on the human organism, in particular on the respiratory system was studied. During 2 consecutive weeks, from Monday to Friday, 4 subjects breathed pure oxygen 30 min at 18 m,

60 min at 15m, and 90 min at 12 m. No significant changes indicating a harmful effect from oxygen breathing were observed. Author (ESA)

N79-30926# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

THE INFLUENCE OF HYPERBARIC ENVIRONMENT IN COMBINATION WITH WORKLOAD AND CONFINEMENT ON HUMAN INFORMATION PROCESSING

Klaus-Martin Goeters Jul. 1978 17 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-567)

(DLR-FB-78-12) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 8,20

A test requiring perceptual speed, memory, and numerical ability was given to subjects before and during working conditions with varying degrees of work-load, confinement, and ambient pressure. Results demonstrate that high workload and confinement for several days do not lower the test scores, but rising partial pressure of nitrogen results in performance decrements. These decrements are already present at a N₂-partial pressure of 3 bar abs. Author (ESA)

N79-30927# National Technical Information Service, Springfield, Va.

ALTITUDE HYPOXIA, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1977

Elizabeth A. Harrison May 1979 251 p 2 Vol.

(NTIS/PS-79/0427/9) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 06S

Two hundred and forty-four abstracts of research reports are presented which cover the following topics: stress physiology, narcosis, acceleration tolerance, adaptation (physiology), psychophysiology, respiration, metabolism, and cardiovascular system as applied to altitude hypoxia. None of the entries are new. GRA

N79-30928# National Technical Information Service, Springfield, Va.

ALTITUDE HYPOXIA, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - May 1979

Elizabeth A. Harrison May 1979 23 p Supersedes NTIS/PS-78/0443; NTIS/PS-77/0446; NTIS/PS-76/0378; NTIS/PS-75/237 2 Vol.

(NTIS/PS-79/0428/7; NTIS/PS-78/0443; NTIS/PS-77/0446; NTIS/PS-76/0378; NTIS/PS-75/237) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 06S

The selected abstracts of research reports cover stress physiology, narcosis, acceleration tolerance, adaptation (physiology), psychophysiology, respiration, metabolism and cardiovascular system as applied to altitude hypoxia. (This updated bibliography contains 14 of which are new entries to the previous edition.) GRA

N79-30929# National Technical Information Service, Springfield, Va.

BIOLOGICAL EFFECTS OF MICROWAVES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1977

Elizabeth A. Harrison May 1979 212 p

(NTIS/PS-79/0432/9) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 05R

Two hundred and four articles depicting the radiation hazards, tolerances, and effects of microwaves in humans as well as in animals are reported. GRA

N79-30930# National Technical Information Service, Springfield, Va.

BIOLOGICAL EFFECTS OF MICROWAVES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - May 1979

Elizabeth A. Harrison May 1979 51 p Supersedes NTIS/PS-78/0432, NTIS/PS-77/0455, NTIS/PS-76/0387 and NTIS/PS-75/384

(NTIS/PS-79/0433/7; NTIS/PS-78/0432; NTIS/PS-77/0455; NTIS/PS-76/0387; NTIS/PS-75/384) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 06R

The selected abstracts cover the biological effects on man and animals from exposure to microwaves. In addition to dosages and tolerances, regulations, and standards are included. (This bibliography contains 45 abstracts, 29 of which are new entries to the previous edition.) GRA

N79-30931# Bureau of Radiological Health, Rockville, Md.
SOME CONSIDERATIONS OF HAZARDS IN THE USE OF LASERS FOR ARTISTIC DISPLAYS Final Report

Richard W. Peterson Mar. 1979 21 p refs (PB-294513/7; DHEW/PUB/FDA-79/8082; FDA/BRH-79/74) Avail: NTIS HC A02/MF A01 CSCL 06R

The nature and magnitude of hazards associated with laser light shows are described. Measures to control access to hazardous radiation are also described. Pulsed, reflected and scanned beams, hazards, and legal obligations are considered. GRA

N79-30932# Civil Aeromedical Inst., Oklahoma City, Okla.
THE SELECTION OF AIR TRAFFIC CONTROL SPECIALISTS: TWO STUDIES DEMONSTRATING METHODS TO INSURE AN ACCURATE VALIDITY COEFFICIENT FOR SELECTION DEVICES

James O. Boone and Mary A. Lewis Mar. 1979 11 p refs (AD-A068581; FAA-AM-79-14) Avail: NTIS HC A02/MF A01 CSCL 05/9

Monte Carlo techniques were employed to demonstrate the effect that recruitment procedures can have on the validity coefficient. It is shown that a more homogeneous group of applications results from highly specific recruitment producing a small applicant group variance considerably reduces the validity coefficient when the coefficient is corrected for selection effects; commonly termed restriction in range. A procedure that eliminates this recruitment problem is discussed. A statistical procedure use when it is necessary to eliminate erroneous data. The procedure employs the notions of statistical distance and probability to identify data that has an extremely small likelihood of belonging to the population of the remaining data set. A.W.H.

N79-30933# Civil Aeromedical Inst., Oklahoma City, Okla.
A COMPARISON OF THE JOB ATTITUDES AND INTEREST PATTERNS OF AIR TRAFFIC AND AIRWAY FACILITY PERSONNEL Final Report

Roger C. Smith Mar. 1979 12 p refs (AD-A067826; FAA-AM-79-11) Avail: NTIS HC A02/MF A01 CSCL 05/9

Air traffic control specialists (ATCSs) and airway facility technicians (AFTs) were compared on measures of job attitudes and interests. A total of 792 ATCSs and 2,366 AFTs completed the Strong Vocational Interest Blank (SVIB) and questionnaires concerning job satisfaction and job attitudes. Both groups indicated high overall job satisfaction and general agreement about areas of job satisfaction and dissatisfaction. However, ATCSs reported more satisfaction than AFTs from various aspects of the work itself and from salary, while AFTs were more satisfied with responsibility, working conditions, and Civil Service retirement. The AFTs were more favorable to management than ATCSs.

Author

N79-30934# Systems Research Labs., Inc., Dayton, Ohio.
MULTIPURPOSE DIGITAL SWITCHING AND FLIGHT CONTROL WORKLOAD Final Report, Sep. 1974 - Aug. 1977

Billy M. Crawford, William H. Pearson, and Mark S. Hoffman Wright-Patterson AFB, Ohio AMRL Dec. 1978 35 p refs (Contract F33615-75-C-0127; AF Proj. 2050; AF Proj. 7184) (AD-A069606; AMRL-TR-78-43) Avail: NTIS HC A03/MF A01 CSCL 01/3

Four subjects were tested in a cockpit simulator using a secondary task to measure reserve information processing capacity under two levels of flight control and four levels of multifunction switching. Results suggest that flight control impacts both

input-output and central processing stages whereas mere anticipation of switching tasks effects input-output only. Difficult flight control reduced the effective information processing reserve by 54 percent on the average. The corresponding losses attributable to anticipation of multifunction switching were 20 and 31 percent for simple and complex tasks respectively. The study has implications for design of effective digital processing aids and mental workload measurement. GRA

N79-30935# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

PERSONALITY PROFILES OF DIVERS INVOLVED IN RESEARCH ACTIVITIES

Klaus-Martin Goeters Aug. 1978 25 p refs In GERMAN; ENGLISH summary (DLR-FB-78-11) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 10.70

Twenty-two experienced divers and 19 student divers (first week of training) answered the personality questionnaire TSS. A significant difference between subjects with and without diving experience is observed in the scale Personal Warmth. Here, the scores increase with experience. The remaining scales show no difference between divers and student divers. Obviously, the personality of divers is not very much influenced by diving activities. The typical diver scores high in mobility, aggressiveness, and emotional stability, but low in rigidity, extroversion, and pretentious style of life. Divers do not differ from the normative mean in need of achievement, dominance, and vitality. Author (ESA)

N79-30936# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

PSYCHOLOGICAL SELECTION OF SPACELAB PAYLOAD SPECIALISTS: THE EVALUATION OF GERMAN APPLICANTS

Klaus-Martin Goeters Oct. 1978 33 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-586) (DLR-FB-78-29) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 13.20

Criteria and methods for the psychological selection of scientific astronauts (payload specialists) are described. Results from the evaluation of 103 German Spacelab applicants are reported. The screening tests revealed potentially poor performance and/or personality problems for a number of applicants. Only 30 percent of all applicants were fully accepted. Author (ESA)

N79-30937# General Electric Co., Philadelphia, Pa. Space Div.

AUTOMATED BIOWASTE SAMPLING SYSTEM FECES MONITORING SYSTEM Final Report

S. R. Hunt and E. J. Gianfield 31 Jul. 1979 186 p (Contract NAS9-15159) (NASA-CR-160301; Doc-79SDS028) Avail: NTIS HC A09/MF A01 CSCL 06K

The Feces Monitoring System (FMS) Program designed, fabricated, assembled and tested an engineering model waste collector system (WCS) to be used in support of life science and medical experiments related to Shuttle missions. The FMS design was patterned closely after the Shuttle WCS, including: interface provisions; mounting; configuration; and operating procedures. These similarities make it possible to eventually substitute an FMS for the Shuttle WCS of Orbiter. In addition, several advanced waste collection features, including the capability of real-time inertial fecal separation and fecal mass measurement and sampling were incorporated into the FMS design. G.Y.

N79-30938# Civil Aeromedical Inst., Oklahoma City, Okla.
VISUAL SEARCH PERFORMANCE DURING SIMULATED RADAR OBSERVATION WITH AND WITHOUT A SWEEP-LINE Final Report

Richard I. Thackray and R. Mark Touchstone Mar. 1979 17 p refs (AD-A068020; FAA-AM-79-12) Avail: NTIS HC A02/MF A01 CSCL 05/5

A study was conducted to determine whether or not the presence or absence of a radar sweepline influences attentional processes and, hence, the speed with which critical stimuli can be detected. The visual display was designed to approximate an advanced, highly automated air traffic control radar display containing computer-generated alphanumeric symbols. Twenty-eight men and women, paid volunteers with no previous air traffic controller experience, were tested over a 2-hour session with half of the subjects assigned to the sweep condition and half to the no-sweep condition. Author

N79-30939# Bolt, Beranek, and Newman, Inc., Cambridge, Mass. A DECISION, MONITORING AND CONTROL MODEL OF THE HUMAN OPERATOR APPLIED TO AN RPV CONTROL PROBLEM Final Scientific Report

Ramal Muralidharan, Sheldon Baron, and Carl E. Feehrer Mar. 1979 96 p refs
(Contract F44620-76-C-0029)
(AD-A069880; BBN-4075; AFOSR-79-0675TR) Avail: NTIS HC A05/MF A01 CSCL 05/5

This report describes application of a decision-making, monitoring and control model (DEMON) for the human operator to a task involving control of Remotely Piloted Vehicles (RPVs). The DEMON model is an extension of the Optimal Control Model (OCM) of the operator derived by infusion decision theoretic notions into the basic OCM structure. The resulting model is designed to treat situations in which control actions may be infrequent and monitoring and decision-making are the operator's main tasks. The analysis of this problem illustrates some of the major considerations in applying DEMON to complex, supervisory control problems. It shows that with fairly straightforward assumptions about the operator's task, DEMON will give reasonable predictions of performance. However, the model results are not compared with actual data so DEMON is presently unvalidated. The development of DEMON was part of a three year research program for the Air Force Office of Scientific Research aimed at investigating human performance models. The report also provides a brief summary of the overall effort. GRA

N79-30940# Bolt, Beranek, and Newman, Inc., Cambridge, Mass. DEVELOPMENT OF HUMAN PERFORMANCE MODELS FOR MAN-MACHINE SYSTEM SIMULATION Interim Report, 1 Oct. 1976 - 30 Sep. 1977

Duncan C. Miller, Ramal Muralidharan, Sheldon Baron, Carl E. Feehrer, and Richard W. Pew Oct. 1978 78 p refs
(Contract F44620-76-C-0029; AF Proj. 2313)
(AD-A069879; BBN-3739; AFOSR-79-0674TR) Avail: NTIS HC A05/MF A01 CSCL 05/5

This report contains discussions and program flow charts pertinent to bottom-up and top-down models developed by BBN to predict the performance of RPV controllers. Included are brief discussions of the control task itself and of problems and issues encountered during model development. GRA

N79-30941# Perceptronics, Inc., Woodland Hills, Calif. ADAPTIVE ESTIMATION OF INFORMATION VALUES IN CONTINUOUS DECISION MAKING AND CONTROL OF ADVANCED AIRCRAFT Annual Technical Report

Randall Steeb, Kent Davis, Yoram Alperovitch, and Amos Freedy Dec. 1978 79 p refs
(Contract F44620-76-C-0094; AF Proj. 2313)
(AD-A069741; PATR-1037-78-12; AFOSR-79-0691TR) Avail: NTIS HC A05/MF A01 CSCL 05/8

This report describes research and development centered on evaluation of information needs in advanced aircraft operations. The selection of information for display is a recurrent, subjective decision involving many factors -- aircraft state, environmental conditions, operator capabilities, and acquisition costs, among others. An adaptive computer model has been developed which incorporates these factors into a multi-attribute decision model. The program is designed to capture the operator's information seeking policy using a training algorithm based on pattern recognition techniques. The individual policy is then used for information system evaluation and for automated information management. Experimental tests of the adaptive modeling and information management approaches were made using a task

simulation resembling multiple intercept operations in advanced aircraft. Individual subjects (12 in study) navigated a simulated aircraft through a hazardous, changing environment. In doing so, the operators selected from five information sources of varying content, cost, delay and detectability. The information was then used to take one of a number of control actions. Information management; using either adaptive estimation or off-line direct policy elicitation, was found to result in improved task performance over manual selection, particularly in high speed stress conditions. The adaptive estimation technique was found to be superior to direct policy elicitation, both for automated information management and as a basis for information source evaluation. Possible applications of the techniques are also discussed. GRA

N79-30942# Illinois Univ. at Urbana-Champaign. Engineering-Psychology Lab.

DEVELOPMENT AND UTILIZATION OF INTERNAL MODELS IN DYNAMIC SYSTEMS: A COMPARISON OF MONITORS AND OPERATORS AS FAILURE DETECTORS Interim Report

Colin Kessel and Christopher D. Wickens Dec. 1978 102 p refs
(Grant AF-AFOSR-3380-77)
(AD-A069730; EPL-78-2/AFOSR-78-5; AFOSR-79-0683TR) Avail: NTIS HC A06/MF A01 CSCL 05/8

The development of the internal model as it pertains to the detection of step changes in the order of control dynamics is investigated for two modes of participation: when the subjects are actively controlling those dynamics and when they are monitoring the same dynamics under autopilot control. The experiment used a transfer of training design to evaluate the relative contribution of proprioception and visual information to the overall accuracy of the internal model. The subjects either tracked or monitored the system dynamics of a 2-dimensional pursuit display under single task conditions and concurrently with a sub-critical tracking task at two difficulty levels. Detection performance was faster and more accurate in the manual as opposed to the autopilot mode. The cue utilization strategies of the subjects were analyzed by ensemble averaging technique and it was found that monitors of automatic systems who have had prior manual experience rely upon different perceptual cues in making their detection responses than those who have not. The proprioception channel was found to have an attention focusing role and once incorporated into the internal model this attention focusing mechanism can be used to advantage even when there is no proprioceptive feedback. GRA

N79-30943# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Plant.

IMPROVED AIRLINE-TYPE SUPPLIED-AIR PLASTIC SUIT

L. Jolley, Jr., D. B. Zippler, C. H. Cofer, and J. A. Harper Jun. 1978 15 p ref
(Contract EY-76-C-09-0001)
(DPSPU-78-30-12; Conf-780657-3) Avail: NTIS HC A02/MF A01

Two piece supplied-air plastic suits are used extensively at the Savannah River Plant for personnel protection against inhalation of airborne plutonium and tritium. Worker comfort and noise level problems gave impetus to development of an improved suit and aid distribution system. The resulting plastic suit and development work are discussed. The plastic suit unit cost is less than \$20, the hearing zone noise level is less than 75 dBA, protection factors exceed 10,000, and user comfort is approved. This suit is expected to meet performance requirements for unrestricted use. DOE

N79-30944# Ingenieurbuero fuer Ergonomie, Munich (West Germany).

ERGONOMIC RESEARCH INTO HUMAN TOLERANCES FOR ROLL AND PITCH AS WELL AS THEIR INFLUENCE ON INDIVIDUAL PERCEPTION AND REACTIONS TO CONTROL PARAMETERS [ERGONOMISCHE UNTERSUCHUNGEN UEBER DIE ZUMUTBARKEIT VON ROLL- UND NICKSWINGUNGEN UND DEREN EINFLUSS AUF DIE AUFNAHME

UND VERABEITUNG VON INFORMATIONEN DURCH DEN MENSCHEN]

Peter Bubb Bonn Bundesmin. der Verteidigung Sep. 1978
71 p refs In GERMAN; ENGLISH summary
(BMVG-FBWT-78-18) Avail: NTIS HC A04/MF A01; Bundesmin.
der Verteidigung, Bonn DM 30

Various flight conditions are compared for their effect on human control performance. The decrease in tracking efficiency under random roll conditions is also evaluated. Controlled elements were selected in reference to the literature. The dynamic properties of the controlled elements were normalized to be characteristic of a low frequency input signal. A tracking task was introduced which was compensatory in two dimensions. Results indicate that low order vibration stress has a greater effect on tracking performance than high order vibration inputs. Further investigations of data point out that the tracking error is not simply composed of an independent input-correlated vibration correlated error-term. It is assumed that these results are due to an adaptive variation of parameters describing the motor processes of the human operator. Author (ESA)

N79-30945# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

A STUDY OF PILOT/OBSERVED INTERACTION IN ALIGNING A HELICOPTER WITH A TARGET

Erhard Danneburg Nov. 1978 34 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-480)

(DLR-FB-79-04) Avail: NTIS HC A03/MF A01

Speed and stability of the alignment of a helicopter with a target are investigated by means of a system simulation. Variables are the maximum yaw rate of the helicopter, the maximum pan rate of the steerable sight or sensor and their optical magnification. The results obtained provide favorable combinations of these parameters for two different cases, i.e. target acquisition and target already picked by means of the sight or sensor, respectively. Author (ESA)

N79-30946# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

A METHOD FOR SEMI-AUTOMATIC ANALYSIS OF EYE MOVEMENTS

Hans Radke Dec. 1978 33 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-475)

(DLR-Mitt-79-02) Avail: NTIS HC A03/MF A01

A semi-automatic computer aided procedure for analyzing data on human eye movement/point-of-regard relationships is described. The use of this technique for the measurement and analysis of a pilot's visual behavior is demonstrated. The resultant data is used for human factors research into the optimal layout of displays and controls in a cockpit. Compared with previous techniques for gathering eye-point-of-regard data, which were difficult and time-consuming, the computer aided method show considerable reduction in the time needed for data analysis.

Author (ESA)

N79-31895*# National Aeronautics and Space Administration, Washington, D. C.

OBTAINING GROWTH HORMONE FROM CALF BLOOD

L. A. Kalchev, K. K. Ralchev, and I. T. Nikolov Aug. 1979 9 p refs Transl. into ENGLISH from Godishnik Sofiiska Univ. Biol. Fak. (Sofia), vol. 62, bk. 1, 1967-1968 p 175-181 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Dept. of Animal Physiol.

(Contract NASw-3199)

(NASA-TM-75326) Avail: NTIS HC A02/MF A01 C SCL 06C

The preparation of a growth hormone from human serum was used for the isolation of the hormone from calf serum. The preparation was biologically active - it increased the quantity of the free fatty acids released in rat plasma by 36.4 percent. Electrophoresis in Veronal buffer, pH 8.6, showed the presence of a single fraction having mobility intermediate between that of alpha and beta globulins. Gel filtration through

Sephadex G 100 showed an elutriation curve identical to that obtained by the growth hormone prepared from pituitary glands. A.W.H.

N79-31896# Civil Aeromedical Inst., Oklahoma City, Okla. EFFECTS OF PROPRANOLOL ON TIME OF USEFUL FUNCTION (TUF) IN RATS

E. A. Higgins, J. M. McKenzie, G. E. Funkhouser, and S. R. Mullen Mar. 1979 14 p refs

(AD-A068535/4; FAA-AM-79-10) Avail: NTIS HC A02/MF A01 C SCL 06/3

To assess the effects of propranolol on tolerance to rapid decompression, a series of experiments was conducted measuring time of useful function (TUF) in rats exposed to a rapid decompression profile in an altitude chamber. In other experiments TUF was measured for rats exposed to an oxygen/nitrogen gas mixture which produced a hypoxic condition equivalent to that in the decompression experiments. The findings were: (1) Rats become less tolerant to hypoxia of an onset rate comparable to that of rapid decompression when given propranolol, and this intolerance is further exacerbated by an increase in physical exertion. (2) Younger animals are more susceptible to this type of hypoxia, but propranolol has no greater effect on hypoxia tolerance in younger animals. (3) None of the reduced tolerance can be attributed to a shift in the oxyhemoglobin dissociation curve. In rats the curve is shifted slightly to the left, whereas, in man, there is a reported shift to the right. Author

N79-31897# California Univ., Irvine.

DIRECT EXPOSURE OF MONOLAYERS OF MAMMALIAN CELLS TO AIRBORNE POLLUTANTS IN A UNIQUE CULTURE SYSTEM Annual Progress Report, 1 Jun. 1977 - 31 May 1978

Ronald E. Rasmussen, T. Timothy Crocker, G. Scott Samuelson, M. E. Witte, and J. T. Taylor Aug. 1978 21 p ref (Grant AF-AFOSR-3343-77)

(AD-A069822; AFOSR-79-0694TR; APR-1) Avail: NTIS HC A02/MF A01 C SCL 06/20

A 6-chamber system for the exposure of mammalian cells to pollutant gases has been assembled and tested. The system allows exposure of monolayers of cells to various concentrations of nitrogen dioxide and recovery of the cells for analysis. Capability for exposure to ozone and sulfur dioxide alone or in combination is being added to the system. Studies with cell lines derived from human and rodent respiratory tissue have shown that the cells are extremely sensitive to inhibition of cell replication at low levels of (nitrogen dioxide) (0.15 ppm) and ozone (0.05 - 0.08 ppm). This effect does not seem to be due to the solution of the gases in the growth medium but rather due to a direct effect on the cells. GRA

N79-31898# Utah Univ., Salt Lake City. Dept. of Biology. ENERGY TRANSFER MECHANISMS IN PHOTOBIOLOGICAL REACTIONS Final Report, 1 Apr. 1960 - 31 Mar. 1979

John D. Spikes 31 Mar. 1979 21 p refs

(Contract EY-76-S-02-0875)

(COO-875-180) Avail: NTIS HC A02/MF A01

Steady-state kinetic studies, flash photolysis and spectral studies, and product formation studies of the sensitized photo-oxidation of the five susceptible amino acids (cysteine, histidine, methionine, tryptophan, and tyrosine) and their derivatives, as well as purines and pyrimidines were carried out. The mechanisms of the photodynamic inactivation of enzymes (trypsin, ribonuclease, lysozyme) were investigated. Mechanisms of photosensitization were also studied. DOE

N79-31899# Committee on Government Operations (U. S. House).

RADIATION PROTECTION

Washington GPO 1978 568 p refs Hearings before a Subcomm. of the Comm. on Government Operations, 95th Congr., 2d Sess., 18-19 Apr., 13 Jul. 1978

(GPO-35-583) Avail: Comm. on Government Operations

The governmental structure which was created to deal with the problem of radiation, and which is charged with the protection

of the public from the hazards of radiations is reviewed. In particular, the role of the Environmental Protection Agency in protecting the public from radiation hazards is examined. The agency is examined as to whether its authorities are clear, whether it has the necessary resources to carry out its mission, whether the administration is providing necessary support, and whether the other agencies are cooperating with it. G.Y.

N79-31900# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Hearing Biocoustics and Biomechanics.

THE EFFECTS OF WHOLE-BODY VIBRATION ON HEALTH
Mar. 1979 11 p refs
(Contract N00014-79-C-0060)

(AD-A068478) Avail: NTIS HC A02/MF A01 CSDL 06/16
For most common prolonged occupational exposures to whole-body vibration there appears to be little or no direct risk to health. However, it is possible that exposure could be annoying or painful and this could lead to functional alterations such as muscular weakness, high blood pressure, fatigue, or decreased nerve conduction velocity. Exposure may also act to exacerbate existing disease states. Specific research guidelines are offered.

GRA

N79-31901# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

MODELS AND ANALOGUES FOR THE EVALUATION OF HUMAN BIODYNAMIC RESPONSE, PERFORMANCE AND PROTECTION

H. E. Vongierke, ed. (AMRL) Jun. 1979 404 p refs In ENGLISH; partly in FRENCH Presented at the Aerospace Med. Panel's Specialists' Meeting, Paris, 6-10 Nov. 1978 (AGARD-CP-253; ISBN-92-835-0240-X) Avail: NTIS HC A18/MF A01

Whole body kinematic models for the prediction of body motion are considered as well as spinal models, head-neck models, and heat injury models for the prediction of internal stress and strain and injury probability under escape, crash, and windblast conditions. Cardiovascular models are included to describe and explain human response to sustained acceleration and air combat maneuvers. Biodynamic models interpreting physiological and performance response as well as human operator control capability in vibration and roll motion environments are also presented. Operational injury analyses as well as laboratory human and animal data are discussed as a basis for further model development and validation. Applications of the models include the prediction of body motions, physiological response and injury probability under biodynamic stress and the assistance in protective system, crashworthiness, and cockpit design.

N79-31902# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

PREDICTION OF WHOLE-BODY RESPONSE TO IMPACT FORCES IN FLIGHT ENVIRONMENTS

Ints Kaleps In AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 14 p refs

Avail: NTIS HC A18/MF A01

The general predictive and structural properties of human body gross motion simulation models and their applicability to flight associated problems are discussed. A specific application of such a model is demonstrated by the simulation of human response to whole body-G sub x impact and the comparison of the results with experimentally observed human responses to the same dynamic exposures. The simulations were performed using the articulated total body (atb) computer model based on rigid body mechanics and possessing a number of internal and external force and constraint options to reflect resistive forces within human joints and to allow the interaction of external configurational elements. The predicted data of limb motions, their accelerations and forces generated in the harness restraint system are compared with those obtained experimentally from acceleration transducers on the head and chest of human test subjects. The model structure and its dynamic modeling capability, the general data input requirements, the specific set of data used for the -G sub x impact simulations, and some of the

shortcomings and required improvements indicated by the simulation are discussed. J.M.S.

N79-31903# Dayton Univ. Research Inst., Ohio.
PROCEDURES USED TO GENERATE INPUT DATA SETS FOR THE ARTICULATED TOTAL BODY MODEL FROM ANTHROPOMETRIC DATA

Duane G. Leet In AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 15 p refs

Avail: NTIS HC A18/MF A01

Computer software simulation techniques used to evaluate safety aspects of aircraft ejection are discussed with emphasis on generation of input data sets from anthropometric data to define body segments and motion. Body segment inertial data, joint locations, segment contact ellipsoids, and body and joint axes orientation are among the input data required on each segment. The techniques developed to generate these data sets are described. J.M.S.

N79-31904# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

CORRELATION OF MECHANISM OF EXTREMITY INJURY AND AERODYNAMIC FACTORS IN EJECTIONS FROM F-4 AIRCRAFT

Steven P. Combs In AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 4 p refs

Avail: NTIS HC A18/MF A01

Extremity injuries incurred during the ejection sequence in 43 of 399 F-4 ejections were analyzed. Of the 43 ejections there were 95 extremity injuries. The injuries were divided into two groups: severe and minimal. Severe injuries consisted of fractures, dislocations, ligamentous tears and nerve palsies. There were 61 severe injuries. Minimal injuries consisted of contusions, lacerations, minor sprains. There were 34 minimal injuries. The 61 severe injuries were divided into 39 upper extremity injuries and 22 lower extremity injuries. The majority of the severe upper extremity injuries involved the proximal joints and the majority of the severe lower extremity injuries involved the distal joints. When the windblast/windflail injuries were compared to the various variables correlation was seen with the knots indicated airspeed, aircraft attitude, and aircraft type. The incident of extremity injury increases with increased airspeed, a nose down attitude, and decreases in the RF-4C aircraft configuration. J.M.S.

N79-31905# Technische Hochschule, Darmstadt (West Germany). Inst. fuer Mechanik.

REFERENCE PARAMETERS FOR SHOCK INPUTS AND SHOCK TOLERANCE LIMITS

K. E. Meier-Doernberg In AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 18 p refs

Avail: NTIS HC A18/MF A01

A data reduction technique based on control techniques and system analysis but adapted and extended for the purpose of single shock events in nonlinear systems is described. The major features of the method include evaluation and definition of system relevant input quantities and of input relevant system properties as reference parameters and uniform plotting of the various deduced shock data input values, exposure limits, safety requirements, test and design parameters, standard Fourier and response spectra in terms of the defined reference parameters. As examples, severity criteria, models, and methods which are used to describe head or whole body tolerance are compared with data by means of the established reference parameters in order to discuss their mechanical meaning and suitable range of application. J.M.S.

N79-31906# Naval Aerospace Medical Research Lab., New Orleans, La.

MULTIAXIS DYNAMIC RESPONSE OF THE HUMAN HEAD AND NECK TO IMPACT ACCELERATION

C. L. Ewing, D. J. Thomas, and L. Lustick *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 27 p refs

Avail: NTIS HC A18/MF A01

The complete kinematic response of the head and the first thoracic vertebral body was measured over the range of variables required for human analog development during impact acceleration experiments. The relationships of the kinematic variables are graphically presented and statistically analyzed. A head and neck model for two dimensional response is evaluated. The approaches and constraints for a three dimensional model are evaluated. Anthropometric effects on the dynamic response are presented. The data base serves as a basis for the validation of human surrogate head and neck response to -X and +Y acceleration. J.M.S.

N79-31907# Naval Aerospace Medical Research Lab., New Orleans, La.

TRANSIENT INTRAVENTRICULAR CONDUCTION DEFECTS OBSERVED DURING EXPERIMENTAL IMPACT IN HUMAN SUBJECTS

P. L. Majewski, T. J. Borgman, Jr., D. J. Thomas, and C. L. Ewing *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 11 p refs

Avail: NTIS HC A18/MF A01

Impact acceleration research utilizing normal human volunteer subjects and electrocardiographic monitoring is discussed. Four episodes of transient intraventricular conduction disturbances are presented and discussed relative to previous clinical and experimental investigations. J.M.S.

N79-31908# Wayne State Univ., Detroit, Mich. Bioengineering Center.

SIMULATION OF HEAD AND NECK RESPONSE TO -G SUB x AND +G SUB z IMPACTS

A. I. King, S. S. Nakhla, and N. K. Mital *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 13 p refs

(Contract N00014-75-C-1015)

Avail: NTIS HC A18/MF A01

A two dimensional mathematical model of the spine was exercised to identify mechanisms of neck injury due to hyperflexion. Loss of pilots due to ditching at sea was one of the motivations for this study. It was found that helmets have the potential of increasing injury severity particularly during a combined +G sub z and -G sub x impact, with the pulses coincident in time. The four parameters that are potentially injurious are neck shear, chin-chest contact force, odontoid process excursion into the spinal canal and spinal cord stretch. R.E.S.

N79-31909# Yale Univ., New Haven, Conn. Engineering Lab. for Musculoskeletal Diseases.

A THREE-DIMENSIONAL MATHEMATICAL ANALOGUE OF THE SPINE STRUCTURE: A COMPREHENSIVE APPROACH

Manohar M. Panjabi *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 10 p refs Sponsored in part by NIH

Avail: NTIS HC A18/MF A01

The human spine was viewed as a collection of functional spinal units, each unit consisting of two adjacent vertebrae and the interconnecting soft tissue. Mathematically this unit of the spine was modelled as two rigid bodies connected by a single deformable link. The latter was a three dimensional three element viscoelastic solid. Experimental techniques were developed which provide the physical properties of the human functional spinal units in three dimensional space. These properties incorporated into a three dimensional mathematical model provided, for the first time, a mathematical analog of the spine which was entirely based upon experimentally derived spine data. R.E.S.

N79-31910# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

A THREE DIMENSIONAL DISCRETE ELEMENT DYNAMIC MODEL OF THE SPINE, HEAD AND TORSO

Ted Belytschko and Eberhart Privityzer *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 15 p refs Prepared in cooperation with Stanford Res. Inst., Menlo Park, Calif.

(Contracts F33615-76-C-0506; F33615-78-C-0523)

Avail: NTIS HC A18/MF A01

A three dimensional, discrete model of the human spine, head and torso is described. This model is an evolution of earlier discrete models which are reviewed and discussed. The anatomy was modeled by a collection of rigid bodies, which represent skeletal segments such as the vertebrae, pelvis, and ribs, interconnected by deformable elements, which represent ligaments, cartilagenous joints, viscera and connective tissues. The model was validated by comparing its impedance to measurements on human volunteers. The principal feature of this model is the generality of its formulation which enables it to be applied to a wide variety of impact situations. Simulations are reported for a vertical ejection, a pre-ejection alignment and bird impact on a canopy. A postprocessor was developed which interprets the complex time history output in terms of injury potential. R.E.S.

N79-31911# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

APPLICATION OF BIODYNAMIC MODELS TO THE ANALYSIS OF F-16 CANOPY BIRDSTRIKE

Lawrence J. Specker, Norman S. Phillips (Dayton Univ. Res. Inst.), and James W. Brinkley *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 12 p refs

Avail: NTIS HC A18/MF A01

High speed film data were analyzed from F-16 birdstrike tests to quantitatively define the deflection motion as a function of the initial test conditions. Crewmember position studies indicated probable head contact with the canopy surface during birdstrike at comfortable seating positions. Helmet size and crewmember size were shown to have a negligible effect on increasing clearance between helmet and canopy. A specially instrumented head-neck apparatus was designed and used in the tests to measure the accelerations of the head and the impact forces and moments at the head and neck. The acceleration data from the head-neck test apparatus were used as input to a head injury severity prediction model to determine the level of injury sustained by the pilot. The force data were compared to known injury force levels. A second approach involved the use of the photometric data to describe the response shape and velocity of the canopy and inertial properties associated with the impact as a driving input to a computer model of the helmeted crewman to further evaluate the crewman response to birdstrike. Author

N79-31912# Strathclyde Univ., Glasgow (Scotland). Bioengineering Unit.

A FAILURE CRITERION FOR HUMAN, VERTEBRAL, CANCELLOUS BONE

M. J. Percy and J. H. Evans *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 7 p refs

Avail: NTIS HC A18/MF A01

In order to define a realistic criterion of failure, the compression and shear characteristics of human, vertebral, cancellous bone were investigated. To produce shear, torsion tests were used and the atmospheric environment during the tests was controlled to simulate physiological conditions. A rational mathematical characterization of the bone was developed to enable a realistic failure criterion to be established, encompassing the large biological variation of the results. The mechanical characteristics of the bone are complex but an elementary consideration of anisotropy led to a characterization that would appear to be sufficient. R.E.S.

N79-31913# Royal Air Force, Halton (England). Inst. of Pathology and Tropical Medicine.

INJURY MECHANISMS ANALYSIS IN AIRCRAFT ACCIDENTS

I. R. Hill *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 10 p refs

Avail: NTIS HC A18/MF A01

An analysis of 30 fatal aircraft accidents, some of which were survivable shows that the basic mechanisms of injury are common to many different accidents. From the investigation the following conclusions can be made: (1) serious or fatal head injury is the single most serious problem in aircraft accidents, particularly in light aircraft; (2) there is a wide margin in injury severity between survivors and fatalities; (3) restraint systems are still inadequate, especially for passengers; (4) the severity of injury is increased by: (a) 'ejection' from the aircraft, (b) severe damage to the airframe, (c) poor design features such as badly sited fuel tanks; (5) the principle method of serious injury is forward flexion over a lap belt; and (6) mathematical scoring of injuries makes more accurate analysis of accidents a feasible proposition. R.E.S.

N79-31914# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamics and Bioengineering Div.

THE VALIDATION OF BIODYNAMIC MODELS

Leon E. Kazarian and Henning E. vonGierke *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 14 p refs

Avail: NTIS HC A18/MF A01

The biological data required for developing and validating an axial musculoskeletal computer model of subhuman primates that in turn can be used to support the validation of a human response model and assist in predicting human tolerance is presented. Comparisons are made between the various validation approaches. The shortcomings and advantages of the various types of biodynamic data presently collected and available are delineated. Comparative whole body primate spinal impact tolerance curves are presented. Some physical constants for subhuman primate tissue are given, and areas where additional data are required to validate a subhuman primate model are identified. M.M.M.

N79-31915# Kentucky Univ., Lexington.

FREQUENCY RESPONSE OF CARDIOVASCULAR REGULATION IN CANINES TO SINUSOIDAL ACCELERATION AT FREQUENCIES BELOW 1 Hz (BASIS FOR BIODYNAMIC MODELING)

C. F. Knapp, J. A. Marquis, J. M. Evans, and D. R. Randall *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 17 p refs

(Contract F44620-74-C-0012)

Avail: NTIS HC A18/MF A01

Sinusoidal, whole body acceleration was used as a noninvasive forcing function to the cardiovascular system of unanesthetized, chronically instrumented canines to determine the low frequency (less than 1 Hz) dynamics of integrated barostatic cardiovascular regulation. Aortic pressure and flow, right and left ventricular pressure, heart rate and spinal axis acceleration were digitally sampled and filtered. The filtered data were then Fourier analyzed. The participation of neurally-mediated cardiac and vascular baroreflex mechanisms in the overall response was evaluated by comparing the subjects' response in a reflexive and nonreflexive condition. Transfer functions were then derived to describe the passive acceleration-induced intravascular pressure disturbances and the control action of the major baroreflex mechanisms. The dynamic (oscillatory) frequency response of the major cardiac and vascular baroreflex mechanisms was found to be limited primarily to the frequency range below 0.10 Hz. A comparison of the participation of cardiac and vascular mechanisms in the overall responses indicated that barostatic control is achieved principally via the systemic vascular mechanisms below 0.02 Hz, via the cardiac mechanisms from 0.04 to 0.10 Hz, and by the combined action of the two between 0.02 and 0.04 Hz. M.M.M.

N79-31916# School of Aerospace Medicine, Brooks AFB, Tex. Biodynamics Branch.

MATHEMATICAL MODELING OF ARTERIAL OXYGEN SATURATION AND EYE-LEVEL BLOOD PRESSURE DURING +G SUB Z STRESS

Kent K. Gillingham and Richard C. McNee *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 7 p refs

Avail: NTIS HC A18/MF A01

Mathematical descriptions of the dynamics of human arterial oxygen saturation (SaO₂) and eye-level arterial blood pressure (ELBP) under conditions of varying +G sub Z stress were obtained by Fourier analysis. Simulated aerial combat maneuvering (SACM) G-stress profiles and the resulting physiological responses to the G stress provided input-output data from which transfer functions were derived. Ensemble averaging of single-run transfer functions generated enhanced empirical G-to-SaO₂ and G-to-ELBP transfer functions, which were approximated by various synthetic functions. Examination of predictive abilities of the empirical and synthetic transfer functions was accomplished by comparison of predicted and mean actual responses to SACM and nonSACM G-stress profiles. Author

N79-31917# Missouri Univ. -Rolla.

UNSTEADY-STATE RESPONSE OF THE VASCULAR SYSTEM TO TRANSIENT AND SUSTAINED AEROSPACE ACCELERATION PROFILES

Xavier J. R. Avula and Hans L. Oestreicher *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 9 p refs Prepared in cooperation with AMRL

Avail: NTIS HC A18/MF A01

A mathematical method to determine the response of the blood vessels to transient and sustained acceleration forces is presented. The method is based on coupling of the Navier-Stokes equations for blood flow and the large elastic deformation theory for the deformation of the blood vessels, and solving them numerically under the appropriate initial and boundary conditions. A mathematical reasoning to neglect the effect of acceleration on microcirculation per se is given. However, microcirculation is indirectly affected by acceleration forces which tend to pool blood and bring about pressure changes in large vessels. Aortic pressures are calculated for examples of monotonically increasing and transient -G sub Z acceleration profiles, and one of the solutions is compared with an available, experimentally measured pressure from an animal experiment. In the absence of proper physiological scaling laws, the qualitative agreement between the theory and experiment is satisfactory. M.M.M.

N79-31918# Naval Civil Engineering Lab., Port Hueneme, Calif. A HEAD INJURY MODEL

Carley Ward *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 12 p refs

(Contract DOT-HS-5-01132)

Avail: NTIS HC A18/MF A01

The history of analytical head injury modeling is briefly reviewed, and the design restrictions that limit their usefulness are discussed. One of the most recent models, a linear finite element idealization of the human brain, is presented. Intracranial pressures computed by this model are compared to pressures measured in human cadaver head impact tests. The computed pressures and observed injuries are correlated for a series of ten tests. Injury prediction based on maximum intracranial pressure is compared to prediction based on the Gadd Severity Index and the Head Injury Criterion Index. It was concluded that adequate padding of possible head impact surfaces and helmets could be very effective in preventing the type of injury observed in these tests. Such padding would eliminate the high-magnitude, impulsive-type head accelerations that produce high-magnitude pressure pulses in the brain. M.M.M.

N79-31919# Rehabilitationsklinik Loipl, Bischofswiesen-Berchtesgaden (West Germany).

POTENTIAL RELATIONSHIP BETWEEN HUMAN CENTRAL NERVOUS SYSTEM INJURY AND IMPACT FORCES BASED ON PRIMATE STUDIES

F. Unterharnscheidt and C. L. Ewing *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 8 p refs Prepared in cooperation with Naval Aerospace Med. Res. Lab., New Orleans

Avail: NTIS HC A18/MF A01

Different species of monkeys underwent impact acceleration forces delivered to the head and neck by three different mechanisms. The first applied linear impact forces directly to the calvarium of the animal approximately through the center of gravity of the head resulting primarily in translational motion and deformation of the calvarium. The second mechanism applied angular impact forces directly to the calvarium by a device molded to the calvarium which forces the head through 45 degrees of forward flexion. The third mechanism applied impact forces indirectly to the head and neck by acceleration of the entire animal using a pelvic-torso restraint in which the head and neck were unrestrained. Low level, no injury experiments to high level, fatal injury experiments were accomplished by each mechanism.

G.Y.

N79-31920# Army Aeromedical Research Lab., Fort Rucker, Ala. Bioengineering and Life Support Equipment Div.

CORRELATION OF HEAD INJURY WITH MECHANICAL FORCES BASED ON HELMET DAMAGE DUPLICATION

Bruce Slobodnik *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 12 p refs

Avail: NTIS HC A18/MF A01

Human tolerance to head impact was assessed by correlating the force levels required to duplicate damage seen in 14 SPH-4 aviator helmets retrieved from US Army helicopter crashes with resulting head injury. The data obtained were used to validate the following: (1) the Wayne State University Concussive Tolerance Curve; (2) the Severity Index value of 1500 currently used in the US by the National Operating Committee on Standards for Athletic Equipment as the concussive threshold for helmeted head impacts; (3) the Head Injury Criterion value of 1000 currently used in the US by the Department of Transportation in occupant crash protection tests as the concussive threshold for impacts to the unprotected head; (4) the peak acceleration value of 400 G currently used by the US Army in evaluating aircrew protective headgear as the survivable limit; and (5) the peak transmitted force value of 5000 lb currently specified in British Standard 2495 as the survivable limit for helmeted head impacts.

G.Y.

N79-31921# Naval Aerospace Medical Research Lab., New Orleans, La.

THE EFFECT OF IMPACT ACCELERATION ON THE ELECTRICAL ACTIVITY OF THE BRAIN

Marc S. Weiss and Michel D. Berger *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 9 p

Avail: NTIS HC A18/MF A01

In a series of pilot experiments, eight Macaca Mulatta with chronically implanted cortical recording electrodes were tested using a range of -X impact accelerations. Both EEG and somatosensory evoked potential (SEP) data were collected and analyzed. The results suggest that for the peak acceleration levels used (281 m/sq s to 1550 m/sq s) the SEP is a more sensitive index of the inertial load on the brain than is the EEG. In particular, the duration of changes in shape of the early part (less than 100 ms latency) of the SEP is monotonically related to the peak sled acceleration. This has important implications for the physiological monitoring of human subjects in impact acceleration experiments.

G.Y.

N79-31922# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

A HUMAN BODY AND CREW STATION MODELLING SYSTEM FOR MOTION STUDIES

George D. Frisch (Naval Aerospace Medical Research Lab., New Orleans) *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 13 p refs

Avail: NTIS HC A18/MF A01

The need to visualize and interpret human body movement data from experiments and simulations led to the development of a computerized, three dimensional representation of the human body and crew station. Particular emphasis was placed on head and neck motion within the confines of the A7E, LAMPS H2, and F18 crew stations, although the program is general enough to accommodate any geometrical configuration. There are numerous computer programs for the analysis or simulation of human movement in various environments, but perhaps the only common feature of all these systems is that they produce motion data to manipulate some skeletal model of the human body. Dissatisfaction with existing body models and stick figure displays led to the development of a human and crew station model for the computer with distinct advantages in display realism, movement definition, collision or interaction detection and cost-effectiveness in a real-time animation play-back environment.

G.Y.

N79-31923# Army Aviation Research and Development Command, Fort Eustis, Va.

THE USE OF MATHEMATICAL MODELING IN CRASH-WORTHY HELICOPTER SEATING SYSTEMS

George T. Singley, III and Joseph L. Haley *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 21 p refs Prepared in cooperation with Army Aeromed. Res. Lab., Fort Rucker, Ala.

Avail: NTIS HC A18/MF A01

Crashworthy helicopter accident data revealing injury types related to seat design, seat occupant injury criteria, recent crashworthy seat test data, and crashworthy seat/occupant modeling technology are discussed. The designer's dilemma in finding the minimum injury solution by designing to the many conflicting variables is presented. The relationship between the spinal vertebra stress-strain characteristics and irreversible injury is discussed.

G.Y.

N79-31924# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

MAN, DUMMY, TEST VEHICLE: A COMPARISON OF TEST RESULTS FOR ESCAPE SYSTEMS WITH THE 3 DIFFERENT TEST METHODS

H.-D. Melzig, E. A. Bockemueller, and U. Schmidt *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 8 p ref

Avail: NTIS HC A18/MF A01

To prove the validity of experimental results gained with dummies or test vehicles for the qualification of man carrying parachutes, series of tests were conducted with parachute jumpers and their 2 analogues: rubber torso dummies and bomb shaped test vehicles. The results for the maximum filling force (opening shock) show significant differences, with highest values for the test vehicle, 75% less for the rubber dummy and an additional 75% less for the man.

G.Y.

N79-31925# Centre d'Essais en Vol, Bretigny-sur-Orge (France). **TENTATIVE ESTIMATION OF THE INJURIES LIKELY TO OCCUR DURING THE CRASH OF A SA 341 GAZELLE HELICOPTER, FROM A STUDY ON MANNEQUINS [TENTATIVE D'ESTIMATION DES LESIONS POUVANT SURVENIR AU COURS D'UN CRASH D'HELICOPTERE GAZELLE SA 341 A PARTIR D'UNE ETUDE SUR MANNEQUINS]**

B. Vettes and R. Eckert *In* AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 19 p refs *In* FRENCH

Avail: NTIS HC A18/MF A01

An SA 341 Gazelle helicopter was released to the ground with equal horizontal and vertical speeds in order to estimate the chances of survival of the occupants, to improve the resistance of the structure, and to construct a mathematical model of an

anticrash structure. Besides the different instruments fixed on the structures, three anthropometric dummies, clothed to represent the pilot, the copilot, and a passenger, were installed and equipped with accelerometers in the head, thorax, and pelvis. A constraint gauge was placed in the dorsal-lumbar region of the pilot. Structural damage was appraised at impact. The acceleration undergone by the occupants was given in intensity curves as a function of time. The most important accelerations are on the Z axis and are between 25 g and 30 g for durations on the order of 20 ms with a mean jolt of 1000 g/s and a vertebral compression of almost 400 daV. Accelerations along the X axis do not exceed 15 g. Injuries to the occupants are localized in the dorsal-lumbar region. Because of lack of data, the injuries eventually inflicted on the low cervical column (C5 to C7) by the rabbit punch are not completely known. Transl. by A.R.H.

N79-31926# Royal Aircraft Establishment, Farnborough (England). Human Engineering Div.

THE USE OF SPINAL ANALOGUE TO COMPARE HUMAN TOLERANCE OF REPEATED SHOCKS WITH TOLERANCE OF VIBRATION, PART 1

Geof Allen /n AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 15 p refs

Avail: NTIS HC A18/MF A01

A method is evolved for comparing theoretically the compatibility between ISO 2631 limits for human tolerance of vertical vibration and recent proposals for limits of tolerance of repeated shocks based on a spinal analogue. The method is applied both limits over a wide range of conditions, including a proposal for the maximum acceptable vibration crest factor to be increased from the present value of 3, to 6. Previous work on biodynamic modelling is briefly reviewed in relation to its application to standards for human tolerance of vibration and shock. G.Y.

N79-31927# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. of Aviation Medicine.

THE RESPONSE OF A REALISTIC COMPUTER MODEL FOR SITTING HUMANS TO DIFFERENT TYPES OF SHOCKS
H. Mertens and L. Vogt /n AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 17 p refs

Avail: NTIS HC A18/MF A01

A mechanical model of the human body in the sitting posture is described. The model parameters were derived from the results of steady state vibration experiments conducted under various levels of static acceleration up to +4 Gz. The resulting nonlinear behavior of the human body was modeled by calculating the characteristics of the model elements. To investigate the model's response under impact loads, the characteristics of the elements were extrapolated beyond 4 G. The model was exercised with different input pulse shapes and the resulting forces and mass displacements were calculated. G.Y.

N79-31928# Naval Air Development Center, Warminster, Pa. Life Sciences Div.

SOME HUMAN RESPONSES TO REPEATED +G SUB z PULSES

Edwin Hendler and David C. Johanson /n AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 17 p refs

Avail: NTIS HC A18/MF A01

Six unprotected and relaxed subjects were exposed to haversine-shaped acceleration pulses while seated upright in a centrifuge and simultaneously performing a continuous tracking task and a discrete visual-motor response-time task. Twenty-five different acceleration pulses were used. Each subject made 5 successive runs a day, with each run containing a different acceleration pulse; each week of 5 test days therefore included all 25 pulses. From the data collected, relationships were explored between the dependent variables (mean heart rate (MHR), mean respiration rate (MRR), mean tracking error (MTE), and mean response time (MRT)) with pulse level (G sub z) and plateau duration (t) for the entire runs and for the individual phases of

runs. Multiple regression equations were derived relating MHR and MTE to both G sub z and t. Correlations between dependent variables were calculated, as were measures of relative variability. G.Y.

N79-31929# Southampton Univ. (England). Inst. of Sound and Vibration Research.

THE BIODYNAMIC RESPONSE OF THE HUMAN BODY AND ITS APPLICATION TO STANDARDS

Michael J. Griffin, Christopher H. Lewis, Kenneth C. Parsons, and Eleri M. Whitham /n AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 18 p refs

Avail: NTIS HC A18/MF A01

The results of five experiments with groups of up to one hundred-and-twelve subjects and ten experiments with a single subject. The experiments were designed to investigate factors that affect the transmission of vertical (z-axis) vibration to the head over the frequency range 1 to 100 Hz. The distributions of response within subject groups were determined as a function of vibration frequency and it was found that subject weight affected seat-to-head transmissibility. There were differences in transmissibility between men and women and between men and boys. Changes in subject posture had a large effect on transmissibility. The effects of changes in muscle tension, head and foot position were also studied and methods of determining transmissibility with discrete sine, swept sine and random vibration inputs were compared. It was found that seat configuration greatly affected the transmission of vibration to the head. The experimental results are considered in the context of the possible development of standards on the biodynamic response of the body. G.Y.

N79-31930# Systems Technology, Inc., Hawthorne, Calif.
PROGRESS IN MEASURING AND MODELING THE EFFECTS OF LOW FREQUENCY VIBRATION ON PERFORMANCE

Henry R. Jex and Raymond E. Magdaleno /n AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 11 p refs Sponsored in part by the Air Force and Navy

Avail: NTIS HC A18/MF A01

Several facets of the comprehensive biodynamic modeling program presented at the AGARD Aerospace Medical Panel Meeting at Oslo, 1974, were successfully completed and are reported. The development of a variety of lumped parameter models to explain and codify the known data on low-frequency vibration effects and to predict likely effects in new situations was brought to a useful level. The relationship and applications of these and other related models are discussed with respect to their development status and potential applications. Specific recommendations are made for more refined experimental data (e.g., simultaneous accelerations on various body locations and better postural and dynamic mode shapes via cinematography, etc.) and interface compatibility among various models. G.Y.

N79-31931# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

THE APPLICATION OF CONTROL THEORY TO THE INVESTIGATION OF ROLL MOTION EFFECTS ON HUMAN OPERATOR PERFORMANCE

A. M. Junker and W. H. Levison /n AGARD Models and Analogues for the Evaluation of Human Biodyn. Response, Performance and Protect. Jun. 1979 9 p refs Prepared in cooperation with Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

Avail: NTIS HC A18/MF A01

The application of manual control theory to the investigation of the effects of motion cues on pilot control behavior is presented. Experiments and modeling approaches which have led to the development of a predictive motion sensitive optimal-control pilot-vehicle model for roll axis motion cues are described. The way in which human operators make use of disturbance and commanded motion cues are also delineated. Author

N79-31932*# Texas Univ. at Austin.

MAKING IT IN ACADEMIC PSYCHOLOGY: DEMOGRAPHIC AND PERSONALITY CORRELATES OF EMINENCE

Robert L. Helmreich, Janet T. Spence, William E. Beane (Indiana Univ. at South Bend), G. William Lucker (Michigan Univ., Ann Arbor), and Karen A. Matthews (Pittsburgh Univ.) [1979] 56 p refs

(Grants NsG-2065; NSF BNS-78-08911)

(NASA-CR-162287) Avail: NTIS HC A04/MF A01 CSCL 05J

Citations to published work, personality, and demographic characteristics were examined in a sample of male and female academic psychologists. A large sex difference was found in citations with men receiving significantly more recognition. Reputational rankings of graduate school and current institution were significantly related to citations, as were components of achievement motivation. Mastery and work needs were positively related to citations while competitiveness was negatively associated with the criterion. A model of attainment in psychology is proposed and possible explanations for the differential recognition of women are explored. Author

N79-31933# Naval Postgraduate School, Monterey, Calif.

EFFECTS ON A-6E BOMBARDIER/NAVIGATOR FLIGHT TRAINING WITH THE INTRODUCTION OF DEVICE 2F114, A-6E WEAPON SYSTEM TRAINER M.S. Thesis

John Richard Tindle Mar. 1979 85 p refs

(AD-A068607) Avail: NTIS HC A05/MF A01 CSCL 05/9

As weapon systems grow increasingly complex and sophisticated, the training requirements for operator personnel become correspondingly more demanding. This increase in training requirements, coupled with increased operational costs, necessitates the use of simulators as an integral part of many training programs. With the introduction of device 2F114, A-6E Weapon System Trainer, the A-6 community will have a state-of-the-art simulator to employ in their training programs. Along with new devices, training programs must become more responsive to factors influencing training effectiveness and transfer of training. This report explores factors influencing simulator training effectiveness, and compares them with factors incorporated in device 2F114 and proposed training syllabi. Appendix B, 'Alternatives in Bombardier/Navigator Training,' identifies syllabus flights that have the potential to be substituted by the A-6E Weapon System Trainer. GRA

N79-31934# Air Force Human Resources Lab., Brooks AFB, Tex.

ADVANCED TRAINING FEATURES: BRIDGING THE GAP BETWEEN IN-FLIGHT AND SIMULATOR-BASED MODELS OF FLYING TRAINING Interim Report, Feb. - May 1978

Ronald G. Hughes Mar. 1979 19 p refs

(AF Proj. 1123)

(AD-A068142; AFHRL-TR-78-96)

Avail: NTIS

HC A02/MF A01 CSCL 05/9

An overview of advanced training features in flying training simulation is presented as well as a conceptual framework for distinguishing between enabling and instructional features. Reported shortcomings in the training of simulator instructor/operator personnel are seen as resulting in part from the rapid transition from in-flight to simulator-based training and in part from the absence of a behavioral conceptualization of the flying task itself. It is suggested that the area in which the flight simulator may be most effectively exploited lies in its capability for allowing the instructor to alter the basic structure of the task itself for the purpose of applying recognized learning principles and methods. Data on the effective application of backward chaining to a 30 degree dive bombing task are presented. GRA

N79-31935# Navy Personnel Research and Development Center, San Diego, Calif.

HEMISPHERIC ASYMMETRY AS RELATED TO PILOT AND RADAR INTERCEPT OFFICER PERFORMANCE Interim Report, Jun. 1976 - Jun. 1977

Gregory W. Lewis and Bernard Rimland Mar. 1979 32 p refs

(ZF61512001)

(AD-A068087; NPRDC-TR-79-13)

Avail: NTIS

HC A03/MF A01 CSCL 05/10

This report describes the application of a relatively new technology, the visual evoked potential (VEP) method of brain wave analysis, as a possible means of improving the prediction of performance in an area that has proven intractable to more conventional testing procedures--the military aviator. The subjects were 28 pilots and 30 radar intercept officers (RIOs) assigned to a Navy Readiness Training Squadron. VEP data were obtained from eight scalp electrode sites for each aviator. Ratings by the operations officer served as the criterion of performance. It was hypothesized that: (1) VEP amplitude differences would be found between the pilot and RIO groups, and (2) within the pilot and RIO groups, individual performance ratings would be related to VEP hemispheric asymmetry (amplitude differences between the right and left hemispheres). GRA

N79-31936# Johns Hopkins Univ., Baltimore, Md. Div. of Behavioral Biology.

METHODOLOGICAL AND OPERATIONAL ASPECTS OF PROGRAMMED ENVIRONMENT RESEARCH

H. H. Emurian, C. S. Emurian, E. R. Schmier, and J. V. Brady 16 Apr. 1979 63 p refs

(Contract N00014-77-C-0498)

(AD-A068587; TR-3) Avail: NTIS HC A04/MF A01 CSCL 05/1

This paper presents a narrative and annotated description of several unreported but significant aspects of a methodology which has been perfected over the past several years for conducting research studies within a laboratory environment which is programmed for continuous residence by small groups of human volunteers. The information presented in this paper complements the more formal and in some important ways less complete, presentations of the methods and procedures which have evolved over the past several years. The intent has been to focus upon the many unreported but significant details associated with such studies so that behavioral programming procedures will more readily fall within the interest and scope of other investigators. GRA

N79-31937# Civil Aeromedical Inst., Oklahoma City, Okla.

OXYGEN EQUIPMENT AND RAPID DECOMPRESSION STUDIES

E. B. McFadden, comp. Mar. 1979 118 p ref

(AD-A070285; FAA-AM-79-13)

Avail: NTIS

HC A06/MF A01 CSCL 06/11

The protective capability of various oxygen systems at high altitude and during rapid decompression is evaluated. Topics include testing of passenger oxygen masks and portable chemical oxygen generators, oxygen first aid for laryngectomy passengers, in-flight decompression, limitations to high altitude operation of small aircraft, and oxygen concentrations in the vicinity of passengers receiving oxygen first aid. K.L.

N79-31938# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.

UNITED STATES ARMY ANTHROMETRY: 1946-1977

Robert M. White Jul. 1978 300 p refs

(DA Proj. 1L7-62723-AH-98)

(AD-A068095; CE/MEL-191; NATICK-TR-79/007)

Avail: NTIS HC A13/MF A01 CSCL 06/14

Body size information on both men and women of the U.S. Army is available in the form of data collected during several major anthropometric surveys carried out during the past 31 years. Anthropometric data for Army men and women measured in 1946, for Army men and male basic trainees measured in 1966, and for Army women and male basic trainees measured in 1977 are presented in this report. Anthropometric data for these six series of U.S. Army personnel are presented in summary tables, in both centimeters and inches. Data for a total of 118 body measurements have been extracted from the summary tables and collated. Through the use of this format, all of the available anthropometric data for any one body measurement may be seen on two facing pages of statistical and percentile values, either in centimeters or in inches. Data for 14 workspace measurements of both Army men and women also are included.

Comparisons of body size between Army men of 1946 and 1966, between Army male basic trainees of 1966 and 1977, between Army women of 1946 and 1977, and between Army men of 1966 and Army women of 1977 are presented and discussed. GRA

N79-31939# Anthropology Research Project, Yellow Springs, Ohio.

ANALYSIS OF BODY SIZE MEASUREMENTS FOR US NAVY WOMEN'S CLOTHING AND PATTERN DESIGN Final Report

John T. McConville, Ilse Tebbetts, and Thomas Churchill Mar. 1979 223 p refs
(Contract N00140-77-C-6882; TF66152309)
(AD-A068600; NCTRF-138) Avail: NTIS HC A10/MF A01 CSCL 06/14

Data from major anthropometric surveys of U.S. Army and U.S. Air Force women are analyzed with a view toward establishing sizing programs for U.S. Navy women's clothing. Summary statistics, percentile and frequency tables, and measurement descriptions are presented for 49 variables related specifically to clothing design. A high degree of comparability was found between the two measured samples in most dimensions, although the Army women, measured in 1976-77, were found to be slightly taller and heavier than the USAF subjects surveyed in 1968, and to have somewhat larger waists and smaller bust dimensions. Using the data from the two military women's surveys and key dimensions and sizing intervals specified by the Navy Clothing and Textile Research Facility, a sizing analysis was conducted. Several different approaches were tried, but the resulting sizing programs do not satisfactorily cover the measured samples and presumably would be similarly deficient for a U.S. Navy population. The authors recommend the selection of different key dimensions and sizing intervals suggested by the actual distribution of body size variability in the military women's samples. GRA

N79-31940# Navy Clothing and Textile Research Facility, Natick, Mass.

ALUMINIZED FIREMEN'S (FIRE PROXIMITY) HANDWEAR: REDESIGN OF EXPERIMENTAL PROTOTYPE Final Report, Oct. 1976 - Sep. 1977

Francis S. Andruk Dec. 1978 11 p refs
(AD-A069895; NCTRF-136; CEEDO-TR-78-06) Avail: NTIS HC A02/MF A01 CSCL 06/17

The Navy Clothing and Textile Research Facility NCTRF continued development work to improve a new experimental configuration of aluminized fire proximity handwear having increased tactility and manipulatory capabilities. An improved prototype was completed and additional quantities of this model are being manufactured for further testing and establishment of thermal protection parameters. Performance of tests is recommended with a view towards completing the program and possible adoption of this new configuration as a replacement for current standard fire proximity handwear. GRA

N79-31941# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

CONTRIBUTIONS OF PSYCHOPHYSIOLOGICAL TECHNIQUES TO AIRCRAFT DESIGN AND OTHER OPERATIONAL PROBLEMS

Robert D. O'Donnell (Aerospace Med. Res. Lab., Wright-Patterson AFB, Ohio) Jul. 1979 88 p refs
(AGARD-AG-244; ISBN-92-835-1325-8) Avail: NTIS HC A05/MF A01

Various techniques of proven or potential value to applied areas of human engineering in general, and noting the instances of their application to the human factors of aircraft design in particular are presented. Emphasis was given to the techniques revealing the processes of intervening between stimulus and response. Techniques and problems of psychophysiological measurements are considered along with the current status and future possibilities of research in the areas of sensation and cognition. M.M.M.

N79-31942# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

HUMAN FACTORS ASPECTS OF AIRCRAFT ACCIDENTS AND INCIDENTS

B. O. Hartman, ed. (School of Aerospace Medicine) Jun. 1979 95 p refs In ENGLISH and FRENCH Presented at the Aerospace Med. Panel Specialists' Meeting, Paris, 6-10 Nov. 1978
(AGARD-CP-254; ISBN-92-835-0241-8) Avail: NTIS HC A05/MF A01

A broad spectrum of aircraft accident areas and a number of different approaches to the problem are presented with emphasis on stress and its effects on the body, cognition, and the emotions.

N79-31943# Air Force Inspection and Safety Center, Norton AFB, Calif. Life Sciences Div.

THREE DECADES OF USAF EFFORTS TO REDUCE HUMAN ERROR ACCIDENTS, 1947-1977

Andrew F. Zeller In AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 9 p

Avail: NTIS HC A05/MF A01

Thirty years after the formal inception of the USAF, major accidents had been reduced from 1,555 to 90. Human error associated with these accidents was reduced as much as material and other involvements. Analysis of the preventive efforts shows three distinct, although overlapping, approaches which have been employed. The administrative approach is the best known. This investigate-evaluate-fix cycle is the common dimension of almost all accident prevention effort. The scientific approach supplements the information by centering upon a systematic and intensive evaluation of human limitations in a defined man/machine setting. The third concept, total system management, emphasizes improvement in the management of the entire system, though the details of what will be instrumental in the prevention of a specific accident are often not defined. In practice, a viable accident prevention program incorporates all three approaches, with emphasis defined in relation to need. A.R.H.

N79-31944# Tactical Air Command, Langley AFB, Va. Aerospace Medicine Div.

MEDICAL AND OPERATIONAL FACTORS OF ACCIDENTS IN ADVANCED FIGHTER AIRCRAFT

Leonard W. Johnson, Jr. In AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 4 p

Avail: NTIS HC A05/MF A01

The proper mix and interface between improving aircraft capabilities and man's capabilities and limitations produce success in aerial and aerospace operations. A dysequilibrium between the medical and operational aspects of man and aircraft combine to produce accidents. Some of man's physiological systems and advanced fighter aircraft characteristics are described as well as multiple operational requirements imposed on men who fly high performance fighter aircraft. The interface between the operational requirements and the medical aspects of some of the accidents therein are related. The establishment, in NATO, of a viable aircraft accident information gathering and dissemination program which would prevent accidents in advanced fighter aircraft is proposed. A.R.H.

N79-31945# Belgian Air Force, Brussels.

ANALYSIS OF THE INTERVENTION OF THE HUMAN FACTOR AS A PRINCIPAL CAUSE OR INFLUENCE IN ACCIDENTS OF MIRAGE AIRCRAFT IN THE BELGIAN AIR FORCE [ANALYSE DE L'INTERVENTION DU FACTEUR HUMAIN EN TANT QUE CAUSE PRINCIPALE OU D'INFLUENCE DANS LES ACCIDENTS D'AVIONS MIRAGE A LA FORCE AERIEENNE BELGE]

A. Flion In AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 6 p In FRENCH

Avail: NTIS HC A05/MF A01

Statistics are presented showing that, between 1971 and 1977, human factors were responsible for 56 of 91 accidents

involving Mirage aircraft used by the Belgian Air Force. Certain parameters likely to be considered eventually in the notion of human factors are analyzed. These include the age of the pilot, his flight experience, the circumstances of the accident in the design of the mission accomplished, the pilot's previous medical history (both physical and psychical), the intervention of leadership, and the interferential factors happening unexpectedly in the triangle formed by man-medium-machine. The effects of the accidents on the pilots are analyzed showing the injuries received, the duration of limited aptitude, and their post-accident careers.

Transl. by A.R.H.

N79-31946# Institute of Aviation Medicine, Farnborough (England).

THE PSYCHOLOGIST IN AIRCRAFT ACCIDENT INVESTIGATION

R. G. Green and R. M. Taylor /n AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 5 p refs

Avail: NTIS HC A05/MF A01

It is well established that in both military and civil flying operations, a large proportion of all accidents occur in serviceable aircraft where the only failure in the system was in the human element. There is therefore an obvious case for the psychologist to attempt to understand the nature of the errors which are made in the hope that such an understanding may lead to the avoidance of such errors. The way in which RAF psychologists are involved in the accident investigation process is described. The way in which this work has enabled accidents to be categorized is also speculatively discussed and compared with the findings of more academic work.

Author

N79-31947# Centro di Studi e Ricerche di Medicina Aeronautica e Spaziale, Rome (Italy).

THE INFORMATION IN AIRCRAFT ACCIDENTS INVESTIGATION

G. Paolucci /n AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 5 p

Avail: NTIS HC A05/MF A01

In aircraft accidents, the data achieved by the survey on the spot are completed by information, contributing to reach in such a way the cause of the accident. The fields to investigate are the event, and the man, the machine, and the medium - before, during, and after the accident. Particular attention has to be paid to the witnesses, not only for their declaration, but even and mostly, for the trustworthiness of their evaluation. Ways and techniques for collecting information in this type of investigation are outlined.

A.R.H.

N79-31948# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.

THE LIMITED RANGE OF THE HUMAN EYE FOR OPTICAL AIRCRAFT ACQUISITION

H.-E. Hoffmann /n AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 11 p refs

Avail: NTIS HC A05/MF A01

A pilot flying according to visual flight rules receives the first information from an approaching aircraft when he can just see this aircraft. The distance in which the approaching aircraft can just be seen i.e. detected, is among other things dependent on the contrast threshold of the human eye. The contrast threshold value indicates what extent must have the difference of luminance between object and its background so that this luminance difference can be just perceived. The DFVLR made experiments determining the influence of different contrast threshold values on the maximum detection range: that range in which an approaching aircraft just can be seen. The results of these experiments were also influenced by environmental parameters (e.g. degree of atmospheric turbidity, background, adaptation luminance) and by characteristics of the approaching aircraft (e.g. inherent contrast, size). The conduct of the experiments is described.

Author

N79-31949# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

ANALYSES OF MIDAIR COLLISIONS IN GERMAN AIRSPACE: METHODOLOGY AND RESULTS

O. Weber /n AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 14 p refs

Avail: NTIS HC A05/MF A01

Theoretical studies concerning conflict detection and resolution in visual meteorological conditions by means of the see and avoid concept, and lessons learned from analyses of midair accidents in German airspace are addressed. The methodology is concerned with some supplementary aspects of the visual detection of an aircraft, the observation and extrapolation of its flight path, and the distance limits where an efficient maneuver can be initiated taking observation errors into account. Restrictions of a pilot's ability to detect an approaching aircraft caused by a small apparent size or unfavorable silhouette of that aircraft, and by opaque structures in his cockpit are discussed. Also treated is the apparent track of an aircraft on the windshield in front of the observing pilot. The features of five real midair conflicts in German airspace are demonstrated.

G.Y.

N79-31950# Institute of Aviation Medicine, Farnborough (England).

PILOT INCAPACITY IN FLIGHT

D. C. Reader /n AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 5 p refs

Avail: NTIS HC A05/MF A01

Incapacity of any crew member of an airplane can have serious implications for the aircraft and occupants. However, in the case of the pilot, the outcome can be disastrous. The hazards of pilot incapacity can be reduced by carrying more than one pilot (such as in transport aircraft). The pilot can be removed from the controls in time to retain control of the aircraft. However, under certain conditions (for instance at low altitudes) this may not be possible; moreover, the pilot may slump forward and restrict the controls. Various restraint systems were devised and these were considered in turn to determine whether their use could avoid the hazards. The incidence of pilot incapacitation was reviewed in both military and civil aircraft and the risk compared with other flight hazards.

G.Y.

N79-31951# Institute of Aviation Medicine, Farnborough (England). General Psychology Section.

GEOGRAPHICAL DISORIENTATION AND FLIGHT SAFETY

R. M. Taylor /n AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 11 p refs

Avail: NTIS HC A05/MF A01

Geographical orientation is the psychological process whereby the aircraft pilot maintains an awareness of his position in relation to geographical points. The antithesis, geographical disorientation is a common occurrence in flight, the consequences of which vary in seriousness. Case studies of individual accidents and incidents indicated that in many respects geographical disorientation in flight can be as insidious, compelling and as stressful as spatial disorientation. Geographical disorientation may precipitate spatial disorientation and vice versa. In severe cases, where the realization of the error is sudden, there is evidence of panic and disorganization of behavior leading to loss of control of the aircraft. Preventative actions that may reduce the incidence of geographical disorientation include better training and preflight planning, improved awareness of the problem, elimination of system induced errors, and improved navigation aids, including maps and charts.

G.Y.

N79-31952# Italian Air Force Medical Service H. Q., Rome.
HUMAN FACTORS IN PRODUCTION AND PREVENTION OF AIRCRAFT ACCIDENTS DUE TO DISORIENTATION IN FLIGHT

N79-31953

Gaetano Rotondo *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents Jun. 1979 6 p refs

Avail: NTIS HC A05/MF A01

To prevent and reduce those flight accidents occasionally due to spatial disorientation, which are tied to the human factor and whose causes can, therefore, be influenced and corrected, it is very important that the pilot has exact knowledge of the possible illusory phenomena which can occur in flight, the awareness that they can be anticipated, and finally that timely actuation of adequate preventive measures allows one to avoid loss of orientation during the various conditions of flight. For that reason the most frequent circumstances and conditions should be examined which can facilitate spatial disorientation in the pilot favoring the mental conflict which originates when there is sensorial incongruity between erroneous sensations coming from the vestibular apparatus and/or the proprioceptors and inadequate visual information. The possible measures necessary to prevent those various conditions contributing to or facilitating disorientation in flight, or neutralizing them whenever they are already in effect, are discussed. G.Y.

N79-31953# National Defence Headquarters, Ottawa (Ontario). **BETWEEN INCIDENT AND ACCIDENT**

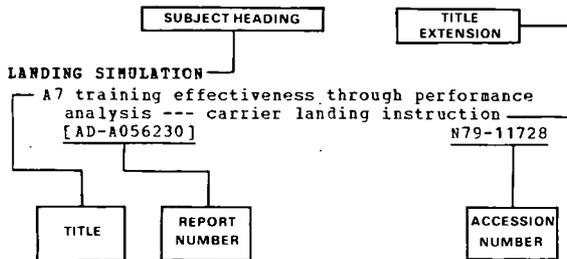
M. L. Tepper and N. H. Haakonson *In* AGARD Human Factors Aspects of Aircraft Accidents and Incidents 1979 6 p refs

Avail: NTIS HC A05/MF A01

In the evolution of an aircraft occurrence, combined stress often plays a significant role. Conceptual models of how a combination of stress-inducing factors can lead to the no man's land between normal operation and incident; between incident and accident are presented. The models are primarily for presentation to aircrew when discussing stress. G.Y.

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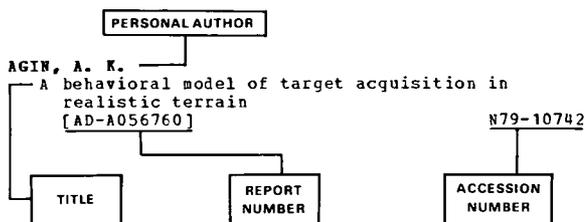
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