Abstracts of Current Aviation Medicine Literature

I. ENVIRONMENTAL PHYSIOLOGY

1. **Physiological and biophysical limits to work in the heat for clothed men and women.** ELIEZER KAMON, BARBARA AVELLINI and JANET KRAJEWSKI. *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, Vol. 44, June 1978, P. 918-925, 20 refs.

Heat acclimated, lightly clothed men and women (four of each) walked on a treadmill at 25% and 43% Vo_2 max. respectively, (M = 194 $W\text{-}m^{-2}$), under seven air temperatures (T_a) ranging from 36 to 52°C. Each experiment involved 1 h of fixed and a 2nd h of progressively increasing ambient vapor pressure (P_a). The relative steady state of rectal temperture (T_{re}) mean skin temperature (T_{sk}) and heart rate (HR) reached in the 1st h were forced upward during the 2nd h by the rising P_a . The critical air vapor pressure (P_{crit}) was identified by the T_{re} point of inflection for each T_a . One man did not fully reach steady state, but inflection could be determined for his physiological responses. The mean values of all points of inflection were calculated for T_{re}, T_{sk} and HR. Significant sex difference in HR was found only by excluding the results of the one man. T_{re} and T_{sk} showed no significant difference between men and women. The coefficient for evaporative heat transfer (h_e), which could be derived using the P_{crit} for the low T_a range, was 14.5± 2.2 $W.m^{-1}.Torr^{-1}$.

2. **Performance of psychological tests in hot environments.** S. K. BHATACHARYA, APARNA ROY and N. L. RAMANATHAN. *The Indian Journal of Medical Research*, Vol. 68, October 1978, P. 660-667, 20 refs.

Fifteen male volunteers (who were science graduates) were administered psychological tests involving reasoning ability, numerical calculation, motor coordination, memory (forward and reverse) and associate learning, in a hot room at 34°C CET preceded by tests in a comfortable environment of 22°C CET. The results of individual performances indicated deterioration in a hot environmental condition. The degree of deterioration depended on the complexity of the test. Studies relating physiological parameters to mental task performance might provide an insight into the observed findings.

3. **Operational characteristics of liquid-conditioned suits.** M. H. HARRISON and A. J. BELLVAVIN, *Aviation Space and Environmental Medicine*, Vol. 49, August, 1978, P. 994-1003, 32 refs.

The data from several studies of liquid-conditioned suits carried out over the last 12 years at the RAF Institute of Aviation Medicine have been collated, collectively reanalysed, and used to describe the characteristics of personal liquid-conditioning systems in terms of interaction between the conditioning and the conditioned system. Heat exchange across a liquid-conditioned suit (LCS) is shown to be proportional to the inlet temperature (T_{in}) of the conditioning liquid. Choice of T_{in} is determined, for resting subjects, primarily by the environmental temperature, by the length of the heat exchange tubing, and by the insulation valve of the clothing worn over the LCS Mean skin temperature (T_{sk}) but not core temperature (T_c) is directly related to T_{in}. However, certainly in exercising subjects, steady state values of T_c can be increased by selecting very low values for T_{in}, which reduce T_{sk} below 29° C. It is suggested that mean T_{sk} should not fall below 30° C when the LCS is used for personal cooling. When the LCS is used for personal heating, sweating should be minimised, or prevented by not allowing T_{sk} to rise to levels sufficient to cause an increase in T_c.

4. **Carbohydrate, lipid and aminoacid metabolism following physical exercise in man.** GORAN HOLM, PER BJORNTORP, and RUDOLF JAGENBURG. *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, Vol. 45, July 1978, P.128-131, 36 refs.

To elucidate early metabolic adaptations of physical training obese and nonobese subjects were studied before and at different intervals after 1 h of bicycle exercise at 70% of maximal working capacity. Four h after exercise intravenous glucose tolerance (IVGT) and plasma level of alanine were decreased. Compared to the diurnal variation, plasma concentration of cortisol was increased. Twenty-four hours after exercise plasma concentrations of cortisol and triglycerides were decreased. Furthermore, plasma insulin during IVGT test was decreased and blood glycerol

increased in the obese subjects. There were no changes in basal insulin, IVGT, or plasma levels of amino acids which were elavated in the obese subjects (valine, isoleucine, leucine, tyrosine, phenylalanine). Forty-eight hours after exercise plasma insulin during IVGT test and plasma triglycerides remained decreased in the obese subjects. Low cortisol levels 24 h after exercise might result in increased insulin effect leading to low plasma insulin levels seen in physically trained subjects. Elevated glycerol level in the obese subjects might be the first sign of diminishing fat stores secondary to increased lipolysis.

5. **Comparison of metabolic and ventilatory responses of men to various lifting tasks and bicycle ergometry.** JERROLD S. PETROFSKY and ALEXANDER R. LIND. *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, Vol. 45, July 1978, P. 60-63, 12 refs.

Four male volunteers served as subjects to examine the metabolic and ventilatory cost of both positive and negative lifting tasks as compared to bicycle ergometry. In different experiments, four boxes weighing 0.91, 6.82, 22.73 and 36.36 kgs were lifted up to or down from a height of 60 cm at rates as high as 70 lifts/min for periods of 4 min. The data were then compared to those obtained from bicycling at a rate of 50 rpm at work loads up to 1,500 kpm/min. Work at any given box weight had a substantially higher oxygen and ventilatory cost than similar levels of work on the bicycle ergometer. The reason for these differences appeared to lie in the energy cost of moving parts of the body. When the weight of the boxes was low, there was little difference between the oxygen cost of positive and negative work, but as the weight of the boxes increased, the expected physiological differences in positive and negative work was established.

6. **Heat acclimatization by a method utilizing microclimate cooling.** P. C. SCHUTTE, G. G. ROGERS, C. H. VAN GRAAN and N. B. STRYDOM, *Aviation Space and Environmental Medicine*, Vol. 49, May, 1978, P. 710-714, 10 refs.

A new approach to heat acclimatization has been shown to be feasible during laboratory experimentation. Wearing microclimate suits containing dry ice as the coolant, three groups of men were subjected to a moderate work rate in three different environments for 4h/d for 8 d. Physiological responses on a subsequent heat tolerance test indicate that the group subjected to an environment of 32.0°C W°B. and 33.5°C D. B. were fully heat acclimatized. The 33/35°C group were also well acclimatized but developed dangerously high body temperatures during the first 2 d. Only partial acclimatization was achieved by the 31/33°C group. The reason why the men acquire heat acclimatization while wearing the microclimate suits in a hot environment is probably that microclimate cooling does not prevent body temperatures from rising it only prevents it from rising excessively. It should be remembered that only one-third of the body is cooled while the rest shows the normal sweating response.

II. CLINICAL AVIATION MEDICINE

7. **Treatment of hypertension in Aviators: A clinical trial with aldactazide.** DAVID H. HULL, ROGER A. WOLTHUIS, JOHN H. THIEBWASSER and DONALD A McAFOOSE, *Aviation Space and Environmental Medicine*, Vol. 49, March 1978, P. 503 – 511, 37 refs.

Thirty-two USAF aircrewmen with mild or moderate uncomplicated essential hypertension were treated with Aldactazide (spironolactone and hydrachlorothiazide). The study was designed to determine the efficacy and safety of this drug combination in aircrew subject to the stress of flying high-performance aircraft. All patients were investigated in detail before, and again 6 weeks after beginning Aldactazide treatment. Adequate blood pressure control was achieved in 94% of patients; 84% were able to return to flying duties. Treatment was associated with a moderate loss of weight and plasma volume, and a slight reduction in renal function. Tolerance to multiple stress tests was unimpaired after treatment. Symptoms attributable to treatment were minimal. We conclude that in the dose used, four tablets or less daily, Aldactazide is a safe and fairly effective second-line treatment for hypertension in aircrewmen.

8. **Weight reduction in a blood pressure clinic.** L. E. RAMSAY, M. A. RAMSAY, J. HETTIARACHCHI, D. L. DAVIES and J. WINCHESTER. *British Medical Journal*, Vol. 2, July 1978, P. 244-245, 11 refs.

Forty-nine hypertensive patients who were overweight were randomly allocated to one of three strategies for attaining weight reduction and were followed for one year. Those referred to a dietitian

lost more weight (mean 5.1 kg) than those given a diet sheet (mean 2.64 kg) or simply advised by the doctor to reduce weight (mean 2.15 kg). One-third of all the patients lost 6 kg or more.

Successful weight loss was associated with a highly significant and substantial improvement in blood pressure control and with less frequent increases in anti-hypertensive treatment.

9. Medical certification of pilots. R. L. DODDS, *Aviation Space and Environmental Medicine*, Vol. 49, March 1978, P. 517 – 518.

This paper reviews some of the problems encountered in administering satisfactory medical requirements for professional pilots. The role of these requirements in the context of flight safety is discussed. The control of risk by the imposition of strict requirements is contrasted with that achieved by training designed to contain the risk introduced in incapacitation. The fact that aviation safety is based on acceptable risk levels is pointed out and the role of physician in this regard is discussed. The need for a widely accepted minimum level of fitness required for aviation duties is brought out. Certain operational aspects are touched upon. Medical requirements based on the desire to avoid on-duty incapacitation are contrasted with those designed to ensure adequate performance. The present ICAO cardiovascular requirement is discussed with particular reference to permanent grounding following myocardial infarction. The significance of inflight crew incapacitation training is pointed out and a plea for close cooperation between licensing authorities, airline operators, and pilots is made.

10. The cardiovascular fitness of airline pilots: Report of a working party of the Cardiology Committee of the Royal College of Physicians of London. CYRIL CLARKE, DOUGLAS BLACK, J. F. GOODWIN, R. W. EMANUEL, K. P. BALL, F. S. JACKSON, D. JEWITT, D. M. KRIKLER, E. L. McDONALD, KENNETH ROBSON, T. SEMPLE, D. S. SHORT and W. WHITAKER. *British Heart Journal*, Vol 40, April 1978, P. 337 - 349, 36 refs.

In this report on the cardiovascular fitness of airline pilots, the working committee of Royal College of Physicians recommends that:-

A. Stringent cardiovascular examination before acceptance of training should be carried out so that cardiovascular diseases at the time of examination as also the increased risk of developing it during the next 30 to 40 years could be detected.

B. Routine medical examinations of trained pilots should be conducted by specialists employing the highest standards in medical examination and instrumentation with the following objectives :—

(1) To ensure the safety of the pilot, his crew and passengers.

(2) To detect the signs of ill health so that treatment could be instituted and the prognosis improved.

(3) To give advise on the maintenance of health by proper exercise, rest, diet, control of obesity and avoidance of cigarette smoking and alcohol.

The committee also suggests the following subject areas for research : —

(a) Environmental, physiological and biochemical changes in flight.

(b) Use of drugs by aircrew-

(i) Hypnotical sedatives

(ii) Beta adrenergic antagonists

(c) Effects of autonomic nervous system on electrocardiogram.

(d) Smoking and carbonmonoxide.

(e) Follow-up studies.

11. Carbamylation distributions in extracorporeal treatment of sickle cell anemia. DAVID A. UVELLI, LAWRENCE C. Y. AGODOA and ALBERT BABB. *The Journal of Laboratory and Clinical Medicine*, Vol. 91, P. 939–947, 12 refs.

The extracorporeal exposure of blood from patients with sickle anemia results in the binding of different amounts of cyanate to the hemoglobin of individual erythrocytes. This distribution pattern of carbamylated hemoglobin may effect the efficacy of treatment. A computer model has been developed to predict the carbamylation distribution attained in batch exvivo exposures. In addition, an autoradiographic technique has been developed whereby the actual distribution pattern of carbamylated hemoglobin in small volumes of blood can be determined. Agreement was demonstrated between the computer model predictions and the actual distribution patterns. The model was applied to published

results of extracorporeal treatments of sickle cell patients, and profiles of loading were compared. With the use of such approaches it will be possible to test the importance of the erythrocyte distribution of carbamylated hemoglobin on clinical effects and to design protocols to achieve an optimum distribution. The procedure may be adapted to the distribution of other therapeutic agents as they become available.

12. Diabetes screening using a quantitative urine glucose method. JOHN K. DAVIDSON, DAVID REUBETT, JAMES C. STERNBERG, and WILLIAM T. RYAN, *The Journal of the American Diabetes Association*, Vol. 27, August 1978, P. 810 - 816, 21 refs.

Sensitivity and specificity of three methods random-urine glucose (RUG) 25mg per deciliter; positive Clinitest; and random plasma glucose (RPG) 140, 120 and 100 mg - per deciliter for detecting the unknown diabetic were compared in 1, 952 screences. RUG of 96.7 per cent was 3 to 25 mg. per deciliter (normoglucosuria), RUG of 2.0 percent was 26 to 100 mg per deciliter (moderate hyperglucosuria) and 1.3 per cent was 100 mg per deciliter (marked hyperglucosuria). Twenty-five randomly selected from each of the first two groups and 18 from the third group had a glucose tolerance test (GTT) ; seven in the third group had fasting plasma glucose tests 150 mg per deciliter. GTTs were evaluated to United States Public Health Service (USPHS), Fajans-Conn (F-C) and summation (S) criteria, and tested screences divided into nondiabetic (ND) and diabetic (DM). NDs with RUG <25 mg per deciliter were false positive screens: renal hyperglucosurics (RHG) if GTT urine glucose >80 mg per deciliter, non-renal hyperglucosurics (NRHG) if GTT urine glucose $>$ 25 mg. per deciliter. The prevalence of DM was 1.24 per cent (USPHS), 1.37 per cent (F-C) and 1.45 per cent (S). The prevalence of false positives (USPHS) was 2.04 per cent (1.19 per cent PHG and 0.85 per cent NRHG).

In the non glucosuria group, 100 per cent who had a GTT were true negatives. In the moderate hyperglucosuria group, 16 per cent (USPHS) were true positives, 84 per cent false positives (44 per cent RHG, 40 per cent NRHG). In the marked hyperglucosuria group, 27 per cent (USPHS) were true positives, 28 per cent false positives (24 per cent RHG and 4 per cent NRHG). By Clinitest, 23 per cent of the DMs (USPHS) were false negatives and 1.8 per cent in the normoglucosuria group were false positives. Nine per cent of the DMs were false negatives in RPG <140, and 4.5 per cent were false negatives by RPG <120.

RUG 25 mg per deciliter was as sensitive as the GTT in detecting unknown DMs but was less specific. Random normoglucosuric screences are unlikely to have diabetes; about 40 per cent of random hyperglucosuric screences have diabetes.

13 Sleep at home and in the sleep laboratory: Disturbance by recording procedures. M. W. JOHNS and CAROLINE DORE. *Ergonomics*, Vol. 21, May 1978, P. 325 - 330, 11 refs.

Nineteen healthy men, aged 20 to 55 yr, who did not suffer from insomnia had their sleep recorded by EEG and EOG in the laboratory for 3 to 12 nights each over periods of 1 to 4 weeks. They also gave subjective reports each day which proved to be valid although not always very accurate assessments of their sleep latency, the number of mid-night awakenings and the times of sleeping in the laboratory. There was some 'adaptation' to the laboratory over the first 2 nights, but awakenings during the night continued for upto 12 nights to be reported more than twice as frequently in the laboratory than at home. They were apparently often caused by intermittent traction of electrodes on the face and scalp as the subjects turned over in bed. From the point of view of mid-night awakenings, EEG/EOG recordings are unlikely to give an accurate assessment of the subject's usual sleep, even after several 'adaptation' nights.

14. Ten-year experience with abnormal EEGs in asymptomatic adult males. JOSEPH J. ROBIN, GIL D. TOLAN and JOHN W. ARNOLD *Aviation Space and Environmental Medicine*. Vol. 49, May 1978, P. 732-736, 15 refs.

This study reports a 10-year experience of the USAF School of Aerospace Medicine with spike waves or focal spikes on a screening electroencephalogram in aviators who did not have a history of seizure, unexplained loss of consciousness, or significant neurologic abnormality at the time of the first abnormal electroencephalogram. Only one of 20 patients went on to develop a seizure disorder 4 years after his first abnormal electroencephalogram.

15. **Method for rehabilitation of the alcohol-addicted pilot in a commercial airline.** FRANCIS R. SCHWARTZ and GEORGE J. KIDERA, *Aviation Space and Environmental Medicine*, Vol. 49, May 1978, P. 729 - 731, 14 refs.

Based upon data available from the National Council on Alcoholism and encouraged by the emerging concept of alcoholism as a disease responsive to the multidisciplinary approach to its management, a program to assist alcoholic employees was instituted in 1968 at the United Airlines Maintenance Operations Center in San Francisco. This progress was developed through the tripartite efforts of management, union and the medical department. Using this basic model, a similar effort to assist flight crew members of our San Francisco pilot domicile emerged in 1970. The method is oriented to the three-fold process of identification, referral for treatment, and follow-up. The mechanism of identification includes an intervention process. Treatment is accomplished in a specialty hospital embracing the principles of Alcoholics Anonymous. The essential monthly follow-up is continued for 2 years. Twentyfive pilots in United's system have been returned to flight deck duties after treatment and recertification.

IV. HIGH ALTITUDE PHYSIOLOGY

16. **Nitrogen-Oxygen saturation therapy in serious cases of compressed-air decompression sickness.** J. N. MILLER, L. FAGRAEUS and P. B. BENNETT, *The Lancet*, Vol. II, July 1978, P. 169 - 171, 9 refs.

Decompression sickness and arterial air embolism which follow exposure to raised environmental pressures of compressed air are usually adequately treated by accepted recompression procedures of relatively short durations. With serious cases, however, conventional treatment may not allow sufficient time at depth for the complete resolution of manifestations because of the need to avoid pulmonary oxygen toxicity which is associated with a prolonged period of breathing compressed air. Treatment by nitrogen-oxygen saturation at a pressure equivalent of 30 m (100 ft) sea water is proposed. Based upon the success of three refractory cases treated by this procedure, recommendations are made for the conversion of standard compressed-air chambers into an emergency saturation mode for therapy.

17. **Visual evoked cortical potentials in men during compression and saturation in He O_2 equivalent to 400, 800, 1200 and 1600 feet at sea water.** JO ANN, S. KINNEY, R. HAMMOND, R. GELFAND and J. CLARK, *Electroencephalography and Clinical Neurophysiology*, Vol 44, February 1978, P. 157-171, 12 refs.

Visual evoked cortical potentials and related EEG activity were recorded from subjects during rapid compression and exposure to pressures of 400, 800, 1200 and 1600 fsw. In one phase, subjects made repeated excursions to 1200 fsw from a base at 800 fsw; in the second phase, the saturated base was 1200 fsw with excursions to 1600 fsw. The results included: (1) For the visual evoked potentials, sizeable and significant decreases in amplitude and increases in latency of the response with depth; (2) Changes in the visual evoked potentials which varied systematically with depth but not with related changes in compression rate or decompression. The changes were small but consistent alterations of normal responses to visual stimulation; and (3) Theta activity in discrete EEG recordings increased progressively with depth. While all subjects showed increases in theta activity the pattern of increase varied individually.

18. **Effects of hypocapnia on psychomotor and intellectual performance.** T. M. GIBSON, *Aviation Space and Environmental Medicine*, Vol. 49, August 1978, P. 943 - 946, 22 refs.

Nine subjects performed five psychomotor tasks (two motor, two intellectual, and one combined motor and shortterm memory) at three levels of $PACO_2$ (38.5, 25.0 and 15.0 torr) with voluntary hyperventilation at 20 l/min. There were no performance decrements at $PACO_2$ levels of 38.5 and 25.0 torr. At a $PACO_2$ of 15.0 torr, there were no decrements of intellectual performance but there were highly significant decrements in motor performance. It is suggested that a lack of regional cerebral hypoxia, arising from compensating changes in regional cerebral blood flow, could be responsible for the preservation of intellectual performance at a $PACO_2$ of 15 torr.

19. **Prevention of hypoxia - acceptable compromises,** J. ERNSTING, *Aviation Space and Environmental Medicine*, Vol. 49, March 1978, P. 495 - 502-23 refs.

The acceptable degree of hypoxia is a most im-

portant factor in the design of pressure cabins and of aircrew oxygen breathing equipment. The studies of the effects of mild hypoxia upon human performance performed since 1960 are reviewed. It is concluded that the hypoxia induced by breathing air at altitudes up to 5000 ft is acceptable for both crew and passengers of combat and passenger aircraft. The magnitude and the effects of the hypoxia induced by rapid decompression are also considered. The results of the experimental investigations are correlated and it is deduced that the minimum acceptable alveolar oxygen tension on rapid decompression is 30mm Hg.

V. AVIATION OTOLARYNGOLOGY

20. Vertigo as reflected by the nystagmogram. LARS-ERIK AFZEEIUS, NILS G. HENRIKSSON and LOUISE WAHIGREN, *Acta Oto-Laryngologica*, Vol. 86, July-August, 1978, P. 123 - 131, 16 refs.

Efforts to evaluate findings in the nystagmogram were made in a material of 338 vertiginous and dizzy patients. A spontaneous nystagmus, a positional nystagmus as well as a difference in caloric reactivity are as solitary findings of little value for revealing peripheral disorders. On the other hand, central disturbances are frequently revealed by inability to track a moving optic target, resulting in an irregular or a saccadic pattern, by persistence of vestibular nystagmus in light, by persistence of such nystagmus at eye-closure, by an increase in spontaneous nystagmus on eye-closure or by dysrhythmic nystagmus in caloric tests. Cases of functional vertigo seem to differ from cases of vertigo from other sources by their increase of spontaneous nystagmus (when present) or by persistence of caloric nystagmus on eye-closure.

21. Speech and pure tone audiometry as a screen for exaggerated hearing loss in industrial claims. P. W. ALBERTI, P. P. MORGAN and I. CRUBA, *Acta Oto-Laryngologica*. Vol. 85, May-June, 1978, P. 328 - 331, 4 refs.

We examined 596 patients referred with possible noise-induced hearing loss by conventional and cortical evoked response audiometry. Discrepancies between the two tests identified 121 (20. 3%) as exaggerating their hearing loss. We then studied the validity of simple conventional tests, which would be available in primary diagnostic facilities, in screening for the exaggerators we had identified. By selecting those whose puretone average (for 0.5 and 1 KHz) was more than 10 dB different from the speech reception threshold or whose initial puretone threshold at 0.5 KHz was 40 dB or greater. We identified 112 (93%) of the exaggerators, at the cost of additional examination of 209 (35% of the total) false-positive. However, this screening means that 46% of the claimants could be evaluated completely in a primary diagnostic facility, and only a small fraction of the exaggerators should be overlooked.

22. Speech intelligibility through communication head sets for general aviation. THOMAS H. TOWNSEND, *Aviation Space and Environmental Medicine*, Vol. 49, March, 1978, P. 466 - 469, 9 refs.

Word discrimination was measured on eight general aviation pilots listening alternately through each of three communication headsets and an aircraft loudspeaker in the presence of light aircraft noise. Each subject listened at the speech intensity designated by him as yielding optimal intelligibility. Performance varied directly with the degree of attenuation provided by the headset. Mean intelligibility scores ranged from 73% through the loudspeaker to 92% through two of the headsets, although retesting through the loudspeaker at a higher signal level improved mean scores to 85%. Articulation function obtained on four normally hearing listeners tested under the same conditions as the pilots revealed that, for situations when little or no attenuation was available (loudspeaker and one headset) greater signal-to-noise ratios were necessary to allow discrimination equivalent to that obtained under conditions of greater noise attenuation (two headsets) Although good intelligibility could be achieved through the loudspeaker given sufficient signal intensity (100 dB SPL) some pilots preferred lower levels even though discrimination was reduced.

23. Results of new air caloric testing method among normal subjects I Biphasic testing. PAUL M. FLEMING, LEONARD R. PROCTOR, ROLLIN G. DIX, and WERNER A. METZ, *The Annals of Otology Rhinology & Laryngology*, Vol. 87, March-April, 1978, P. 248-256, 14 refs.

A new air caloric testing method is described in which the temperature of a continuous aural irrigation is switched between hot and cold values at times calculated to control the intensity of the resulting vestibular stimulation. Applications of low or high caloric stimulus intensities to normal subjects were well

tolerated and reliably produced appropriate low or high intensity nystagmus responses. Nystagmus intensity values obtained from this study were compared with predicted intensity values from a computerized simulation of the actual test conditions, and also with values obtained when using biphasic water irrigation. As a result, further improvements in our methodology have been effected.

VI. AVIATION OPHTHALMOLOGY

24. Monocular peripheral vision as a factor in flight safety. D. S. KOCHHAR and T. M. FRASER, *Aviation Space and Environmental Medicine*, Vol. 49, May, 1978, P. 698-706, 9 refs.

The performance of static visual identification tasks and simulated operational flying tasks, by nine binocular pilots and nine adapted monocular pilots, was measured in a unique operational visual simulator. It was hypothesized that, with head free to move, an adapted monocular pilot would perform as well as a binocular pilot, while an unadapted monocular (simulated by covering an eye) would perform less well. Other hypotheses were advanced. The static primary central task required sequential identification of dial readings. The dynamic primary central task involved simulated aircraft landing operations. During each set of primary tasks, a set of secondary peripheral visual tasks was performed. Results of the primary tasks and times of execution of the secondary tasks were subjected to analysis of variance. Factors included head position (fixed or free), stimulus location in peripheral field eye state (seeing eye, blind eye), and type of central task (static, dynamic). All hypotheses were evaluated.

25. Heterophoria - Its influence on stereopsis and the importance of cycloplegia in refraction testing of Pilot applicants. JORMA CASTREN, JOHAN STJERNSCHANTZ, and JUHANI AHO, *Aviation Space and Environmental Medicine*, Vol. 49, May, 1978, P. 737-741, 10 refs.

Heterophoria, its influence on stereopsis, and the importance of cycloplegia in refraciton of pilot applicants were studied. Distant heterophoria was found in 94.5-100% while near heterophoria was found in 86.9-98. 1% of the cases, depending on the test used. Hyperphoria of over 1 prism diopter was extermely rare. No statistically significant correlation between distant heterophoria and the degree of stereopsis could be demonstrated at a range of up to at least 6 prism diopters. Cycloplegia induced a mean difference of +0.75 diopter in refraction before and during cycloplegia. Eight percent of the applicants failed because of refractive errors (spherical extremes, —0.75 diopter and +4.50 diopters ; cylindrical extreme, 1.25 diopters). It is concluded that stereopsis does not seem to be affected much by heterophoria within moderate limits, and that cycloplegia in refraction testing of young pilot applicants must be considered relatively important.

VII. OXYGEN THERAPY

26. Effects of hyperbaric oxygen on certain growth features of candida albicans. WILLIAM J. CATRNEY, *Aviation Space and Environmental Medicine*, Vol. 49, August, 1978, P. 956—958, 7 refs.

Candida albican (Robin) Berkhout, isolated from an adult female with recurring candidiasis, was tested in vitro for macroscopic and microscopic growth features at varying hyperbaric oxygen levels and at various exposure times and intervals. The organism was found to be inhibited within a pressure/time range well tolerated by human subjects, suggesting that hyperbaric oxygen might be used successfully in treating human candidates. Overall experimental results provide an in vitro basis for use of compression chamber therapy in candidiasis treatment.

VIII. EJECTION AND ESCAPE

27. Stability of the cervical spine under tension. MANOHAR M. PANJABI, AUGUSTUS A. WHITE III, DAVID KELLER, WAYNE O. SOUTHWICK and GARY FRIEDLEANDER, *Journal of Biomechanics*, Vol. 11, 1978, P. 189-197, 13 refs.

A carefully done in vitro study is presented on the surgical plane motion patterns of the human cervical spine as the various components (ligaments, disc and face joints) are sequentially transected, and as an axial tensile load is applied in increments until the spine fails. Sound practices regarding preservation and maintenance of the physiological environment were utilized. A simple roentgenographic measuring technique using steel pins and needles as markers, provide reliable information about the displacement patterns of vertebrae. The results indicate that failure of the spine takes place when at least all the anterior or all the posterior plus two anterior components, have been transected. Also presented are the

results of motion pattern changes, and their significance for developing a safe clinical test for evaluating spine injury.

IX. EFFECTS OF VIBRATION

28. An equal sensation study of seated subjects in three translational modes. B.K.N. RAO and B. JONES. *Ergonomics*, Vol. 21, February, 1978, P. 123–134, 16 refs.

A matching technique, similar in principle to that employed by Ashley (1970) has been adopted, to evaluate equal sensation levels between sinusoidal and wide-band random vibrations. The technique employed improved methodology, better facilities and all the three translational modes.

A series of two experiments were conducted. In experiment-1, subjects were exposed to four levels of sinusoidal vibrations corresponding to ISO's (1974) FDP 16 min, 25 min, 1 h and 25 h boundaries at 6 Hz in the vertical mode (a_z axis) and at 2 Hz in the back-to-chest (a_x axis) and right-to-left side (a_y axis) modes. Subjects were asked to rate their vibration sensations on a ten point scale and to categorise their sensations on a four point category scale, while taking into account the FDP durations. They were then asked to match the random vibration to sinsoidal vibration for an equal sensation effect if exposed over such durations.

In experiment 2, the four matched random vibration levels were employed as reference levels. Subjects were then asked to match various sinusoidal vibrations (1-20 Hz) to random vibrations to achieve equal sensations, again taking into consideration the stipulated FDP durations.

The data gathered from both experiments were analysed and the results (mean) of experiment 1, in general, showed that at higher FDP levels, random vibrations when weighed with appropriate ISO weighing networks gave significant lower r.m.s. acceleration values than sinusoidal vibration levels. Results (mean) of experiment 2 yielded equal sensation contours whose shapes revealed some difference both at low and high frequency ends, compared with ISO boundary profiles. Changes in contour profiles with acceleration levels were also observed. Significant differences between sinusoidal and random vibrations in all the three vibration modes were observed. The paper also discusses some problems encountered by some subjects during the course of the investigation.