Abstracts of Current Aviation Medicine Literature

I ACCELERATION PHYSIOLOGY :

1, G-tolerance enhancement : Straining ability Comparison of aircrewmen, non-aircrewmen, and trained centrifuge subjects.

G tolerance measurements, both relaxed and using a protective straining maneuver, were made on aircrewmen, and trained centrifuge subjects at the USAF School of Aerospace Medicine over the past 3 years. Results indicated that currently trained pilots (including fighter-type pilots) are not as proficient at performing a G protective straining maneuver as fully trained centrifuge panel members. Pilots should be able to gain at least 2 G over relaxed G tolerance with adequate training. Evidence exists to indicate an optimum time for G training would be during the period of undergraduate pilot training.

[Whinnery, J E. Aviat Space Environ Med. 53 (3) : 232, 1982]

2. An analysis of the risk of human cardiac damage during +Gz stress : A review

The available information concerning the subendocardial hemorrhage, myofibrillar degeneration, and necrosis observed in miniature swine after acute +Gz exposure, is reviewed and evaluated for any possible occurrence of similar pathology in humans. It is concluded that +Gz exposure poses no significant risk for cardiac damage in humans. Three primary considerations lead to this conclusions : 1) The lesions in swine probably result from very high (toxic) levels of both spmpathetic adrenergic tone to the heart and circulatic plasma catecholamines acting on the cardiac cells. Most of these catecholamines appear to be released as a result of the overall stress involved in exposing concious miniature swine to +Gz on the centrifuge, and not directly as the result of the +Gz per se. Thus, the lesions in miniature swine appear to develop as a consequence of a somewhat unique form of the porcine stress syndrome. 2) +Gz exposure is not as psychologically stressful for humans. Therefore, humans would not be expected to have, and do not appear to have, catecholamine levels (cardiac or systemic) as high as those observed in miniature swine during +Gz stress. This conclusion is supported by direct comparisons of the heart rate and plasma catecholamine levels in men and miniature swine during +Gz exposure. 3) Although a large amount of clinical cardiologic data exists from humans who have been exposed to +Gz stress, none of these data indicates any degree of cardiac damage. Even more conclusive is the absence of any cardiac damage in the heart of a human subject who had many significant +Gz exposures over a 2 year period. Thus, the pathology in miniature swine does not appear to be an acceleration phenomenon, and probably does not occur in humans exposed to +Gz stress.

[Laughlin, MH. Aviat Space Environ Med. 53 (5) : 423, 1982]

3. Human tracking performance changes during Combined +Gz and ±Gy stress

An experiments has been conducted on the centrifuge to examine roll-axis tracking performance in both static and stress environments. The stress

environments were + 5Gz for 95 s and combined+ Gz/± 1 or +2 Gy for 95 s. Compared to the static condition, performance decrements of 16% were measured at + 5Gz, 45% at combined+5 Gz/± Gy, and 70% at combined + 5Gz/± Gy. Heart rate increases were noted during the stress environments but no significant heart rate differences were noted between the +5Gz and the combined +5Gz/±2Gy conditions. The conventional lap belt and shoulder harness restraint system, while not optimum, was adequate for these G environments.

[Frazier JW, Repperger DW, Toth DN and Skowronski VD. Avait Space Environ Med. 53 (5) : 435, 1982]

II BIOMECHANICS

4. A technique for measurement and description of three-dimensional six degree-of-freedom motion of a body joint with an application to the human spine

A new experimental technique for the measurement of three-dimensional six degrees-of-freedom motion of a body joint and data reducation is presented. It utilizes three spheres that are rigidly attached to the moving body. Six of the nine components of three translation vectors of centers of the spheres are measured by six linear variable differenitial transformers (LVDT). Data is recorded in real-time by a minicomputer. Equations are derived to compute the three Euler rotation angles and the three-dimensional translation vector at a given point of the rigid body. Further, this six-dimensionalmotion vector is transformed into six parameters that describe the instantaneous helical axis of motion of the joint. Practical considerations in developing a program to compute these helical axis parameters are presented. The technique has been successfully employed to study kinematics of the human spine segments. Examples for the L3-4 lumbar spine segment, subjected to different loads are included. This technique, although especially developed for the *in vitro* study of the three-dimensional flexibility measvrements of the spine segments, may be advantageously utilized in other situations where small three-dimensional motion needs to be studied with high accuracy and in real time.

[Panjabi MM, Krag MH and Goel VK. J Biomechanics 14 : 447, 1981]

5. Model Experiments to study the stress distributions in a seated buttock

Mechanical stress states that develop in the buttock during sitting may exceed tissue tolerance and lead to decubitus ulcer formation in susceptible patients, such as those with spinal cord injury. The danger of this complication can be reduced by using suitable cushions to minimize stress magnitudes and gradients within soft tissues. In this investigation, a two-dimensional physical model of the buttock—cushion system was developed to aid in cushion design. The model consists of PVC gel simulating flesh, cast around a wooden core simulating the ischium bone. A grid etched on the gel permits measurement of strains via photographs of the undeformed and deformed model buttock supported by various cushion materials. The displacement field is analyzed, using a finite strain theory and a strain energy function, to obtain the tissue stresses'. In this manner, the performances of five clinically used cushion materials were campared with respect to the hige stress regimes developed in the model buttock.

[Reddy NP, Patel H, Cochran GVB and Brunski JB Biomechanics 15 (7) : 493, 1982]

III CLINICAL MEDICINE

6. Effect of transcendental Meditation on mild and moderate hypertension

Sixteen Hindu patients of mild to moderate essential hypertension undertook a carefully supervised programme of Transcendental Meditation (TM) After six months, there was a fall in mean systolic, diastolic and mean arterial pressures of 16.75, 9.81 and 12.12 mm Hg respectively which was highly significant. Ten (62.5%) of the 16 patients were considered to have responded satisfactorily as they showed a fall of mean arterial pressure by 15 mm or more or to diastolic blood pressure of less than 90 mm Hg. Results are comparable to treatment with drugs. Most of the reduction in pressure took place in the first two months. A feeling of well being was reported by nearly all the subjects.

It is suggested that in cooperative patients treatment may be initiated with TM alone for first

two months and drugs added or substituted if results are not satisfactory.

[Agarwal BL and Kharbanda A. J Asso Phys Ind. 29 : August, 1981]

7. Aortocoronary artery bypass : Results in 26,404 patients

Between October 1969 and December 31, 1981, 26,404 patients with coronary insufficiency underwent direct myocardial revascularization using aortocoronary bypass (ACB). Among these patients, 21,821 had ACB alone, and the remaining 4,583 had ACB in addition to correction of other cardiac and vascular lesions. In the series of patients having ABC alone, the hospital (early) mortality was 3.0%, with a 2.1% early mortality for 1981. In patients with ACB and concomitant surgery, hospital (early) mortality was 4.2%, with a 3.9% early mortality for 1981. On analysis of risk factors, it was found that 30% of the patients were over the age of 60; 72% had some degree of left ventricular dysfunction; 20% were in New York Heart Association functional class IV; 70% showed evidence of preoperative infarction; 12% had diabetes ; 34% had hypertension ; and 13% had a history or current evidence of congestive heart failure. Among surviving patients, 93% were improved or asymptomatic after undergoing ACB. These results indicate the benefit of surgical treatment for both symptomatic relief and increased life expectancy.

[Cooley DA and Mathur VS. Indian Heart Journal 34 (4) · 1982]

8. The frantiers of cardiomyopathy

The history of cardiomyopathies over the past three decades is briefly surveyed and the definition of cardiomyopathy as "heart muscle disease of unknown cause" is reaffirmed. The recent slight modification of the classification based on disorders of structure and function into hypertrophic dilated (congestive) and restrictive/obliterature cardiomyopathy is underlined.

The hypothesis that hypertrophic cardiomyopathy results from abnormal catecholamine function in the developing heart is reviewed and supported. The concept of "obstruction" in hypertrophic cardiomyopathy is critically reviewed on the basis that true obstruction to outflow from the left ventricle is not present and that the pressure gradients often recorded are the result of elimination of the cavity of the cavity of the ventricle as a result of powerful contration of extensively hypertrophied muscle. The importance of impaired diastolic function with general and regional abnormalities of relaxtion of a very complex nature is stressed. The natural history of hypertrophic cardiomyopathy is reviewed and the high incidence of sudden death confirmed in a personal series of over 250 patients studied over two decades. A relation between ventricular arrhythmia and sudden death been noted Studies of antiarhythmic therapy disclosed that, while neither beta adrenergic blocking agents nor calcium blocking agents such as verapamil control arrhythmias studied by ambulatory tape monitoring, amiodarone is highly effective. It remains to be seen whether amiodarone will reduce the incidence of sudden death, the mechanism of which is discussed in the light of causes other than arrhythmia such as impairment of ventricular filling and reduction in left ventricular volume. A tentative scheme of treatment is suggested based on control of symptoms with beta adrenergic blocking agents and management of arrhythmias with amiodarone. The aetiologies of dilated congestive cardiomyopathy remain obscure. The possible place of virus infection leading to a disorder of cellular immunity is stressed.

Endomyocardial fibrosis as the leading cause of restrictive/obliterative cardiomyopathy is briefly described and the similarities in pathology and haemodynamics between endomyocardial fibrosis of the tropics and Loeffler's eosinophilic endomyocardial fibrosis are stressed. Evidence that the immature eosinophils found in patients with hypereosinophilic syndrome and endomyocardial disease can damage the eedocardium is reviewed.

Finally, the involvement of cardiomyopathies in many fields of general internal medicine is stressed and it is suggested that no longer are the cardiomyopathies rare or curious diseases but relatively common disorders which are of interest to medical scientists in many fields and no longer the sole problem of the cardiologist.

[Goodwin JF. Br Heart J. 48 : 1, 1982]

9. Exercise testing in mitral valve prolapse before and after beta blockade

Exercise electrocardiograms must be interpreted with the understanding that not every positive test is indicative of coronary artery disease. Mitral valve prolapse mimics coronary heart disease clinically and often in the electrocardiographic response to exercise. Twelve patients with mitral valve prolapse in whom exercise testing was positive underwent a repeat study after beta blockade. All tracings returned to normal after adequate blockade, evidenced by 17 to 22% reduction of resting and exercise heart rates. To the best of our know ledge, this is the first such report in the English literature.

The results of this study suggest that an exercise test after beta blockade should become part of the routine procedure in such patients. The elimination of false positive electrocardiographic responses by beta blockade should help improve the specificity of the exercise test. Moreover, similar responses should lead to the suspicion of mitral valve prolapse.

[Abinader EG and Shahar J. Br Heart J. 48 : 130, 1982]

10 Cardiovascular Effects of Obesity and Hypertension

Although often coexisting in the same patient, obesity and essential hypertension exert disparate cardiovascular effects. An excess of adipose tissue augments cardiac output, stroke volume, and left ventricular filling pressure, expands intravascular volume, and lowers total peripheral resistance. In contrast, essential hypertension in a nonobese patient is associated with a contracted intravascular volume, high total peripheral resistance, and normal cardiac output, but increased left ventricular stroke work due to high afterload. Left ventricular adaptation will consist of eccentric hypertrophy in the obese (irrespective of arterial pressure) and concentric hypertrophy in the non-obese hypertensive patient. The combination of obesity and hypertension burdens the heart with high perload and high afterload, thereby greatly enhancing the risk of congestive heart failure. Peripheral resistance and intravascular volume may be normal in mildly hypertensive obese patients because of the mutually antagonising effects of the increase in arterial pressure and the increase in body weight. The fall in arterial pressure associated with weight loss seems to be caused by a decrease in adrenergic activity which leads to a fall in cardiac output without change in vascular resistance. Obesity hypertension may be the result of an inappropriately raised cardiac output in the presence of a relatively restricted arterial capacity due to the low vascularity of adipose tissue. In morbid obesity increased blood viscosity may contribute to the raised arterial pressure.

[Messerli FH. Loncet May 22, 1982]

IV ENVIRONMENTAL PHYSIOLOGY

II. Effect of restricted potassium intake on its excretion and on physiological responses during heat, stress.

The effect of low potassium (K^+) intak on its excretion, concentration in sweat and on physiological responses during heat stress was evaluated on eight Indian male soldiers in winter months at Delhi. After a stabilization period of 3 days on each diet, i.e., 85mEq of K^+/d (diet I, normal), 55 mEq of K^+/d (diet II), and 45 mEq of K^+/d (diet III), the physiological responses and the sodium and potassium concentrations in sweat, plasma, RBC, and urine were measured when the subjects were exposed to heat for 3 h daily in a climatic chamber maintained at 40°C DB and 32°C WB. The Subjects worked in the chamber at the rate of 495 W/h for 20 min periods with 40 min rest between each period of exercise. The whole body sweat was collected after the first the spell of work and was analysed for sodium and potassium levels. Throughout the study the subjects remained on possitive sodium balance except on day 4 in diet III. Fluid balance also remained positive while potassium balance was negative in subjects on diet II and diet III. There was no significant change in heart rate, sweat volume, oral temperature, sodium, and potassium concentrations in plasma and RBC during the entire period of the study. Even in the subjects with negative potassium balance there was no

change in the sodium and potassium concentrations in sweat during exercise in heat. The only evidence of potassium conservation was a reduced excretion in urine. Out of the eight subjects, in one subject there was a flattening of the "T" wave in the ECG and reduction in amplitude of the "T" wave in two more subjects. As there is no reduction in sweat potassium concentration and the urine volume is low, the marginal level of reduced excretion of potassium in urine with a high rate of sweating (7-81) in subjects doing work in the tropics, there is every likelihood of potassium deficiency if a liberal intake is not ensured.

[Malhotra MS, Sridharan K, Venkateswamy Y, Rai RM, Pichan G, Radhakrishan U and Grover SK Eur J Appl physiol occup physiol. 47 : 169, 1981]

12. Task categorization and the limits of human performance in extreme heat

This paper examines human performance limitations in differing task categories in conditions of elevated ambient temperature. Analysis of extant data affirms that decrement in the three task categories, namely : 1.) mental and cognitive skills, 2.) tracking and 3.) dual task performance, may be expected as environmental exposure exceeds 85°F, effective temperature (E.T.). Further, the systematic changes in impairment onset with tasks requiring differing levels of response complexity in varying time, E.T. conditions, are documented. These changes imply earlier heat stress related decrement in those task categories which require greater response complexity. The proposed thresholds of performance impairment are subsequently equated with absolute, physiologically noncompensable, rises in deep body temperature Support for the motion that prescribed rises in deep body temperature may delimit efficient performance in each category is found in studies which have examines task performance in situations where deep body temperature has been independently manipulated. Performer skill level is posited as potentially most influential in the mitigation of such heat induced decrement.

[Hancock PA. Aviat Space Environ Med 53 (8) : 778, 1982]

13. Discomfort judgements of translational and angular whole-body vibrations

In a previous series of experiments the subjective intensities of translational (Z-axis) and angular (roll, pitch, and yaw) vibrations were compared, using a psychophysical matching technique. To test the validity and generality of the matching results, an independent set of similar data was obtained in the present experiment, using the method of category production. Seated subjects set levels of translational vibrations, in the X-, Y-, and Z-axis and angular vibrations, in roll and pitch, that they judged to be "uncomfortable" on a scale of vibration discomfort. Frequencies of 2.5, 3.15, 4.0, 5.0, 6.3, and 8.0 Hz were presented in each vibration direction. As frequency increased the mean acceleration judged to be uncomfortable increased for Y-axis and roll ribrations, decreased for Z-axis vibrations, and was essentially constant for X-axis and pitch vibrations. The Y-and Z-axis results correspond well to equal intensity contours in existing vibration exposure criteria, and the roll results show good agreement with data from the roll matching experiment. The X-axis and pitch results are similar to the results from the pitch matching experiment and indicate the importance of the backrest in determining the effects of X-axis translational vibrations and angular vibrationsin pitch.

[Shoen Berger RW. Aviat Space Environ Med 53 (5) : 454, 1982]

14 Vibration and comfort I. Translational seat vibration

A series of studies of discomfort caused by multi-axis vibration at the seat, feet and back of seated persons is described. This first paper reports on studies with translational seat vibration. Two experiments concerned with the effects of level, frequency and direction of the translational vibration of a firm flat seat are reported.

At octave centre frequencies from 1 to 63 Hz the first experiment determined the levels of fore-and-aft, lateral and vertical seat vibration which caused discomfort equivalent to 0.5 and 1 25 m/s² r.m.s

10 Hz vertical seat vibration. In the second experiment, comfort contours equivalent to 0.8 m/s² r.m.s. 10 Hz vertical seat vibration and subject transmissibilities were determined from 18 males and 18 females at preferred third-octave centre frequencies from 1 to 100 Hz. In both studies the feet of subjects were not vibrated and there was no backrest.

It was concluded that the shapes of equivalent comfort contours need not normally depend on vibration level. The forms of both individual and group equivalent comfort contours and seat-to-head transmissibilities are presented. Significant correlations were found between subject characteristics (size and transmissibility) and subject relative discomfort. The males and females produced similar equivalent comfort contours.

Information on the computerized application of the method of constant stimuliation which was developed for the series of experiments is presented together with a consideration of alternative methods of determining the central tendency of the data. A method of assessing the effect of vibrator distortion on judgements of equivalent discomfort is also defined.

[Griffin MJ, Whitham EM and Parsons KC. Ergonomics 25 (7) : 603, 1982]

15. Vibration and comfort II. Rotational seat vibration

This second paper in a series of studies of the discomfort produced by multi-axis vibration is concerned with rotational seat vibration. The effects of level, frequency and direction of the roll, pitch and yaw vibration of a firm flat seat have been studied in two experiments. At octave centre frequencies in the range 1-31.5 Hz the first experiment determined the levels of roll, pitch and yaw seat vibration which caused discomfort equivalent to 0.5 and 1.25 m/s² r.m.s. 10 Hz vertical seat vibration. In the second experiment, comfort contours equivalent to 0.8 m/s² r.m.s. 10 Hz vertical seat vibration were determined from 18 males and 18 females at preferred third-octave centre frequencies from 1 to 31.5 Hz. In all cases the axis of rotation passed through the centre of the seat surface. There was no vibration of the feet and no backrest.

It was concluded that the shape of equivalent comfort contours need not normally depend on vibration level. Both individual and group equivalent comfort contours are presented. Although there were significant correlations between subject relative discomfort it is not thought that these correlations have much practical application. In all three axis the median contours of vibration acceleration increase in proportion to vibration frequency. Sensitivity is greatest for roll vibration and least for yaw vibration of the seat.

[Parsons KC and Griffin MJ Ergonomics 25 (7) : 631, 1982]

16. Subjective response to whole-body vibration the effects of posture

In an investigation of the effects of posture on subject responses to whole-body vibration, 20 undergraduate subjects produced equal sensation contours adopting three postures each on different occasions. The postures adopted were standing, sitting upright and sitting slouched.

The results indicated significant differences in the contour shapes from the three postures, and level set in the sitting postures were significantly lower than in the standing posture. No difference was obtained between the two sitting postures.

Implications of these findings are discussed regarding the role of transmissibility in subjective response to vibration, and the necessity to produce different standards for different postures.

[Oborne DJ and Boarer PA. Ergonomics 25 (7) : 673, 1982]

V HIGH ALTITUDE PHYSIOLOGY

17. Man at extreme altitude

The history of man's attempts to learn more about the physiology of extreme altitude is brefly reviewed. The earliest exploits were by balloonists who were often exposed to very severe hypoxia, sometimes with fatal consequences. A turning point was the work by Paul Bert using lowpressure chambers; he was able to prove that the deleterious effects of low barometric pressures were caused by the low Po_2, though other explanations for mountain

sickness such as a low arterial Pco_2 continued to be promoted for some time. Many early physiologists believed that active secretion of oxygen by the lungs was necessary to explain man's tolerance of extreme altitudes. Indeed, Haldanechampioned this view until his death in 1936, though strong evidence to the contrary had accumulated since the work of Krogh and others in the first decade of the century. High climbs by mountaineers have stimulated much interest in the physiology of severe hypoxia. Norton reached over 8.500 m on Mt. Everest in 1924, but the summit was not attained with out supplementary oxygenunitil 1978—the last 300 m took 54 years ! This suggeststhat the summit, altitude 8,848 m, is very nea the limit of human tolerance, and predictions based on maximal work levels measured at lower altitudes are consistant with this. The American Medical research Expedition to Everest, 1981, was specifically planned to obtain data on human physiology at extremealtitudes, and a number of measurements were made over 8,000 m, including some on the summit itself. It is apparent that the mountain can be climbed without supplementary oxygen only because the barometric pressure at the summit is not as low as has often been predicted, and because of the extreme hyperventilation that man develops under these conditions.

[West JB. J Appl Physiol : Respirat Environ Exercise Physiol. 52 (6) : 1393, 1982]

18. Clinical and experimental evidence for the use of hypothermia in decompression sickness

During consruction of the Coxwell sewer tunnel and subway in Toronto, a number of patients with decompression sickness failed to respond completely to repressurization alone After the addition of hypothermia, significant improvement occurred. These observations stimulated an experimental study in which 36 rabbits were exposed to 60 or 70 p.s.i. for 1 h. After sudden decompression over 70 s, they were either observed, cooled in air at 0°C, or cooled in water at 3°C. Immersion in water significantly reduced the mortality rate, while cooling in air did not. These experimental results supported the clinical observations that hypothermia was an effective therapeutic adjunct in the treatment of decompression sickness.

(Simmons EH, Odriscoll SW and Gamarra JA. Aviat Space Environ Med. 53 (3) : 266, 1982)

19. Air embolism : Possible role of surfactant on recompression

The relationship between surface tension and surface area has been measured on each of three common pulmonary surfactants—dipalmitoyl lecithin (DPL), dipalmitoyl phosphatidylethanolamine, and sphyngomyelin — under simultaneously simulated physiological conditions. These are selected to simulate the state of any surfactant that has migrated onto the surface of venous bubbles filtered by the pulmonary vasculature. It is concluded that, in the absence of shunt vessels, only DPL could reduce surface tension enough to allow pulmonary gas emboli to escape into arterial blood and then only after compression. This finding is discussed in relation to the delay in any appearance of bubbles in arterial blood and the possible facilitation of the release of asymptomatic lung bubbles by recompression therapy. The suggestion is made to reconsider stopping recompression of a subject with peripheral decompression sickness (the bends) at the depth of relief rather than risk releasing pulmonary gas emboli by further recompression. It is also demonstrated how the introduction of 1-min stops into compression can avoid surface tension falling to the low values at which it is theoretically possible for venous bubbles to escape into arterial blood during pulmonary hypertension.

(Hills BA and Barrow RE. J Appl Physiol : Respirat Environ Exercise Physiol. 52 (1) : 119, 1982)

VI NEURO - AND SENSORY PHYSIOLOGY

20. Electroencephalographic findings During mantra meditation (Transcendental Meditation) A controlled, quantitative study of experienced meditators

Based on analysis of EEG, heart rate, galvanic skin resistance and oxygen consumption, Wallace

(1970) and Wallace et al. (1971) postulated that transcendental meditation (TM) induces a wakeful hypometabolic state different from an ordinary relaxed drowsy state. The main EEG changes seen during TM were increased regularity and amplitude of the alpha activity. Supporting Wallace's proposal, Banquet (1973) concluded, on the basis of spectral analysis of the EEG, that the meditative state was a unique state of consciousness, separate from wakefulness, drowsiness or sleep.

This assumed hypometabolic state is however, not restricted to TM, as subjects who had learned a relaxing method were also able to decrease their oxygen consumption significantly more by relaxing than by just sitting with the eyes closed (Beary et al. 1974). Further, Fenwick et al. (1977) concluded that both the metabolic changes and the EEG phenomena during TM could be explained by accepted physiological mechanisms, as the hypometabolic state was not more than that produced by muscle relaxation and the EEG changes were not different from those observed in the state of sleep onset.

Hebert and Lehmann (1977) observed theta bursts with frontal dominance exclusively in subjects practising TM and nearly twice as often during meditation as compared to ordinary wakefulness.

Pagano et al. (1976) reported that a considerable part of the meditation time was spent in various sleep stages. Also Wachsmuth (Thesis 1978) noticed sleep episodes during TM. The EEG pattern during these episodes could not be differentiated from that seen during sleep onset (Wachsmuth et. al. 1980). On the contrary, Tebecis (1975) did not find any change of EEG activity during TM.

With these ambiguous EEG findings during TM in mind, the present study was undertaken to analyse quantitatively, and controlled, the effect of TM on the EEG. We have compared the EEG recorded during TM with that during various stages of consciousness: wakefulness, drowsiness, sleep onset and sleep. All the meditators had year-long experience and they were used while not meditating as their own controls. Furthermore, we have compared the EEGs from the TM group with those of an age-matched control group not practising TM.

(Stigsby B, Rodenberg JC and Moth HB. Electroencephal clin Neurophysiol 51 : 434, 1981)

21. Evaluation of the amplitude and frequency components of the surface EMG as an index of muscle fatigue

The frequency components and amplude of the surface electromyogram (EMG) were measured during both 3-s (tensions of 5-100% of the maximum voluntary contraction (MVc)) and fatiguing contractions at 25, 40 and 70% MVC in the handgrip, biceps, adductor pollicis and quadriceps muscles in six male subjects. For the handgrip and biceps muscles, the experiments were repeated at three different muscle lengths : the length at which the muscle was able to exert its maximum isometric strength, and the muscle length above and below that length which corresponded to a length at which the muscle could exert 80% of it maximum. The frequency components of the EMG were the same during brief fatiguing isometric contractions in any of the muscles examined here as long as the muscles contracted near their optimal length. Shortening the muscle length prior to contraction caused an increase in the power in the low frequencies of the EMG power spectra while stretching a muscle had the opposite effect during isometric contractions. The amplitude of the EMG during brief and fatiguing contractions were similar for all muscles except the biceps. The biceps showed a non-linear relation between the amplitude of the EMG and tension during brief isometric contractions and to a lesser extent during fatiguing contractions.

(Petrofsky JS, Glaser RM and Phillips CA Ergonomics 25 (3) : 213, 1982.

22. Aging and visual function of military pilots a review

This report reviews what is known about the effects of age on visual function and discusses the implications of age related changes in vision for the flying performance of military pilots. Most visual functions decline to some degree with age, and the

rate of decline has been roughly characterized in the general population. There is, however, virtually no data on military pilots, and extrapolation from the general population requires caution. Individual variation in the effects of age is great, and military pilots are a select group presumably in better general health than the general population. Several visual functions that decline with age seem particularly relevant to pilot performance : Contrast sensitivity, dynamic acuity, recovery from glare, function under low illumination, and information processing. Vision examinations currently given to military and commercial pilots do not measure these visual functions. The feasibility of supplementing existing vision examinations with measurements of these functions should be explored ; such an assessment should consider both research issues and policy implications. Research is needed on several major problems in this area. It is not possible at present to characterize well the effect of changes in visual function of the performance of complex tasks, such as flying. This report suggests several specific measures that might help characterize the effects of changes in visual function on pilot performance. Data on changes in visual functions with age should be collected from military pilots, preferable with multivariate, longitudinally designed studies. Research is suggested to assess the extent to which experienced pilots may compensate for declining visual functions and to determine how such compensationis achieved. The report suggests studies of the interaction of age with other factors, such as cardio vascular changes, that may effect performance, especially under stress.

[Sekuler R, Kling D and Dismukes K. Editors Aviat Space Environ Med 53 (8) : 747, 1982]

23. Visual scanning behavior and mental workload in aircraft pilots

This paper describes an experimental paradigm and a set of preliminary results which demonstrate a relationship between the level of performance on a skilled man-machine control task, the skill of the operator, the level of mental difficulty induced by an additional task imposed on the basic control task, and visual scanning performance. During a constant, simulated piloting task, visual scanning of instruments was found to vary as a function of the level of difficulty of a varballoading task. The averaged well time of each fixation on the pilot's primary instruments increased as a function of the loading. The scanning behaviour was also a function of the estimated skill level of the pilots, with novices being affected by the loading task much more than experts. The results suggest that visual scanning of instruments in a controlled task may be an indicator of both workload and skill.

[Tole JR, Stephens at, Harris SR RL and Ephrath AR Avait Space Environ Med 53 (1) : 54, 1982]

24. On the significance of heterophoria for stereoscopic vision

This study was undertaken to explain the possible correlation between heterophoria and stereopsis because in the literature, there are different opinions. The subjects were 806 recruits. They were trained as rangefinder men, of whom a perfect steropsis is required. The permitted maximal limits of heterophoria were 1 prism diopter (Pr D) vertically, of esophoria 5 PrD, and of exophoria 6 Prd. Soldiers with abnormal stereopsis, myopia, hyperopia more than 1.75. or astigmatism over 0.50 diopters, were omitted. The haterophoria was tested with Herschel's prism to 5 m distance The stereoscopic vision was invesigated using Pulfrich's device and the so called three-needles test. No statically significant correlation could be demonsted between heterophoria and the degree of srereopsis. Surprisingly, it could be noticed that persons with esophoria finished Pulfrich's test more quickly than those with exphoria. This difference was statistically highly significant. In the three-needle test, the results had the same trend. This might have some importance importance to rangefinder men and to pilots if it can be confiremed in the military practice.

[Castren J, Rutanen H and Aho J. Aviat Space Environ Med 53 (4) : 393, 1982]

VII MAN-MACHINE INTEGRATION AND LIFE SUPPORT SYSTEMS

25. Systems Anthropometry : Development of a Stereoradiographic Measurement System

A thrhe-dimensional measurement system using stereoradiography and anatomical lannmarks is des-

cribed. Two sets of radiographic targets are employed to obtain a three-dimensional description and mobility of the human body.

[Reynolds HM, Hallgren RC and Marus JJ Biomechanic 15 (4): 229, 1982]

26. Auxiliary cooling: Comparison of air-cooled vs. water-cooled vests in hot-dry and hot-wet environments

Water-cooled, air-cooled, and ambient air-ventilated auxiliary cooling vests were evaluated in a hot-wet climate (HW) (35°C, 75° R. H.) and a hot-dry envirnment (HD) with additional infrared radiation (Ta = 49°C, 20% R.H , 68°C black globe temperature). Twelve subjects dressed in full chemical warfare combact uniforms underwent 120 min of heat exposure in each combination of climate and cooling vest, except for the hot-dry environment and ambient-air vest. During each exposure, total exercise time was 20 min and rest time 100 min. This resulted in a mean time weighted metabolic rate of 180 W. Both water-cooled and air-cooled vests were sufficient for cooling in the HW climate : heat storage ($\triangle$S) was 13 and 7 W, final rectal temperature (Tre) 37.4 and 37.3°C, and heart rate (HR) 134 and 112 b. min^{-1}, respectively. While using the ambient-air vest, all variables were significantly ($p > 0.05$) higher ($\triangle$S, 25 W; Tre 37-7°C; HR, 139 b. min^{-1}; respectively). In the HD climate, both water and air-cooled vests were in sufficient with a $\triangle$S of 46 and 48 W, final Tre of 38.4 and 38°C, and final HR of 151 and 147 b min^{-1}. However, both cooling rests improved the subjects physiological status compared to these predicted variables without auxiliary cooling. No significant differences were found between the air or the water-cooled vests in either the HD or HW climates. It was concluded that an air-cooled vest can be used with the same efficiency as a water-cooled vest. In contrast, the ambient-air vest was shown to have a low effectiveness in HW and to be dangerous in a HD climate.

[Shapiro Y, Pandolf Kd, Sawka MN, Toner MM, Winsmann FR and Goldman RF. Aviat Space Environ Med. 53 (8) : 785, 1982]

VIII PSYCHOLOGY AND PSYCHIATRY

27. Psychological testing at high altitudes

Psychological testing was done on 20 subjects at various altitudes (sea level, 3, 810m, and 5,000m) during a 35-d mountaineering) expendition to Denali (Mt. McKinley). Intellectual functioning and personality changes were studied. While little variation was noted at the lower altitude, at 5,000m there was a marked deterioration in cognitive ability. This was accompanied by a sharp increase in paranola and obsessive-compulsiveness and smaller increases in depression and hostility.

[Nelson M. Aviat Space Environ Med. 53 (2) : 122, 1982]

28. An introduction to disaster : Some considerations of a psychological nature

This paper provides a review of the literature dealing with the psychological reactions of individuals and groups to disaster. The paper was intended for use by a broad readership and serves both as an introduction to the field as well as a resource document for workers already engaged in disaster planning and training. Characteristic stages of human response to disaster situations are discussed as well as the specific immediate reactions of individuals and groups. Phenomena such as "scapegoating," long term reactions, reactions of rescue and relief personnel, psychological first aid, and disaster planning, are among the other topic examined.

[Singer TJ Aviat Space Environ Med 53 (3) : 245, 1982]

29. Recent life change measurement in canadian forces pilots

This study is the first in a series of steps aimed at developing a management tool that will provide a technique for screening accident-prone aviators. Because "life change" is found to be a contributing factor to stress and development of illness in both civilian and military population, the study of life change events in aviators is a reasonable point from which to begin. The Holmes and Rahe Recent Life Change Questionnaire was administered to an experimental group of 158 aviators and two control groups : One group of 127 ground crew who were matched for age and location, and a group of 46 who were matched for rank. Significant differences were found between some of the subgroups but there were no significant differences between the experimental group and either of the control groups. Nonetheless, this aviator population is functioning at a level of life change induced stress which would normally predict health changes in 50% of the general population. Therefore, it is concluded, the effect of excessive life change as a contributing factor to personal stress and illness or accident merits further study.

[Mc Carron PM and Haakonson NH. Aviat Space Environ Med 53 (1) : 6, 1982]