EVALUATION OF LBNP AS COUNTERMEASURE TO CARCINOMA DECONDITIONING. K. Yajima(1), M. Igarashi(1), A. Miyamoto(1), T. Ro(1), K. Hiyama(1), T. Nakazato(1), S. Yumikura(2), M. Doi(2) and C. Sekiguchi(2). 1)Nihon University, Tokyo, Japan, 2)NASA.

METHOD. To evaluate the effects of LBNP as a countermeasure for carcinoembryonic deconditioning in space, seven young male volunteers were admitted to the hospital and experienced 6-degree head down tilt (HDT) for 3 days. Passive 60-degree head-up tilt (HUT) was performed before and after HDT. Four volunteers received 30 mmHg LBNP for 30 minutes to induce fluid shift to the lower body twice a day (every morning and afternoon) during HDT for 3 days, while 3 of 7 volunteers (the control group) did not receive LBNP. Continuous blood pressure monitoring, heart rate, and impedance plethysmogram were measured during the HUT test before and after HDT. RESULTS: One volunteer became presyncpe during the first LBNP and also became presyncpe again during the HUT test after HDT. The other LBNP volunteers (3 out of 4) did not show undesirable conditions. One volunteer of control group was observed over a period of 120 days in 15 healthy male volunteers, divided into three groups. Group I (5 subjects) experienced 3 weeks, Group II (5 subjects) 1 week of horizontal bed rest. Group III (5 subjects) served as ambulatory control group. All bed rest subjects received a Ca balanced individual diet and were kept under close supervision in a hospital. Blood and urine samples were collected throughout the bed rest periods and during follow up (15 weeks).

RESULTS: Serum and 24 urine parameters of Group I showed changes that resembled the typical and well known pattern of disuse osteoporosis (slight increase of Serum Ca, increase of osteocalcin, decrease of serum PTH, increase of urinary Ca and Hydroxyproline). Group II showed similar trends, however, changes were not significant compared to base line. CONCLUSION: A bed rest period of more than 1 week appears to be necessary to show significant biochemical changes due to immobilization.

DISUSE OSTEOPOROSIS: CHANGES IN BIOCHEMICAL PARAMETERS DURING AND FOLLOWING SIMULATED MICROGREDY OF DIFFERENT DURATION. K. Lohn*, DLR Cologne, Germany; S.R. Mohler*, E. Powers*, T. Hangartner, Wright State University, Dayton, OH.

A limiting factor for prolonged human exposure to microgravity is the loss of bone mass. Immobilization and bed rest have proved to be useful models for earth based simulation of weightlessness effects. To further our understanding biochemical bone parameters were observed over a period of 120 days in 15 healthy male volunteers, divided into three groups. Group I (5 subjects) experienced 3 weeks, Group II (5 subjects) 1 week of horizontal bed rest. Group III (5 subjects) served as ambulatory control group. All bed rest subjects received a Ca balanced individual diet and were kept under close supervision in a hospital. Blood and urine samples were collected throughout the bed rest periods and during follow up (15 weeks).

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ENHANCED GAMMA COMPUTED TOMOGRAPHY FOR BONE DENSITY MEASUREMENT IN SHORT TERM BED REST SUBJECTS. W.P. Power(1), S.R. Mohler(1), T. Hangartner, Wright State University, Dayton, OH.

INTRODUCTION. Prolonged space flight may produce bone density loss of sufficient magnitude to adversely impact extended duration space travel. Trabecular bone density change which occurs early in space flight has not been adequately measured due to the limited accuracy of prior measuring devices. METHODS. The OsteoQuant gamma computed tomography device, with 0.5% change in trabecular bone density detection ability, was used to characterize changes in the bone density of healthy male bed rest subjects. Three groups of five subjects received periodic measurements of trabecular bone density of the distal radius and distal tibia. Five had three weeks bed rest, five had one week bed rest, and five were controls.

RESULTS. Trabecular bone density changes in the bed rest groups approached 1%. There was an unexpected rise in trabecular bone density of both bed rest groups in the first week of bed rest, followed by a decline in bone density during the bed rest period. CONCLUSION. The initial rise in trabecular bone density at the onset of bed rest may represent a new finding. The OsteoQuant could be used to measure changes in bone density in connection with current space shuttle missions.

THE SPATIAL DISORIENTATION TRAINING SYSTEM BUILT IN AIR FORCE CHINA. Liang Nian*, Institute of Aviation Medicine AF, Beijing 100071, China.

INTRODUCTION. To reduce the incidence of the Spatial Disorientation (SD) accidents a 3D training System was built in AF of China. METHODS. This System consists of a), Education, through which the pilots should acquire adequate knowledge about the 3D SRP and SDP, its etiology, manifestations and the methods for coping with it b) Ground-Based training, through which allow the pilots to safely experience the SD simulated by Barany chair and Ogulinic stimulator and to acquire adequate skills in dealing with the 3D by Visual-Instrument Orientation c) In-Flight Training, through which allow the pilots to acquire the actual skills of identifying 3D (spatial reference) by simulating a series of flight maneuvers in the training aircraft and to acquire the skill of maintaining correct spatial orientation to avoid disorienting conflict and the skill of developing optimal control strategies for recovery from unusual attitudes. RESULTS. Ten thousands pilots are trained for overall training program. The 59 out of 84 pilots are reduced from 84.5% to 33.3%. CONCLUSION. This 3D training System is realistic and effective for avoiding 3D accidental.
COMPARISON OF SIMULATOR SICKNESS SYMPTOMATOLOGY IN TWO FIXED-WING AND TWO ROTARY-WING SIMULATORS. Michael G. Ljungblad, PhD*; Naval Air Systems Command; Robert S. Kennedy, PhD†; Essex Corporation; Sherri A. Jones, M.S., Naval Training Systems Center.

INTRODUCTION. Studies have found that moving-base simulators of rotary-wing aircraft may elicit higher simulator sickness levels than fixed-base simulators, as measured by self-report, postural, and visual tests. A standardized scoring technique was developed which facilitates comparison between simulators and a factor analysis revealed three distinct factor clusters corresponding to oculomotor, visual-vestibular, and neurovegetative systems. METHODS. Four simulators were examined in the present experiment. Two “sister” moving-base simulators (2F11 and 2F14) for the AH-64 helicopter and two fixed-wing simulators (2F11 and 2F14) for the A6 and E46 aircraft. The helicopter simulator employ CFT infinity appliances and the other two were dome projection systems. The 2F14 was a fixed base. Approximately 100 aircraft were observed in each simulator.

RESULTS. Simulator sickness was found in all simulators when total scores were taken into account, with the highest incidence in the helicopter simulators. When the symptomatology was scored according to the three factor clusters, it was found that the CFT-based helicopter simulators had the highest reports of eyestrain and the fixed-base simulator had the highest reports of disorientation. Nausea was reported about equally in all three of the motion-base simulators.

CONCLUSION. Different symptom clusters which occur in specific simulators with sufficient regularly suggest using this method of analysis in an attempt to identify specific equipment features that relate to simulator sickness.

NUTRITION AND ACCELERATION TOLERANCE: CURRENT UNDERSTANDING. G. H. Evans and L. P. Knott*; Valparaiso University. Valparaiso, IN 46383 and Armstrong Laboratories, Brooks AFB, TX 78235-5000.

INTRODUCTION. Nutritional status and the influence of diet on individual ability to perform in the increased acceleration environment is an important aeromedical concern. Although relatively more information has been generated regarding the nutritional needs of the infantry soldier, little data is available for the special case of the high performance pilot (HPP). METHODS. Approximately 5 decades of nutritional research and current sources of nutrition information provided sources for this review. RESULTS. In the present experiment. Two “sister” moving-base simulators (2F11 and 2F14) for the AH-64 helicopter and two fixed-wing simulators (2F11 and 2F14) for the A6 and E46 aircraft. The helicopter simulator employ CFT infinity appliances and the other two were dome projection systems. The 2F14 was a fixed base. Approximately 100 aircraft were observed in each simulator.

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CONCLUSION. Different symptom clusters which occur in specific simulators with sufficient regularly suggest using this method of analysis in an attempt to identify specific equipment features that relate to simulator sickness.


INTRODUCTION. CONVOL EDGE (CE) is a new anti-G system that is the standard in F-16 aircraft. It was later selected for retrofit to the F-15 fleet. Evaluation of the prototype system thus far has resulted in assessment of its effectiveness at the different seat-back angles used in each aircraft. METHODS. Conditions were structured to permit the comparative evaluation of traditional gear, i.e. PGI and PBG, and CE with PBG. Each was scored on the endurance attained by experienced subjects riding a standardized centrifuge test profile. RESULTS. In comparison with traditional gear the combined influence of introducing CE and PBG increased the endurance attainable from both seats (ANCOVA p<0.01 for F-15, p<0.001 for F-16). Incremental increases of endurance appeared to accompany the introduction of CE and PBG respectively, but were much larger, and statistically significant (paired-t test), in the F-16 case only. CONCLUSION. The endurance advantage conferred by PBG is thus demonstrated in both F-15 and F-16 seat configurations, but is more marked, and displays statistically definable increments, only in the F-16 case. How slight postural differences between the seats may cause this is unclear. Whether or not it will influence aircraft acceptance in either aircraft should emerge from ongoing operational tests.

AEROBIC AND STRENGTH TRAINING EFFECTS DURING HINDLIMB SUSPENSION. D. Harley, MJ Piusley, NH McKe, KD Forsyth, and W. Rhodes; Department of Physiology and Surgery, School of Physical and Health Education, University of Toronto, Toronto, Ontario, Canada, MSS 1A8.

INTRODUCTION. The hindlimb suspension model has been used to study the response of skeletal muscle to a simulated "microgravity" environment. The purpose of this study was to determine the influence of strength training (electrical stimulation) and aerobic exercise (treadmill running) on the response of the slow muscle fibers to hindlimb unloading and the influence of aerobic training on hindlimb unloading. METHODS. Female Wistar rats (275g) were randomly assigned to suspended (S, n=20) and non-suspended (NS, n=30) groups. Both groups were subdivided into sedentary, aerobic and strength-training groups. Training started 7 days after being removed from a harness during the training sessions (3 days/week). Muscle contractile function and morphometry were assessed at the end of six weeks. RESULTS. In S rats, soleus peak twitch tension (Pt, N/g), tetanic tension (Po, N/g) and mean cross-sectional area (CSA, um2) of type II and Ia fibers were reduced, respectively, to 82, 78, 47 and 68% of NS values (p<0.05). In group S, plantaris fiber CSA was reduced to 82 (type I) and 81% (type II) of NS values (p<0.01). Within S and NS groups respectively, sedentary values (mean+sd) for soleus Pt (2.29±0.79, 2.8±0.92 N/g), Po (10.8±3.0, 13.8±0.98 N/g), type I CSA (1696±240, 2324±576 um2) and type II CSA (1712±233, 2234±314 um2) were not significantly changed by either strength or aerobic training. Compared to sedentary activity, strength training increased plantaris Pt by 23% in S and 29% in NS groups (p<0.05). CONCLUSION. Intermittent aerobic or strength training intervention during prolonged hindlimb suspension may be ineffective in reducing the amount of muscle wasting due to simulated "microgravity" exposure.

SKELETAL MUSCLE RESPONSES TO UNLOADING IN HUMANS. G. Dudley, P. Teasch, B. Hether, G. Adams & P. Buchanan*; NASA & Blackburn Corp, Kennedy Space Center, FL 32899, Karolinska Institute, S-10401, Stockholm, Sweden.

INTRODUCTION. This study examined the effects of unloading on skeletal muscle structure. METHODS. Eight subjects walked on crutches for six weeks with a 10 cm elevated sole on the right shoe. Thisremoved weight bearing by the lower limb. Magnetic resonance imaging of both lower limbs and hip and knee structure. RESULTS. Unloading decreased (n=20) muscle cross-sectional area (CSA) of the knee extensors, lower limb fibular heads, the intact left lower limb. However, the CSA of the knee extensors exhibited a 20% decrease (P<0.05) in the 16 weeks. The knee extensors and quadriceps showed a 20% decrease (P<0.05) in CSA. The reduction in muscle mass was observed in the knee extensors, the quadriceps, and the hamstring muscles of the left lower limb. A significant decrease (30%) in the mass of muscle mass was observed in the knee extensors, the quadriceps, and the hamstring muscles of the left lower limb. A significant decrease (30%) in the mass of muscle mass was observed in the knee extensors, the quadriceps, and the hamstring muscles of the left lower limb. A significant decrease (30%) in the mass of muscle mass was observed in the knee extensors, the quadriceps, and the hamstring muscles of the left lower limb. A significant decrease (30%) in the mass of muscle mass was observed in the knee extensors, the quadriceps, and the hamstring muscles of the left lower limb.