INTRODUCTION: When inadequate stimuli are available for accommodation, as in the dark or under low contrast conditions, the lens shows accomodating movements. Resilient positions are likely, under autonomic control, and can change with visual task demand. We hypothesized that motion sickness in a flight simulator might result in dark focus changes. Central autonomic systems in the brainstem are metabolically active before and after simulator exposure when comparisons were made between sick and non-sick pilots subjects. In two of these experiments, the average shift in dark focus for the sick subjects was toward increased activity before and after simulator exposure to induce motion sickness symptoms. METHODS: 14 subjects received training flights in three experiments there were significant differences between dark focus changes.

INTRODUCTION: The problem of G-LOC continues to exist and could potentially escalate if advances are made in aircraft maneuverability and speed. In order to investigate this problem and understand the mechanism of G-LOC we have used anesthetized laboratory rats and mice. These animals are well suited for G-LOC research are used because of the abundance of literature that proves techniques in their basic energy metabolism. METHODS: A small animal centrifuge (SAC) was fabricated (21") radius, angular rate of +20 Gz/sec with the unique capability of brain fixation and induced gravity. Fragile body fat, nitrogen or microwave irradiation. Additional SAC capabilities include monitoring of body activity, brain blood flow, blood and intracranial pressure and physiological changes in thermoregulation. RESULTS: The +Gz tolerance was found to be 20-25 Gz and 30-35 Gz for rats and mice, respectively. The times to G-LOC (isoelectric EEG) at these G levels are 14.5±2.9 sec for rats and 17.6±1.3 sec for mice. The EEG remained isoelectric for an additional 10-30 sec following deceleration. Brain fixation techniques have proved to be effective for measuring metabolic alterations before, during and after the +Gz exposure. The time course changes in energy metabolism and glucose use in the cellular model. The use of laboratory animals is required since this information is currently unattainable from human subjects.


INTRODUCTION: The altitude insomnias affects the sea level inhabitants staying at high altitude without an adequate period of previous adaptation. Few studies have been carried out focusing on the relationship among the self-reported quality of the sleep, the sleep structure, and the other physiological variables (EEG, ECG, INFRARED IMAGING) involved in the adaptation to the hypoxic hypoxia. METHODS: Fourteen healthy, range age 18-29 years old volunteers were involved in the study. The subjects signed a questionnaire about the quality of their nocturnal sleep. Six of the 14 subjects underwent also polysomnographies (EEG, EOG, RMO, EEG, THORACIC IMPEDANCE) with Oxford 9000 dynamic recorders: two times at sea level (two months before the flying mission) and two times at 4400 m. Two weeks before the flying mission each subject started waking up for 10 min every hour during the night. The polysomnographies were completely achieved after 3 weeks at 4940 m.

INTRODUCTION: Although G-LOC in pilots is known to have occurred as early as World War I, its mechanism is unknown. G-LOC occurs in conjunction with a critical reduction in cerebral blood flow during high +Gz stress. Eye level arterial blood pressure is reduced to zero within 2 sec, but +Gz is observed 7-10 sec after the onset of +Gz. This suggests that the reduction in blood pressure is not the only factor that causes G-LOC. The present study investigates the effect of +Gz exposure on rat brain lactate metabolism. METHODS: Awake rats with implanted EEG electrodes were restrained and placed on our small animal centrifuge. Control rats were exposed to baseline +Gz and experimental group were exposed to +25 Gz for 30 s and brain samples were collected 1 m post +Gz. Two other groups of rats were exposed to +15 to 35 Gz for 30 s and brains were fixed by microwave. Brain tissue hemogenates were analyzed for glucose, lactate, creatine and phosphates for both rats and mice showing significant differences within 15 sec after onset of +25 Gz in rats. Total Fe content showed a similar decrease. Total protein content in mice brain decreased at +20 Gz and higher. Hb and Fe content in mice brain tissue were being investigated. CONCLUSION: The decreases in total protein and Hb are indicators of a decrease in total blood flow to the brain. But the presence of Hb suggests that trapped blood remains in the brain. We believe that this residual blood acts as an energy pool and delay the onset of G-LOC in a high +Gz environment that follows a decrease in carotid artery blood pressure.


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The optimum authority gradient appears to occur where it is less
common for the junior pilot at least a Navy LT or Marine CAPT.
The accident rate of these IFR certified

THE FREQUENCY OF SELF-MEDICATION AMONG U.S. NAVY AIRCREWS AND ITS
ROLE IN AIRCRAFT MISHAPS. G.L. Donskii*, J.B. Brinker, and D.F. Neri. Naval
Aerospace Medical Institute and Naval Aerospace Medical Research Laboratory,
Pensacola, FL 32508.

INTRODUCTION. The Navy prohibits the practice of self-medication in its
aircrews. Self-medication is defined as the act of taking medication without the consent of
a flight surgeon. Nevertheless, reports continue to reveal the unauthorized use of
medications in aircraft mishaps. Although self-medication is rarely listed as a causal factor in these mishaps, the anecdotal frequency of its appearance in these reports suggest the possibility of an unrecognized role. Further, the fact that a highly disciplined aircrew is violating a well known regulation with some frequency speaks to the need to identify the factors pertaining to this abuse.

METHODS. Naval aviators, naval flight officers, and enlisted aircrew from six training and fleet squadrons are being
surveyed to identify the frequency of self-medication, the medications being used, and the conditions prompting such use. The survey is confidential in that individual anonymity is maintained during the collection process. The survey instrument elicits data on personal use of both over-the-counter and prescribed medications taken without medical consultation. Solicited data include time since aircrew designation, incidence and frequency of self-medication, basis for self-medication (colds, headaches, etc.) and identifi-
cation of medications used. Additionally, Naval Safety Center (NSC) and Armed Forces Institute of Pathobiology (AFIP) data on mishap aircrews and medication use will be reviewed for a comparison analysis.

CONCLUSIONS. The brief will review the results of the aircrew survey and correlate those results with the information obtained from the NSC and AFIP. The incidence of self-medication from the survey will be compared to the mishap data. The implications of these results for aircrew, safety personnel, flight surgeons, and policy makers will be discussed.
IMPROPER IFR PROCEDURES IN COMMUTER AND AIR TAXI CRASHES. M.W. Lamb* and S.P. Baker. Sunshine Aviation Safety Studies, Questa, NM 87556; Johns Hopkins Injury Prevention Center, School of Public Health, Baltimore, MD 21205.

INTRODUCTION. Of 127 commuter and 597 non-scheduled air taxi crashes during the period 1983-1988, we categorized 46 as improper IFR procedure; 67% were fatal. METHODS. NTSB briefs were reviewed for the period. An epidemiological analysis of all cases explored relationships between circumstances, accident factors, and contributory factors. RESULTS. Of these 46 improper IFR crashes, 22 (48%) were due to pilot errors, 5 (11%) were due to ATM errors, and 19 (41%) were due to a combination of both. CONCLUSIONS. The present study indicates that improper IFR procedures are a significant contributor to air taxi crashes.

INCIDENCE OF INFLIGHT MEDICAL EMERGENCIES IN BUSINESS AIRCRAFT. R.T. Carrison, Wright State School of Medicine, Dayton, Ohio 45461-0597.

INTRODUCTION. Studies of factors possibly contributing to thromboembolic disease were performed during a long distance flight from Vancouver to Frankfurt in the economy class of a Boeing 747-400. Altogether 18 apparently healthy volunteers were studied.

METHODS. Lower leg volumes (photoelectronic body device) blood pressure, and heart rate fluid intake (protocol) and urine production as well as several rheological and hemostaseological parameters were determined initially and after 6 and 9 hours. RESULTS. The volume of leg edema and hematocrit levels of all volunteers increased statistically significantly when compared to their initial values. The increase seemed to be more marked than in earlier studies. Rheological and hemodynamic parameters and most of the haemostaseological parameters showed only slight and no relevant changes. Only factor VIII values showed an increase at the end of the flight. All volunteers showed a positive fluid balance and an increase in body weight, blood pressure and heart rate, fluid intake (in mEq/hr, placebo, 16.7 ± 1.8; DDAVP, 14.5 ± 3.5, p<0.005). In cold water, this agent had no effect on sodium excretion (in mEq/hr, placebo, 310 ± 61; DDAVP, 48 ± 17, p<0.005).CONCLUSIONS. DDAVP inhibits the diuresis induced by immersion in cold water. DDAVP inhibits the diuresis induced by immersion in cold water; S. Farruk, M. Grawender, M. von Mimmern, B. Vanselow.

MAL DE BARROCO (MD) AND HABITATION TO SEA CONDITIONS. O. Spitzer, C.R. Gordon*, I. Doveck, Y. Melamed, and A. Shupak. Motion Sickness and Human Performance Laboratory, INHI, Haifa, Israel.

INTRODUCTION. MD is the transient sensation of unsteadiness and/o/o disequilibrium experienced on land after disembarking from a ship. In a previous study, we reported the high incidence of MD among naval crew members and added support to the relation of seasickness susceptibility, but not to experience of MD. METHODS. 116 crew members completed a questionnaire and MD score was assessed. RESULTS. 72% of the subjects had experienced MD: 29% (34) only once, 26% (32) occasionally, and 15% (17) were often. Although the appearance of MD was not related to experience at sea, on their first sea voyages, a significant positive correlation was found between MD and seasickness susceptibility. CONCLUSIONS. MD was found to be a frequent experience, which has high incidence during initial voyages and its reduced occurrence can be partially explained by long-term habituation to sea conditions.

INTRODUCTION. During the ascent of an airplane the atmospheric pressure decreases and the corresponding volume of air within the semiclosed cavities of the middle ears and the paranasal sinuses increases, whereas the volume of gas that has decreased during the descent. When the pressure in these cavities with the cabin pressure, symptoms of barotrauma appear. Last three years several studies have reviewed our clinic with symptoms of otic or sinus barotrauma. Surprisingly they all told flown a Boeing 737 aircraft. METHODS. To test the hypothesis that flying a Boeing 737 aircraft increases the chance of a barotrauma, the cabin pressurization schedule of a Boeing 737 was compared with the schedule of both a Boeing 747 and a DC 10 aircraft. RESULTS. The maximum aircraft altitude of all three airplanes is 37,000 feet. The maximum cabin pressure of the Boeing 737 is 8,000 feet. This is considerably above the levels of the aircrafts of the type Boeing 747 and DC 10. CONCLUSION. The pressurization schedule of the Boeing 737 aircraft is less comfortable than the schedules of the Boeing 747 and the DC 10 aircraft. Boeing 737 aircraft seems to increase the chance of a barotrauma.

PANEL ABSTRACTS

THE AGING PILOT DILEMMA: E. Altekruse, Johnson, SC 29832

INTRODUCTION. Historically pilots emerged from WW II with reputations as fast living reckless daredevils. On the big screen they smoked, drank and caroused. Now we know these unhealthy life styles can have disastrous consequences. In the 1940s and 1950s, it was common to attribute these consequences to aging. As a result, the stigma of age lead to discrimination in many forms. In 1960, the U.S. mandatory retirement age of 60 for airline pilots. Prior to that time the retirement age for pilots varied amongst airlines. Physiologic and psychosocial theories of biological and psychological techniques has enlightened the medical community and society to the fact that, strictly speaking, aging has taken a "bus rap" and the stigma of some health condition can more properly be attributed to abuses listed above and other life style factors. Many agencies and institutions are now reevaluating their policies relating to the consequences of aging. PANEL. Assembled here are experts representing the FAA, National Institute on Aging, NASA, the Naval Aeromedical Institute, professionals from academia and medical directors of international airlines. They will bring us up to date on their institutions endeavors to scientifically determine the consequences of aging and establish realistic policies relating to age, qualification and retirement.

STUDIES ON MANDATORY RETIREMENT AGE FOR PILOTS. P. S. Della Rocca and D. E. Schroeder. Human Resources, Research Division, FAA Civil Aeromedical Institute, Oklahoma City, OK 73121.

INTRODUCTION. The "Age 60 Rule" (14 C.F.R. Part 121) has generated varying levels of controversy during its 30 year existance. Research by Golazewski (1983) has been used to support the conclusion that pilots of age 60 and older have higher accident rates. Questions concerning these findings and other issues surrounding the regulation led the FAA Associate Administrator for Regulation and Certification to renew research efforts on the relationship between aging, experience, and pilot performance. APPROACH. Information will be presented on the status of ongoing research within the FAA concerning the "Age 60 Rule. Research studies are designed to improve methods of investigation, as well as to pursue research recommendations from groups of experts that has previously reviewed the question. The first study consolidates existing historical databases (the National Transportation Safety Board's Accident database, the FAA Airmen Certification database and the FAA Medical database) in a replication and extension of the Golazewski study. Analysis of pilot age and gender and accidents were conducted to establish a relationship. Subsequent studies assess the feasibility of using new or existing psychological and performance assessment methodologies for predicting subtle age-related cognitive deficits in pilots. CONCLUSIONS. The purpose of these studies is to improve upon historical research methodologies that has purposed to examine a relationship between age and accidents. Findings from the three investigations will be used to reassess the status of the "Age 60 Rule."
PILOT AGING POLICIES IN INTERNATIONAL AIRLINES

I. Glaizer, M.D.  
Chief Medical Officer  
EL-AL ISRAEL AIRLINES, LTD.  
BEN GURION AIRPORT, ISRAEL.

INTRODUCTION:  
For decades regulatory agencies adhered to an arbitrary upper age limit for pilots engaged in passenger operations. Based on these rules, major international commercial airlines set up contractual agreements with unions and/or individual pilots. With the advent of modern diagnostic techniques and operational monitoring these rules and contracts were recently challenged.

DEVELOPMENT:  
Stress should be put on medical-physiological criteria rather than purely chronological arbitrary limits. Performance capability is essential in determining one’s fitness as a pilot. Medical technology provides new diagnostic techniques which enable us to predict with better confidence that a pilot will not become suddenly incapacitated especially where the cardiovascular system is concerned. The degradation of a pilot’s perceptual, psychomotor and intellectual functioning which is expected in the aging process may be detected and assessed with a great measure of confidence by physicians, co-workers and family and documented during simulation performance and line checking. In a relatively small airline like EL-AL the medical officers and flight operations supervisory staff know each pilot personally and in many cases are familiar with the family environment. This enables them to detect occasionally some hidden stresses. EL-AL maintains the long-established mandatory retirement of operating crew members at age of sixty. However it was recently agreed (as first officers only) on a yearly contract provided they fulfill the medical and operational criteria. This meets the current government regulations and we feel confident that no undue risk is involved. Similar arrangements exist in a few other airlines. Our first year’s experience will be discussed.

A PILOT’S PERSPECTIVE ON LONG HAUL OPERATIONS IN TWO CREW COCKPITS.  
- Paul D. Galicher, Northwest Airlines, Minneapolis, MN.

A comprehensive approach to the issue of flight crew fatigue must address crew performance requirements as well as psychophysiological factors such as sleep loss and circadian rhythmicity. Emphasis on the former has increased with the relatively recent introduction of advanced two-crew airframes and the accompanying growth in flight deck automation and CRT displays. This paper will address these factors from a pilot’s perspective. Included will be a description of typical flight crews and crew duties along with the associated occurrence of boredom and fatigue. One topic of particular concern is the programming of automated flight systems in terminal areas at the end of long-haul flight segments. The discussion will also focus on the use of augmented crew during extended range operations and the problems encountered in the scheduling of rest breaks in onboard sleep facilities.

FLIGHT CREW FATIGUE IN ADVANCED LONG-HAUL COMMERCIAL AIRPLANES  
- P.C. Greber  
Boeing Commercial Airplane Group, Seattle, WA.

The rapid increase in two-crew glass cockpit airplanes operating on long-haul routes has generated international interest in better understanding how fatigue affects crew performance on advanced commercial flight decks. This topic provides a unique opportunity for human factors experts to focus on a combination of biomedical, operational, and equipment design issues that directly impact human operators. The panel will examine the issue from the different perspectives of individuals who are actively involved in the ongoing debate. The presentations will emphasize the physiological basis for long-haul crew fatigue, the contribution of the flight deck environment to crew alertness, and the operational factors unique to such airplanes in the long-range environment. Panelists will also discuss both regulatory, operational and design approaches for mitigating the potentially negative effects on overall crew performance. A general discussion will follow completion of the individual papers.

TWO-MAN CREW OPERATIONS: PILOT’S VIEWPOINT.  
- D. E. Hudson  
Airline Pilots Association- Aeromedical, Denver, Colorado.

Commercial air operators are moving toward greater use of advanced-technology aircraft with increasing levels of automation. Frequently, this transition entails a reduction in the size of cockpit crew; specifically, from 3 to 2 pilots, eliminating the position of flight engineer. This reduction is being accomplished in the context of a dramatic increase in commercial traffic, no revision in FAA Flight Time/Duty Time regulations and efforts by commercial carriers to exploit the full potential of the new, long range aircraft coming into service. Professional pilot groups are very concerned that human factors considerations, i.e., fatigue, circadian dysrhythmia, scheduling parameters and the human/automation interface are not being adequately addressed.