VIROLOGY

INTRODUCTION: When inadequate stimuli are available for accommodation, as in the dark or under low contrast conditions, the lens seeks to remain in its resting positions are reliable, under autonomic control, and can change with visual task demands. We hypothesized that motion sickness in a flight simulator might result in dark focus changes in simulated training flights in three different flight simulations. Two were helicopter simulators and entailed CFI presentation using infinity optics; one involved a demo presentation of a computer-generated visual display system. RESULTS: In all three experiments there were significant differences between dark focus activity before and after simulator exposure when comparisons were made between sick and non-sick pilot subjects. In two of these experiments, the average shift in dark focus for the sick subjects was forward increased myopia when each subject was compared to his own baseline. In the third experiment, the group showed average shift outward of small amount and the subjects who were sick showed significantly less outward movement than those who were symptom free. CONCLUSIONS: Although the relationship between sickness and changes in accommodative behavior is not simple, one dark focus changes in simulator sickness imply parasympathetic activity. Because changes can occur in relation to endogenous and exogenous events, such measurement may have useful applications as discussed below. It seems necessary that the malleability studies of visually coupled systems, virtual reality systems, and space adaptation syndrome.


INTRODUCTION: We have recently reported the observation of electroencephalographic (EEG) delta wave activity as a rat in the correlate of motion sickness symptom onset and progression. This activity was repeatedly characterised and described these EEG changes. METHODS: 8 subjects participated in a computerised experiment using rotating chair Coriolis stimulation to induce symptoms of motion sickness. 16 channel montage using subdermal electrodes was used to record EEG and residual motion baseline through to frank sickness. Colorized topographic mapping using a computerized system demonstrated the location of the origin and propagation of power spectral changes. Sequential video imaging of the topographic maps was then used to generate animated sequences of spatial evolution. RESULTS: 7 subjects responded with high energy delta activity onset unilaterally in the temporal or tempo-parietal regions during early motion sickness symptoms. This activity propagated occupationally, ipsilaterally, and then contraterally to the temporo-parietal and/or occipital hemispheres. CONCLUSIONS: EEG delta activity begins as a relatively focal process and becomes bilateral and diffuse as frank sickness evolves.


INTRODUCTION: G-LOC induced loss of consciousness (G-LOC) has been proposed to result from an isoelectric EEG and frank sickness evolution during high Gz stress. However, accurate measurement of G-LOC during high Gz stress is difficult to accomplish. METHODS: Six to ten transcranial electrical stimulation to induce motion sickness symptoms and sudden exposure to the brain during high Gz stress. In the present study, 3 methods to estimate G-LOC were used. RESULTS: Rats were exposed to a single >+25 Gz and brain samples were collected at brain fixation at desired times. Mice, similarly were exposed to >+25 and 35 Gz for 35 and 45 s respectively, fixed by microwave. Brain tissue homogenates were analyzed for total protein, hemoglobin (Hb) and iron (Fe). RESULTS: Total protein (254%) and Hb (360%) content decreased significantly after onset of >+25 Gz in rats. Total Fe content showed a similar decrease. Total protein, Hb and Fe content in mice brain decreased at >+20 Gz and higher. Hb and Fe content in mice brain 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 that could delay the onset of G-LOC in a high Gz environment that follows a decrease in cardiac artery blood pressure.

CHANGES OF THE QUALITY AND OF THE STRUCTURE OF THE NOCTURNAL SLEEP DURING THE ADAPTATION AT THE HIGH ALTITUDE (4400 m). S. G. Darses. Practica di Mare Airport, Ponzia (Rome) Italy; E. Leonardi - Stato Maggiore IAP (Rome) Italy.

INTRODUCTION: The altitude insomnus affects the sleep length 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 (EEG, EEG/IMP) involved in the adaptation to the hypoxic hypoxia. METHODS: 14 healthy adults, age range (24-52) answered general and daily EEG, RESPIRATION) involved in the adaptation to the hypobaric hypoxia. RESULTS: A40

INTRODUCTION. Despite numerous technological advances to improve G-LOC detection, loss of consciousness due to Gz stress continues to be a problem with high-G flights. In recent years, research has focused on the use of EEG relating U-LUC with cerebral activity. It has been shown that with U-LUC EEG amplitude decreases and can become isoelectric. However, the isoelectric point may occur beyond useful consciousness. Thus changes in EEG frequency components during this period may be a more sensitive indicator of the level of consciousness. METHODS. In a new study, rats were exposed to +25 Gz in a centrifuge run, but not after 24 hr. The largest increase in water content (edema) was noted in the brain after +2 exposure was investigated. RESULTS. Preliminary results suggest that during baseline and onset of acceleration EEG activity consisted of all component frequencies from 0-30 Hz. Early in the G exposure there was a significant shift towards the delta frequency band (0-4 Hz). At the point of delta activity in the EEG, delta frequency disappeared along with all other frequencies. Early recovery following exposure was again marked by a pronounced increase in delta activity. CONCLUSION. Spectral analysis can be a more objective sensitive approach to G-LOC detection by identifying changes in component frequencies.

THE FREQUENCY OF SELF-MEDICATION AMONG U.S. AIRCRAFT CARRIERS AND ITS ROLE IN AIRCRAFT MISHDOWNS. G.L. Down*, J.B. Brinker*, and D.P. Novi*, Naval Aerospace Medical Institute and Naval Aerospace Medical Research Laboratory, Pensacola, FL 32508.

INTRODUCTION. The Navy prohibits the practice of self-medication in its aircraft. 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 aircrew involved in aircraft mishaps. Although self-medication is rarely listed as a causal factor in these mishaps, the anecdotical frequency of its appearance in these reports suggests the possibility of an unrecognized role. Further, the fact that these mishaps are occurring in a workplace where highly disciplined aircrew are 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 flight crew who were surveyed to identify the frequency of self-medication, the medications being used, and the conditions prompting such use. The survey was confidential in that individual anonymity is maintained during the collection process. The survey instrument elicited data on both over-the-counter and previously prescribed medications taken without medical consultation. Solicited data include: time since airplane designation, incidence and frequency of self-medication, basis for self-medication (cold, headache, etc.), and medications used. Additionally, Naval Safety Center (NSC) and Armed Forces Institute of Pathology (AFIP) data on mishaps involving self-medication will be reviewed for a comparison analysis. COMMENTS. The brief review will result in the analysis of the aircrew survey and correlate these 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.

THE EFFECT OF TRANS-COCKPIT AUTHORITY GRADIENT ON NAVY/MARINE HELICOPTER MISHAPS. R.A. Alkhov*, HS Berkovitz, BM Williamson, and WY Wramyr*, Naval Safety Center, NAS Norfolk, VA 23511-7786.

INTRODUCTION. The pairing of pilots in the cockpit has been called the "trans-cockpit authority gradient" by Elwyn Edwards, who believes there is an optimum gradient of rank and experience or ability to allow an effective interface between aviators. In order to determine if such an optimum gradient could be identified empirically, we undertook an analysis of Navy and Marine Corps mishaps which had a pilot causal factor assigned. METHODS. All class A and B helicopter flight mishaps for the eleven calendar year period 1980-90 were examined. Mishaps were categorized into 5 pilot pairings. The distribution of the ranks of all naval aviators who were involved in aircraft mishaps which were not caused by aircrew factors was used to estimate the number of hours flown by each of the pilot/copilot combinations to arrive at the aircrew record rate per 100,000 flight hours for each category of rank pairing. RESULTS. The most junior officers are paired with their seniors, the potential for pilot error is increased over those crews that have juniors paired together, seniors paired together, or with the junior pilot at least a Navy LT or Marine CAPT. CONCLUSIONS. The optimum authority gradient appears to occur where it is least steep with regard to experience and ability.


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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, factors, and crashing. RESULTS. Twenty crashes were below minimums on approach; six were off course. One pilot tried to land after sighting the runway late. Six crashed attempting missed approaches, and thirteen used other improper IFR procedures. When ceilings were low, many pilots attempted tailwind landings on runways served by ILS approaches in order to take advantage of lower straight-in minimums. 80% of the crashes were at night. Few pilots observed altimeters and avionics.

CONCLUSION. Possible interventions should be explored include night IFR route checks, requiring a given number of day IFR hours in order to qualify for night Part 135 pilot-in-command, reestablishing a minimum ceiling for all Part 135 night IFR approaches, and setting night minimum visibility at one mile.

INCIDENCE OF INFLIGHT MEDICAL EMERGENCIES IN BUSINESS AIRCRAFT. R.T. Carrington. Wright State School of Medicine, Dayton, Ohio 45401-0297. INTRODUCTION. An analysis of inflight illness and death in business aircraft was undertaken using a mailed survey of six hundred eighty nine members of the National Business Aircraft Association. RESULTS. Twenty two percent of those respondents indicated illness or death of an inflight illness at six instances involved passengers, the rest were crew members. Eighty four percent of inflight illnesses were accompanied by other illnesses. Of inflight illnesses, sixty six percent involved passengers, the rest were crew members. Eighty four percent of inflight illnesses were accompanied by other illnesses. The incidence of illness as well as death in business aircraft was significantly higher in the business jet category (33%). Immersion in comfortable water reduces catecholamines; exposure to cold is associated with an increased concentration of these autacoids. Since vasopressin-mediated inhibition of urine and sodium excretion is modulated by adrenergic agonists, the study of cold and circulating catecholamines, is the hypothesis that DDAVP can also decrease the diuresis and natriuresis induced by immersion in thermal neutral water (31°C) was undertaken. RESULTS. Twenty percent of the 660 respondents indicated at least one death or injury during their experience of MD during their service in the economy class; 35 air taxi cases involving improper IFR procedure; 67% were fatal. METHODS. NTSB full reports were studied for the I1 scheduled commuters 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, factors, and crashing. RESULTS. Twenty crashes were below minimums on approach; six were off course. One pilot tried to land after sighting the runway late. Six crashed attempting missed approaches, and thirteen used other improper IFR procedures. When ceilings were low, many pilots attempted tailwind landings on runways served by ILS approaches in order to take advantage of lower straight-in minimums. 80% of the crashes were at night. Few pilots observed altimeters and avionics.

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INTRODUCTION. During the ascent of an airplane the atmospheric pressure decreases, decreasing the volume of the semiclosed cavities of the middle ears and the paranasal sinuses increases, whereas the volume of air that was decrease during the descent. When the pressure in these cavities is not equal to the cabin pressure, symptoms of barotrauma appear. Last three years several commercial airlines requested our clinic with symptoms of otic or sinus barotrauma. Surprisingly they all had 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 37000 feet. The maximum cabin pressure of the Boeing 737 is 8000 feet. This is considerably above the levels of the aircrafts of the type Boeing 747 and DC 10. Therefore a Boeing 737 aircraft seems to increase the chance of a barotrauma.

CONCLUSION. The pressurization schedule of the Boeing 737 aircraft is less comfortable than the schedules of the Boeing 747 and the DC 10 aircraft. Therefore a Boeing 737 aircraft seems to increase the chance of a barotrauma.

PANEL ABSTRACTS

THE AGING PILOT DILEMMA: E. Altekruse, Johnson, SC 29812

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 those unhealthy life styles can have disastrous consequences. In the 1940s and 1950s it was common to attribute those consequences to aging. As a result, the stigma of age has lead to discrimination in many forms. In 1960 the US FAA established a mandatory retirement age of 60 for airline pilots. Prior to that time the retirement age for pilots varied amongst airlines. Previously pilots were accepted because of esoterical techniques has enlightened the medical community and society to the fact that, strictly speaking, aging has taken a "bus nap" and the pilots of some health condition can more properly be attributed to abuse 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. P. Della Rocca and P. S. Schneider| 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 existence. 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 age, experience and pilot performance. APPROACH. Information will be presented at 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 had 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. Analyses of pilot age and accident rates will be conducted to determine 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 a relationship between age and accidents. Findings from the three investigations will be used to reassess the status of the "Age 60 Rule".


As fliers age, their attitude toward flying changes. The nature of this change is shaped by the original motivation to fly, and also by experience: aircraft accidents, deaths, other losses, marriage, divorce, children, job tension, finances, etc. Aging takes its own toll of perception of health, loss of "invaluable," physical endurance, sense of slow reaction time or inability to respond to sudden novel stimuli. The rate of lessened functions differs, as does the sense of their loss and the utility of coping skills. If these skills fail, the results may be dangerous denial, depression, counter-phobic activity, fear of flying, or other pathology. Aeromedical practitioners should be familiar with these patterns, and should know how to use careful history-taking and skilful mental status evaluations to elicit information about possibly harmful coping skills. If these skills fail, the results may be dangerous denial, depression, counter-phobic activity, fear of flying, or other pathology. Aeromedical practitioners should be familiar with these patterns, and should know how to use careful history-taking and skilful mental status evaluations to elicit information about possibly harmful coping skills. If these skills fail, the results may be dangerous denial, depression, counter-phobic activity, fear of flying, or other pathology.
PILOT AGING POLICIES IN INTERNATIONAL AIRLINES

I. Glazer, 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, many international commercial airlines set up contractual agreements with unions and 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 age 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 physiologists, co-workers and family and documented during simulator performance and line checking.

In a relatively small airline like EL-AL the medical officers and flight operation 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 reevaluation 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.

REVIEW OF PERFORMANCE, MEDICAL, AND OPERATIONAL DATA ON PILOT AGING ISSUES. I.I. Stoyanov, Ph.D. Life Sciences Division, National Aeronautics and Space Administration, Washington, D.C. 20546.

Introduction: An extensive review of the literature and studies relating to performance, medical, operational, and legal data regarding pilot aging issues was performed in order to determine what evidence there is, if any, to support mandatory pilot retirement. Popular misconceptions about aging, including the failure to distinguish between the normal aging process and disease processes that occur more frequently in older individuals, continue to contribute to much of the misunderstanding and controversy that surround this issue. Results: Review of medical data related to the pilot aging issue indicate that recent improvements in medical diagnostic and treatment technology have made it possible to identify to a high degree individuals who are at risk for developing sudden incapacitating stress, and for treating those with disqualifying medical conditions. Performance studies revealed that after controlling for the presence of disease states, older pilots are able to perform as well as younger pilots on many performance tasks. Review of accident data showed that older, healthy pilots do not have higher accident rates than younger pilots and, indeed, evidence suggests that older pilots have an advantage in the cockpit due to higher experience levels. The Man-Machine-Mission-Environment interface of factors can be managed through structured, supervised, and enhanced operations, maintenance, flight reviews, and safety procedures in order to endure safe and productive operations by reducing the margin of error and by increasing the margin of safety. Conclusions: There is no evidence indicating any specific age as an arbitrary cut-off point for pilots to perform their flight duties. A combination of regular medical screening, performance evaluation, enhanced operational maintenance, and safety procedures can more effectively ensure a safe pilot population than any mandatory retirement policy based on arbitrary age restrictions.

FLIGHT CREW FATIGUE IN ADVANCED LONG-HAUL COMMERCIAL AIRPLANES - P. C. Grieber*. 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 biometrical, 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.

ALERTNESS MANAGEMENT IN TWO-PERSON LONG-HAUL FLIGHT OPERATIONS. M. R. Rosekind and P. H. Gander*. NASA Ames Research Center, Moffett Field, CA and San Jose State University Foundation at NASA Ames Research Center.

Long-haul flight operations involve cumulative sleep loss, circadian disruption, and extended and irregular duty schedules. These factors reduce pilot alertness and performance on the flightdeck. Conceptually and operationally, alertness management in flight operations can be divided into preventive and operational countermeasures. Preventive strategies are utilized prior to a duty period to mitigate or reduce the effects of sleep loss, circadian disruption and fatigue during subsequent flight operations. Operational countermeasures are used during operations as acute techniques for maintaining performance and alertness. Results from previous NASA Ames field studies document the sleep loss and circadian disruption in three-person long-haul flying and illustrate the application of preventive strategies and operational countermeasures. One strategy that can be used in both a preventive and operational manner is strategic napping. The application and effectiveness of strategic napping in long-haul operations will be discussed. Finally, long-haul flying in two-person highly automated aircraft capable of extended range operations will create new challenges to maintaining pilot alertness and performance. Alertness management issues in this flight environment will be explored.

A PILOT’S PERSPECTIVE ON LONG HAUL OPERATIONS IN TWO CREW COCKPITS. - Paul D. Gallacher, 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 aircraft. 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 profiles 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. This 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.


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 threats 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.