

ICASM 2014 Scientific Agenda

Abstracts

OP01

TECHNOLOGY INNOVATIONS-TO BOLDLY GO WHERE NO ONE HAS GONE BEFORE

*INNOVATIONS TECHNOLOGIQUES-ALLER LÀ OÙ AUCUN
HOMME N'EST ALLÉ AVANT*

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This presentation will describe emerging developments in aerospace transportation technologies, as well as the latest breakthroughs in the design and implementation of advanced medical technologies and their practical impact on aerospace medicine, human performance and flight safety.

Technological developments in commercial passenger aircraft (narrow and wide body), silent aircraft, very light jets, hybrid aircraft, electric aircraft, lighter than air vehicles, personal flying machines, unmanned aerial vehicles/systems, supersonic and hypersonic vehicles, suborbital commercial space vehicles, orbital commercial space vehicles, commercial space ports and commercial space stations will be discussed. Technological innovations in medicine such as digital medicine, bio-engineering, virtual medical imaging, regenerative medicine, stem cells therapies, cloning, brain computer interfaces, biomedical devices, genomics and gene therapies, nano-medicine, neuro-technology, medical robotics, engineered replacement organs, etc., will be discussed.

Several life-altering medical breakthroughs on the horizon include: restoring vision to the blind, organs on demand, brain repair and augmentation, elimination of genetic conditions, cures for neurological conditions, prevention of heart attacks, elimination of cancer deaths, development of smart drugs, and vaccines against cancer.

OP02

AVIATION FATIGUE COUNTERMEASURES. PART I: VALIDATED STRATEGIES FOR FATIGUE MANAGEMENT

CONTRE-MESURES DE LA FATIGUE EN AVIATION. PARTIE I: STRATÉGIES VALIDÉES EN GESTION DE LA FATIGUE

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Pilot fatigue is a significant, but often under-reported problem in both civilian and military aviation operations. Although estimates vary, official statistics indicate that fatigue is involved in approximately 4-8 percent of aviation mishaps, and surveys of

pilots and aircrews reveal that fatigue is an important concern throughout today's 24/7 flight operations. Regulatory efforts aimed at limiting flight hours and ensuring at least minimal periods of crew rest have to some extent mitigated fatigue-related difficulties on the flight deck, but it is clear that a combination of more effective counter-fatigue strategies has been the key to optimizing aviation safety in recent years. Over the past few decades, our scientific understanding of human sleep, fatigue, and circadian rhythms has expanded considerably. As a result effective countermeasures such as 1) ensuring quality off-duty sleep, 2) optimizing crew scheduling, 3) taking advantage of strategic napping, 4) utilizing counter-fatigue medications, 5) employing rest breaks, 6) taking advantage of posture effects, 7) treating sleep disorders, and 8) eliminating unproven practices have all helped to safeguard the alertness, performance, and safety of both civil and military aviation personnel. In Part I of our aviation counter-fatigue discussions, these strategies will be briefly reviewed.

OP03

AVIATION FATIGUE COUNTERMEASURES PART II: ADVANCES IN FATIGUE MANAGEMENT

*CONTRE-MESURES DE LA FATIGUE EN AVIATION PARTIE II:
AVANCÉES EN GESTION DE LA FATIGUE*

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Decades of research and operational experience have validated the traditional approaches currently in use to manage the aircrew fatigue stemming from unpredictable work hours, long duty periods, circadian disruptions, and disturbed or restricted sleep. However, our evolving understanding of the nature of fatigue along with recent advances in technology has created new possibilities for the future of fatigue management in aviation. In Part I, the current, scientifically-validated countermeasures were reviewed. Here, in Part II, emerging ideas and opportunities will be presented. Among the new promising counter-fatigue approaches are: 1) blue light to optimize alertness in the workplace, 2) alternative therapies for fatigue such as hypnosis, 3) selection of fatigue-resistant individuals for deployment in high-fatigue environments, and 4) strategies for enhancing slow-wave sleep to bolster the beneficial effects of short sleep periods or power naps. While these countermeasures are still in the investigative stages, many promise hope for enhanced alertness and performance during otherwise compromised times when sleepiness negatively impacts the safety and effectiveness of a mission. Once the countermeasures are scientifically validated, they can be integrated into a safety system so that fati-

gue can be more effectively managed and safety and performance can be optimized.

OP04

FATIGUE RESEARCH AT THE FAA CIVIL AEROSPACE-MEDICAL INSTITUTE

RECHERCHES SUR LA FATIGUE À L'INSTITUT CIVIL DE-MÉDECINE AÉROSPATIALE DE LA FAA

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The Federal Aviation Administration (FAA) has been conducting research on the impact of human fatigue on civil aviation operations since the 1960s. Fatigue is a complex state characterized by a lack of alertness and reduced mental and physical performance, often accompanied by drowsiness. Fatigue research performed by scientists at the FAA Civil Aerospace Medical Institute (CAMI) in Oklahoma City is currently focused on two disciplines: human factors and functional genomics. The study of human factors in aviation is aimed to gain a better understanding of how humans can best be integrated with aviation systems and thus minimize human error while optimizing performance. The study of functional genomics is dedicated to the discovery of biomarkers, environmentally responsive genes and their protein products, in the context of normal and abnormal physiological states. This approach combines information from messenger ribonucleic acid (mRNA) and protein expressions with computational methods to examine networks of responsive genes that signal factors that may affect human performance in flight. Fatigue in aviation can have a significant impact on safety, as it can result in cognitive degradation, reduced productivity, suboptimal performance, and may ultimately lead to loss of life. The presentation will review recent FAA biomarker research performed in collaboration with Washington State University on the topic of sleep deprivation relative to cognitive impairment. In addition, a review of CAMI fatigue research over the 1965-2014 period will be discussed with an emphasis on Air Traffic Controllers, Flight Attendants, Pilots, and Maintenance Technicians. Specific research topics that will be addressed include sleep, shiftwork, risk management, long range operations, model validation, management tools, and training. This research is in response to various congressional mandates to better understand how fatigue and schedule issues are manifested in the aviation environment and to transition fatigue countermeasures from the laboratory to the operational field.

OP05

PHARMACOLOGICAL STRATEGIES FOR THE MANAGEMENT OF SLEEP & ALERTNESS IN EXTENDED OPERATIONS- RESULTS FROM STUDIES CONDUCTED DURING EXTENDED WAKEFULNESS & SHIFT WORK

STRATÉGIES PHARMACOLOGIQUES POUR LA GESTION-DU SOMMEIL ET DE LA VIGILANCE DANS LES OPÉRATIONS DE LONGUE DURÉE-RÉSULTATS DES ÉTUDES MENÉES PENDANT L'ÉVEIL PROLONGÉ ET LE TRAVAIL POSTÉ

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Introduction. Modafinil is in use for maintenance of performance/alertness during extended wakefulness. This presentation submits a synopsis of our studies to examine certain issues related to its optimal dosage, effect size, untoward effects, effects on tolerance to +Gz, value in shift work and effect on subsequent quality of sleep & its modulation with Zolpidem.

Methodology. Three placebo-controlled double-blind studies were conducted on healthy male non-smokers. In Study I, 45 participants, divided into three groups, were administered two doses of placebo/modafinil (100 mg)/modafinil (200 mg) at ~16 & ~25 hours of extended wakefulness of 32 hours. In Study II, 20 fighter pilots were examined during simulated flying (0, 19 & 26 hours of extended wakefulness and after 6 hours of subsequent sleep induced with zolpidem). They received two doses of modafinil (200 mg)/placebo at 2300 h on D1 and 0600 h on D2 followed by zolpidem (10 mg)/placebo at ~1330 h on D2. Study III examined efficacy of modafinil (100 mg) and zolpidem (10 mg) during shift work with sleep/rest window misaligned with circadian rhythms in 72 participants. Task performance/sleepiness/fatigue/sleep-quality/+Gz tolerance were dependent measures.

Results. Modafinil improved sleepiness, fatigue, +Gz tolerance and performance, the last with a small effect size. 100 mg of modafinil was effective. Quality of induced sleep, with manipulation of extended wakefulness with modafinil, was inferior to that in the night prior. Sleep after modafinil was less refreshing and restorative. This effect was not attenuated with zolpidem. Untoward effects with modafinil were negligible. During shift work, performance did not change. Zolpidem improved sleep quality and reduced sleepiness in subsequent awake period. Participants perceived less fatigued at the end of the study. This perception was not modulated with modafinil/zolpidem.

Conclusions. Quality of sleep after modafinil is a concern. Value of modafinil in shift work is debatable.

OP06

DETECTING FATIGUE: LESSONS LEARNED

DÉTECTION DE LA FATIGUE: LEÇONS APPRISSES

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Focusing on measurement technologies in the domains of psychophysiology and human performance, this presentation documents a portion of 40 years of lessons learned about fatigue detection in field studies and operational transportation environments. Topics include quantitative and polysomnographic EEG, eye blinks and eye closures, heart rate and heart rate variability (vagal tone), sleep and activity logging, human performance measurement (especially variability), and mental lapses and vigilance performance. Examples from the technical literature are provided. Having concluded that EEG, ECG, aircraft control measures and measures of attention are impractical in the cockpit, a recommendation is made for a detection philosophy that incorporates parallel measurement with inputs from sleep and time zone logging, a fatigue model and a PERCLOS device.

OP07

THE ESTIMATED RISK OF FATAL CARDIOVASCULAR DISEASE IN ASYMPTOMATIC AERONAUTICAL PERSONNEL (SCORE RISK)-A 3-YEAR FOLLOW-UP STUDY

RISQUE ESTIMÉ DE MALADIE CARDIOVASCULAIRE MORTELLE CHEZ LE PERSONNEL AÉRONAUTIQUE SYMPTOMATIQUE (SCORE DE RISQUE)-UNE ÉTUDE DE SUIVI DE 3 ANS

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Introduction. Cardiovascular diseases (CVD) will always be a major concern for aeronautical disposition and aircrew standards. The priority concern of the European Society of Cardiology resulted in publishing of the risk charts (SCORE risk).

Aim. To evaluate the proportion of asymptomatic aeronautical personnel meeting the ESC criteria for preventive measures, namely the risk of fatal CV death in 10 years (currently or extrapolated to age 55).

Methods. We studied 200 subjects randomly selected from aeronautical personnel. Patients with established coronary artery disease were excluded. Using the SCORE risk charts, subjects were classified according to their risk, both currently and projected at age 55, initially and after 3 years of follow-up.

Results. Subjects were divided in 2 groups: below age 40 and over age 40. Smoking status was present in 37.5% and respectively 62.5%. After 3 years, the percents were: 31.5% and 48.5%. Hypertension was noticed in first group in 9.5% initially, and 10.5% after 3 years. In subjects over age 40 the percents were 18% and 20.5% in follow-up. Hypercholesterolemia was present in group I: 17.5% initially and 15.5% after 3 years; in group II: 38.5% and 32%. The percentages of subjects who should be targeted for preventive interventions according to ESC guidelines were significant in study group II: 2.2% initially and 1.9% after 3 years for current risk greater 5%, and 27.2% initially and 23.1% after 3 years for projected risk greater 5% at age 55.

Conclusions. The percentage of asymptomatic aeronautical personnel whose current risk of fatal CVD in 10 years is low; however, assuming no change over time, almost 25% of subjects over age 40 would be at high risk by age 55. After a 3-year program of preventive measures, the estimated projected risk of fatal cardiovascular disease was slightly reduced, necessarily enforcing the program of prophylactic measures in subjects over age 40.

OP08

PREVALENCE OF CARDIOVASCULAR DISEASE RISK FACTORS AMONG DUTCH COMMERCIAL PILOTS

PRÉVALENCE DES FACTEURS DE RISQUE CARDIOVASCULAIRE CHEZ LES PILOTES COMMERCIAUX NÉERLANDAIS

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Introduction. Cardiovascular disease is a major cause for unfitness for flying duties among civil aircrew. During the annual medical examination attention is paid to cardiovascular risk factors to try to prevent cardiovascular disease. According to both JAR.FCL 3 and EASA rules cholesterol levels have to be measured in class 1 pilots at the first medical examination after their 40th birthday. In 2006 the Dutch SCORE based cardiovascular risk chart has become available. Since then it has been made possible to determine the individual 10 years cardiovascular risk in these class 1 pilots based on the cholesterol/ HDL-cholesterol ratio, the systolic blood pressure and smoking behaviour.

Methods. The next three months we are going to investigate 578 files of class 1 pilots born in the years 1959 to 1963 retrospectively to collect these risk factors and to see if there is any relationship between a high risk score (more than 10%) and cardiovascular events 10 years later. These medical records are held in the form of paper files at the Aero Medical Institute, a department of KLM Health Services in The Netherlands. Variables that are collected for analysis are gender, age, BMI, blood pressure, total cholesterol, HDL-cholesterol, smoking, family history of cardiovascular disease and cardiovascular risk scores based on the Dutch risk chart.

Results. During the conference we shall present these data and give an overview of all cardiovascular events within this group of pilots. Secondly the relation between cardiovascular disabilities and high risk scores (more than 10%) will be presented.

OP09

PREVALENCE OF RISK FACTORS FOR CARDIOVASCULAR DISEASE IN CIVIL AVIATION PERSONNEL WITH CORONARY ARTERY DISEASE DURING THE PERIOD 2010-2012

PRÉVALENCE DES FACTEURS DE RISQUE DE MALADIE CARDIO-VASCULAIRE CHEZ LE PERSONNEL DE L'AVIATION CIVILE PORTEUR D'UNE MALADIE CORONARIENNE AU COURS DE LA PÉRIODE 2010-2012

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Introduction. Coronary heart disease is the most common cause of sudden incapacitation in flight and, as predisposing factors to this condition are described as cardiovascular risk, we asked: Is the airman prevalence of cardiovascular risk different from that of the general population?

Objective. To determine the prevalence of risk factors for cardiovascular disease in civil aviation personnel treated for coronary artery disease by the National Institute of Aerospace Medicine (INMAE) Fitness and Health committee during the period from January 2010 to December 2012.

Methods. A cross sectional study was conducted by reviewing aeromedical records and psychophysiological tests of airmen who were treated for coronary heart disease. Sixty-one cases were analyzed and the following data were extracted: age, blood pressure, smoking, cholesterol, glycemia, background, gender, height, flight hours, and type of license.

Results. The prevalence of risk factors in the airmen was: hypertension 34.4%, diabetes 9.8%, hypercholesterolemia 31.2%, smoking 57.3%, obesity 19.6%, and sedentary 68.8%.

Conclusions. The prevalence of risk factors differs between the general population and aviation personnel, especially with regard to smoking, which requires specific cessation programs and close monitoring to modify the risk profile and therefore improve aviation safety.

OP10

A DOPPLER-BASED NOISE-IMMUNE STETHOSCOPE: USER EVALUATIONS AND UNIQUE TRAINING REQUIREMENTS

UN STÉTHOSCOPE À BASE DOPPLER IMMUN AU BRUIT: ÉVALUATIONS DES UTILISATEURS ET PRÉ-REQUIS UNIQUES DE FORMATION

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Introduction. Helicopters used to provide aeromedical transport are extremely noisy (105 dB), preventing auscultation with traditional acoustic stethoscopes. Acoustic engineers at USAARL have developed a Noise-Immune Stethoscope that is a hybrid dual function device with a Doppler-based active mode for use in high-noise environments. The NIS has been shown to be effective in laboratory helicopter evaluations, but less consistent results have been obtained in uncontrolled user evaluations in less noisy environments (e.g., shipboard, hospital). One consistent comment was that users did not feel comfortable using the NIS in Doppler mode.

Methods. The NIS was deployed for field-testing with ground ambulance crews and air ambulance crews with enhanced personal training with an NIS-experienced USAARL flight surgeon. A training CD illustrating proper NIS technique and sounds was also disseminated for self-study.

Results. Flight medics who received personal training and instruction rated the NIS as useful in the aeromedical evacuation environment, while ground ambulance medics did not find the environment noisy enough to make the Doppler mode worthwhile.

Discussion. The results of the NIS development program and these user tests, conducted by a variety of agencies, led to a 2013 Army decision to deploy NIS to aeromedical evacuation units. USAARL is now working to ensure that the necessary, effective, but currently time-intensive training process is carried forward into the NIS fielding plan. Further assessment of NIS performance with cardiopulmonary pathology is recommended.

OP11

A NEW THEME FOR AVIATION MEDICINE: CAN WE ACCEPT THE NEW ORAL ANTICOAGULANTS?

UN NOUVEAU THÈME POUR LA MÉDECINE AÉRONAUTIQUE: POUVONS NOUS ACCEPTER LES NOUVEAUX ANTICOAGULANTS ORAUX?

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Background. New oral anticoagulants (NOACs) are an alternative for vitamin K antagonists (VKAs) to prevent stroke in patients with non-valvular atrial fibrillation (AF) [Heidbuchel, *et al.* Europace, 2013 May, 15(5):625-51]. The FAA accepts VKAs in special cases, EASA differentiates between class 1 + 2 and LAPL. For class 1 + 2 medicals no anticoagulation is allowed.

Methods. Analysis of literature in order to clarify the risk of bleeding under a medication with NOACs.

Results. Meta-analysis of large NOAC trials shows favourable risk/benefit ratio over warfarin. [Ruff *et al.* The Lancet 2013]

Conclusions. Under certain conditions, the use of NOACs appears possible and safe in pilots. The new group of drugs should be discussed in aviation medicine.

OP12

UNITED STATES FAA SPECIAL ISSUANCE MEDICAL CERTIFICATION IN PILOTS TREATED WITH STEM CELL TRANSPLANTATION

ÉMISSION DE CERTIFICATS MÉDICAUX PAR DÉROGATION PAR LA FAA AMÉRICAINE POUR LES PILOTES TRAITÉS PAR TRANSPLANTATION DE CELLULES SOUCHES

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In the United States, pilots must hold a first, second, or third class medical certificate attesting to meeting medical standards in U.S. Title 14 CFR, Part 67. The FAA Federal Air Surgeon has the authority to grant Special Issuance of a medical certificate to a pilot not meeting the medical standards, as long as there is no danger to public safety. A pilot with a disqualifying medical condition receiving a new or innovative treatment regimen or modality will likely be denied medical certification. However, with time, and experience with a particular treatment, special issuance medical certification might be considered.

Stem cell transplantation as a primary or adjunct treatment is an example of such a situation. Stem cell transplantation is the infusion, or injection, of healthy stem cells into the body to replace damaged or diseased stem cells. This may be necessary in certain bone marrow disorders, or when high-dose chemotherapy or radiation therapy is given in the treatment of blood disorders such as leukemia, lymphoma or multiple myeloma.

The FAA Headquarters Medical Appeals Branch has evaluated a total of 16 cases where stem cell transplant was part of the therapy for a variety of medical conditions. In most cases, the underlying disease or other medical treatment was the cause of the denial of medical certification and not the use of stem cell transplantation. Four cases were judged acceptable for special issuance medical certification. The diagnoses were Non-Hodgkins lymphoma treated with chemotherapy and autologous stem cell transplant; homozygous sickle cell disease treated by allogenic stem cell transplant; right temporal lobe primitive neuroectodermal tumor treated with resection, radiation, chemotherapy, and autologous stem cell transplant; and multiple myeloma treated with external beam radiation and stem cell transplant. These cases will be discussed in relation to the risks to aviation safety.

OP13

PECULIARITIES OF THE CARDIOVASCULAR CLINICAL EXAM IN SPACE

PARTICULARITÉS DE L'EXAMEN CLINIQUE CARDIOVASCULAIRE DANS L'ESPACE

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Introduction. During space flight, the cardiovascular system (CVS) experiences very important changes provoked by the absence of gravity (0G). These changes substantially modify the normal cardiovascular clinical parameters as measured on Earth, so that if they are evaluated by terrestrial cardiology criteria, they indicate severe pathology, but are normal at 0G and follow the process of adaptation to the space environment.

Methods. A general review was conducted over the accumulated experience gained in space medicine, particularly related to the anatomical and functional changes that space environment conditions impress on the CVS.

Results. The principal cardiovascular modifications in space are the following: migration of liquids from the inferior towards the superior body regions; facial edema; dilation of face and neck veins; homogeneous pressures (arterial, venous, capillary) in the entire organism; elevation of the diaphragm and liver (5 cm); diminution of heart size (20%) and horizontalization of the same; alteration of the thorax (becomes shorter and wider); increase of intrapulmonary blood (average of 800 ml); homogeneous distribution of the circulation, ventilation and pulmonary pressures; diminution of the total blood volume (approximately one liter); diminution of pulse amplitude and collapse of the superficial veins in the lower limbs. All of these data are abnormal in a cardiologic exam on Earth, but are normal in space and follow an adaptive process.

Conclusions. The normal clinical cardiovascular parameters in space, if they are evaluated by terrestrial cardiology criteria, would result indicative of severe pathology, but are normal in 0G and obey a process of adaptation to the space environment.

OP14

EVALUATION OF A MINIATURIZED TRANSESOPHAGEAL ECHOCARDIOGRAM FOR CARDIAC MONITORING IN MICROGRAVITY

ÉVALUATION D'UNE ÉCHOGRAPHIE TRANSŒSOPHAGIENNE MINIATURISÉE POUR LA SURVEILLANCE CARDIAQUE EN MICROGRAVITÉ

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Introduction. With the prospect of human missions beyond Earth orbit in the near future, there is a growing potential need for continuous cardiovascular monitoring in the case of an incapacitating medical emergency in space. A relatively new miniaturized transesophageal echocardiogram (TEE) probe may be an ideal imaging and monitoring medical tool for future spaceflight missions.

Methods. The ImaCor hemodynamic transesophageal echo (hTEE) probe was evaluated in microgravity in parabolic flight using a TEE training mannequin equipped with a static but anatomically correct heart model. Image acquisition and hTEE insertion was carried out by five undergraduate students with no prior medical experience. Images were captured both in microgravity and on the ground at three positions: deep gastric with long axis views of both ventricles, transgastric with a short axis view of the left ventricle, and transaortic. Simulated pericardial effusions were also imaged. The quality of the images was graded on a three-point scale in a blinded fashion by a board certified cardiac anesthesiologist.

Results. There was no significant difference in the quality of the images acquired in microgravity compared to those obtained on the ground ($p > 0.05$). This held true for all three views investigated as well as for evaluations of pericardial effusions. Post-flight debriefing of the flyers revealed that insertion of the hTEE probe was not impaired in microgravity compared to placement on the ground.

Conclusion. The microgravity environment does not appreciably affect the placement of the hTEE probe nor the quality of the images obtained. Additionally, the hTEE probe can be effectively placed by novice flyers with no prior medical training. The hTEE probe is small, lightweight, easy to use, and effective in

microgravity, making it a good candidate cardiac imaging and monitoring tool for future human spaceflight missions.

OP15

HOW IS THE HEMATOLOGY INVOLVED IN THE ERA OF AEROSPACE MEDICINE? SYSTEMIC AND HEMATOLOGICAL CHANGES IN THE ASTRONAUT

COMMENT L'HÉMATOLOGIE EST-ELLE IMPLIQUÉE DANS L'ÈRE DE LA MÉDECINE AÉRONAUTIQUE? LES CHANGEMENTS SYSTÉMIQUES ET HÉMATOLOGIQUES CHEZ L'ASTRONAUTE

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The human body in microgravity presents many metabolic changes. This has had low progress in space research because there are a small number of astronauts and many operational difficulties of conducting research. There are possibilities of reproducing the effects of the exposure to microgravity in murine model in the laboratory or continuously put human volunteers in head-down bed rest (HDBR) at -6°C to evaluate the immune innate response and the state of the bone marrow to study the neocytolysis (selective hemolysis of neocytes) in microgravity. Circulating reticulocytes become neocytes, and later mature erythrocytes. After 10 days in space, erythrocytes reduction is approximately 10%; they have a shorter half-life and this affects the amount of hematocrit in response to a negative stimulus for eritropoyetin secretion by the kidneys. There is a presence of schistocytes and stomatocytes, because the glutathione tends to increase the membrane rigidity, and the erythrocytes tend to deform. Changes in physicochemical properties of the plasma membrane of erythrocytes are favored by vascular pressure changes, microviscosity and permeability, and they can influence the efficiency of oxygen transfer. Also, lactate concentrations are increased with dominance of an anaerobic state and this may contribute to the early discomforts of space travel, such as headaches, nausea, and malaise. This model shows an alternative path in response to programmed cell death. It is vitally important to suppress the formation of cancer cells, as well as having angiogenic and antiapoptotic power which are essential in the process of ischemia and acute inflammation at endothelial, retinal, cardiac, neuronal, and nephron cellular levels. With readaptation to Earth there appears a stimulation of erythropoiesis which is aimed at maintaining the optimal level of red blood cells, necessary for the increased demand of oxygen in the tissues under the conditions of gravitation of the Earth.

OP16

SURGERY IN SPACE, EARTH ANALOG AND SPACE TRAINER

CHIRURGIE DANS L'ESPACE, APPAREIL DE FORMATION SUR TERRE ET DANS L'ESPACE

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Introduction. In order to aim for a long term space missions, we need to manage those pathologies that may only be managed by surgery. Proposals about robotic remote surgery has been posted, because of the delay of data transmission this option is unacceptable.

ble, the robotic systems should only be used with partial automation in order to help the surgeon to perform precise procedures. Space long term missions will offer many challenges that, if humanity is capable to overcome, life in earth will be easier using this new space technology, then we may begin the real conquer and colonization of our solar system. One of many challenges is the surgery in space, not only the methods but also the continuing education and practice that the space surgeons should need.

Methodology. Once that the Surgery Simulator for Space Laparoscopy has been tested on a fixed environment on Earth's surface, will give us the basis for material/equipment in order to use this container in parabolic flights that will simulate a microgravitational environment, the container fluid will be replaced by air in order to let the animal material to gravitate as in space. This simulator will also function as a trainer for surgeons in space, whom should preserve their practical skills in order to be ready to act if its needed. The parallel design of new laparoscopic tools will be needed in order to overcome the free movement of the internal organs and bleeding during a laparoscopy in a microgravitational environment.

Expected Results. This simulator will be used to perform laparoscopic procedures in parabolic flights, overcoming the challenges that have been previously observed, the efficacy of this method with be compared with the previous microgravity surgery flights.

Preliminary Conclusions. It's expected that the simulator not only will function to develop new tools needed for space laparoscopic surgery, it will function as a trainer in space in order to provide current training for the space surgeons.

OP17 SURGERY SIMULATOR FOR SPACE LAPAROSCOPY TRAINING

*SIMULATEUR DE CHIRURGIE POUR LA FORMATION SUR
LAPAROSCOPIE DANS L'ESPACE*

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Introduction. Richard M. Satava published the first experimental space surgery essay; it describes the limitations of open surgery. He also contradicts his essay, because of the potential organ gravitation along with blood and other fluid diffusion around the spacecraft. He describes in his work that laparoscopic surgery is an alternative to contain the intra-abdominal organs in their closed cavity; however, this approach makes it difficult to visualize and manipulate the organs because of their gravitation. As an alternative, we propose the use of assisted surgery technology by computerized and robotized systems that will solve the technical aspects caused by microgravity.

Objective. To design and build a simulator for laparoscopic surgery that also simulates microgravity in the space surgical environment in order to perform surgical procedures of the digestive tract on experimental animal.

Methodology. A 40 x 40 x 60 cm acrylic simulator, 12 mm wide, was designed. This container also includes a water irrigation and aspiration system, and surfaces to accommodate the experimental model, including an acrylic dome. Previously prepared abdominal organs would be submerged in the simulator to practice dissection and suture procedures with conventional laparoscopic surgical instruments under a simulated microgravity environment.

Expected Results. The simulator will be used to conduct laparoscopic surgical procedures by students from the Panamerican University's Faculty of Medicine, as well as by surgery residents, and practicing surgeons. The efficacy of the system will be evaluated by comparing the duration of the surgical procedure between the microgravity simulator and conventional methods.

Preliminary Conclusions. It is expected that the statistical findings will support the the simulator as an adequate device to emulate microgravity and thus permit medical students and residents to experience surgery under microgravity conditions. It will also offer an innovative didactic tool that would complement the surgical program of the Panamerican University. This effort also offers an opportunity to design new laparoscopic tools for use in space.

OP18 ULTRACOMPACT ANESTHESIA SYSTEM FOR SPACE MISSION *SYSTÈME D'ANESTHÉSIE ULTRACOMPACT POUR MIS- SION SPATIALE*

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An anesthesia machine used on a space mission should be compact and practical. Inhaled anesthesia is much safer than intravenous anesthesia, since sevoflurane or isoflurane are non-flammable, have low toxicity, and depth of anesthesia is regulated through respiration.

A simple inhalation anesthesia attachment was invented which, by fitting to a conventional bag valve mask (BVM), allows the addition of key functions: (1) vaporization of the anesthetic agent; (2) manual/automatic ventilation; and (3) removal of anesthetic gas.

In tests conducted on Earth, when 5 ml of isoflurane were sprayed from the syringe, the inhalation anesthetic gas concentration within the breathing circuit was instantly elevated, and the exhalation anesthetic gas concentration reached a therapeutic range within 15 sec. This state lasted for 2 min and then gradually reverted. It has been confirmed that the anesthetic gas is fully eliminated from the body and recovery from anesthesia occurs over a period of 15 min.

With a novel APL valve using pneumatic pressure as a power source, non-step regulation of airway pressure and repetition of automatic inhalation/expiration in rats and in artificial lungs were achieved. Moreover, 99.9% removal of anesthetic gas in breath was achieved using an attached activated charcoal filter.

So far, favorable anesthetic effects have been confirmed in experiments of sedation, asthma treatment, and subgingival scaling in humans, subgingival scaling and tooth extraction in dog, and electroconvulsion with the use of muscle relaxants in rats.

This anesthesia system is not only easy to operate, safe, ultracompact, but also does not require electronic components (Electromagnetic Compatibility).

Therefore, if its performance is successfully validated at the ISS, it is likely to become a powerful tool for medical treatment and surgery in space. It may also have promising future applications in disaster medical care, medical support in developing countries, anesthesia/ventilation during air or maritime transportation of patients, etc.

OP19**EVALUATION OF 3D PRINTED SURGICAL INSTRUMENTS BY MARS ANALOG CREW MEMBERS***EVALUATION DES INSTRUMENTS CHIRURGICAUX IMPRIMÉS EN 3D PAR LES MEMBRES DE L'ÉQUIPAGE D'UNE MISSION SUR MARS SIMULÉE***JY Wong, AC Pfahnl**Center for Innovative Technologies & Public Health, Toronto, Ontario, Canada
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Introduction. The first off-Earth fused deposition modeling (FDM) 3D printer is scheduled for launch in 2014. This study evaluated the functionality of four FDM 3D printed acrylonitrile butadiene styrene thermoplastic surgical instruments during a 4 month-long simulated Mars mission.

Methods. Five crew members (2M, 3F, median age: 28 years) with no prior surgical experience completed 16 timed sets of simulated prepping, draping, incising, and suturing tasks to evaluate the relative speed of using four 3D printed instruments compared to conventional instruments.

Results. The average and standard deviation for time to completion of the prepping task for the control sponge stick was 10.1 ± 3.0 s and 3D printed instrument was 10.0 ± 2.9 s. The average and standard deviation for time to completion of the draping task for the control towel clamp was 4.3 ± 1.2 s and 3D printed instrument was 4.7 ± 1.7 s. The average and standard deviation for time to completion of the incising task for the control scalpel handle was 18.6 ± 7.2 s and 3D printed instrument was 16.3 ± 4.9 s. The average and standard deviation for time to completion of the suturing task for the control toothed forceps was 60.5 ± 21.9 s and 3D printed instrument was 59.8 ± 19.9 s.

Conclusion. For long duration analog mission crew members with no prior surgical experience, there was no substantial difference in time to completion of simulated tasks with control vs. FDM 3D printed sponge stick, towel clamp, scalpel handle and toothed forceps.

OP20**PHYSIOLOGICAL INTERPRETATION OF A-LOC INCIDENTS***INTERPRÉTATION PHYSIOLOGIQUE DES INCIDENTS A-LOC***SK Sushree, KP Rohith, A Gowda, P Sannigrahi**Indian Air Force, Bangalore, Karnataka, India
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Introduction. Although the phenomenon of Almost Loss Of Consciousness (A-LOC) is known to the Aviation Fraternity since 1980s, it is not well researched. Very few studies have attempted to elaborate the characteristics of A-LOC; however, the explanations are not conclusive. The present study is a retrospective analysis which has endeavored to address the lacunae in the literature.

Methods. The study was conducted in the Department of Acceleration Physiology and Spatial Orientation, IAM IAF, Bangalore. A retrospective analysis of the G training data in High Performance Human Centrifuge for a time span of 4 years (2009 to 2013) was carried out.

Results. In total 8093 videos were analyzed and 71 A-LOC incidents were reported. The videos were evaluated for the charac-

teristics of A-LOC. Convulsions and involuntary body movements were observed in 36 and nystagmus was observed in 43 pilots. 30 out of 71 pilots who had A-LOC were interviewed about the event; amnesia and dreams were reported by 11 and 02 pilots respectively. The average incapacitation period was noted to be 10.14 ± 3.26 s.

Discussion. On the basis of findings like nystagmus, maintenance of postural tone, convulsions, amnesia, dreams during A-LOC, the neuro-physiology of A-LOC has been hypothesized. Presence of nystagmus, maintenance of posture suggests intact Vestibulo-Ocular Reflex and Sensory Motor Tract respectively. Non-recollection of dreams, amnesia suggests breach in memory and/or information processing for higher functions. The mechanism in toto can be explained by regional difference in blood flow and vulnerability of cerebral centers to ischemic hypoxia. Convulsions in A-LOC could be attributed to hyper-excitability of nerve fibers due to hypoxia.

OP21**USAF GLOC RATES FOLLOWING THE IMPLEMENTATION OF FULL-COVERAGE G-SUITS***TAUX DES PHÉNOMÈNES DU VOILE NOIR DANS LA USAF SUIVANT L'UTILISATION DES COMBINAISONS ANTI G À COUVERTURE COMPLÈTE***KG Hughes**711 Human Performance Wing, Wright Patterson AFB, USA
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Introduction. G-induced loss of consciousness (GLOC) has been a risk associated with all high-G aircraft resulting in loss of aircraft and life. G-suits used by the USAF had changed little since the 1940s until the implementation of Advanced Technology Anti-G Suits (ATAGS) in the F-22 Raptor in the late 1990s. Full coverage G-suits are used by many military services in countries around the world to include the United Kingdom, Norway and Finland. The USAF has used ATAGS in the F-22 for the past two decades, and the F-35 Joint Strike Fighter is equipped with full coverage G-suits. Epidemiologic mishap data convinced the USAF to implement full-coverage G-suits in legacy aircraft (F-16 and F-15C) beginning in March 2011.

Methods. A brief review of full coverage (FC) G-suit technology and USAF historical GLOC data will be presented, along with GLOC mishap rate analysis since Mar 2011 to evaluate the effect of full-coverage G-suit technology on USAF GLOC rates.

Results. The average GLOC rate in the US Air Force F-16 is 1.47/100,000 flying hours (FH) for the 20-year period of 1993-2013, and has been 4.2/100,000 FH and 3.9/100,000 FH in the past two years since the integration of FC G-suit technology. Approximately 30% of F-16 pilots are flying with FC G-suits, and no GLOCs have occurred while wearing them.

Conclusion. GLOC rates in US Air Force F-16 pilots has continued to rise since the implementation of FC G-suit use, however these GLOCs have occurred in the pilots wearing legacy 5-bladder G-suits which indicates the GLOC rate may be higher than it appears.

OP22**EFFECT OF TOTAL SLEEP DEPRIVATION ON STRAINING G LEVEL TOLERANCE AND ITS MITIGATION WITH MODAFINIL***EFFETS DE LA PRIVATION TOTALE DE SOMMEIL SUR LA TOLÉRANCE AUX G ET SES ATTÉNUATIONS AVEC MODAFINIL*

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Introduction. Present study examined effect of 32 hours of Total Sleep Deprivation (TSD) on straining G level tolerance and its modulation with Modafinil.

Methods. Straining G level tolerance of 45 well rested and slept, healthy, male humans (20-22 years) was measured in a baseline (non sleep deprived) state and after 32 hours of TSD. During TSD, the participants were randomised to receive two doses of Placebo (Gp P), Modafinil 100 mg (Gp M1) or Modafinil 200 mg (Gp M2) at ~16th and ~25th hour. Oral temperature, HR and MAP were also recorded. Stanford Sleepiness Scale (SSS) was used to score subjective perception of sleepiness/alertness. Results were analysed using ANOVA/ pairedt test/Friedmans ANOVA.

Results. Modafinil (especially 200 mg) caused significantly increase in HR and MAP and prevented a nocturnal circadian dip in oral temperature. Straining G level tolerance decreased significantly after TSD in Gp P (5.5 ± 0.2 G in baseline vs. 4.8 ± 0.3 G after TSD; $t = 2.51$, $p = 0.026$) and Gp M1 (5.2 ± 0.2 G in baseline versus 4.3 ± 0.3 G after TSD; $t = 2.98$, $p = 0.011$). In Gp M2, there was no significant change (5.1 ± 0.2 G in baseline vs. 5.0 ± 0.2 G after TSD; $t = 0.56$, $p = 0.583$). Scores on SSS increased significantly in Gp P ($\$2 = 28.88$ $p = 0.000$) and M1 ($\$2 = 10.74$ $p = 0.013$) but not in Gp M2 ($\$2 = 2.29$ $p = 0.514$).

Conclusion. Modafinil (200 mg) effectively mitigated decrease in level G tolerance due to TSD. It corroborated with scores of subjective perception of sleepiness/alertness. Such an effect was not seen with 100 mg dose.

OP23**AN ANALYSIS OF TCD TO INTERPRET CHANGES IN CEREBRAL CIRCULATION UNDER +GZ**

UNE ANALYSE DU DOPPLER TRANSCRÂNIEN POUR INTERPRÉTER LES CHANGEMENTS AU NIVEAU DE LA CIRCULATION CÉRÉBRALE SOUS +GZ

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Introduction. Few recordings of Transcranial Doppler (TCD) under Gz have been reported in literature. This study is perhaps the first description of the characteristics of TCD under Gz. These characteristics have been used to offer probable descriptions of vascular events in cerebral circulation under Gz.

Methods. 20 participants were subjected to a GOR run. TCD, ECG, respiratory rate and non-invasive BP were measured.

Results. Interpretation of TCD wave indicates an increase in vascular resistance under Gz, which gradually increases with Gz till it results in peripheral light loss (PLL). Blood Flow Velocity did not decrease, and in some cases, increased close to PLL. These seemingly bizarre results have been interpreted and explained in the paper.

OP24**RESTRAINT USE: SIMULATING GY**

UTILISATION DE DISPOSITIF DE RETENUE : SIMULATION GY

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Introduction. Super maneuverable aircraft are capable of executing maneuvers involving Gy acceleration. This has resulted in a renewed interest in centrifuge studies involving Gy acceleration. However, the restraint systems available in the centrifuge seat are designed primarily for Gz acceleration and are largely ineffective in preventing sideways movement of the torso, as well as neck snap under Gy acceleration. Thus additional restraints are needed for participants undergoing Gy acceleration.

Methods. The present study was conducted on High Performance Human Centrifuge. 30 healthy male volunteers participated in the study. All subjects underwent a combined acceleration profile +Gz/+2Gy using the newly designed restraint system. A restraint was designed specifically for this acceleration profile. Effectiveness of the restraint was tested both subjectively and objectively.

Results. All subjects were found to be comfortable with the new restraint and it was found to be very effective in restraining subjects while undergoing Gy acceleration.

Conclusion. The study brings out a new effective system for restraining subjects during Gy simulation in centrifuge. The operational significance of installing a restraint system in addition to the five point harness in aircraft capable of executing significant Gy is also highlighted.

OP25**“FIRE EATER’S” LUNG DISEASE FOLLOWING A HELICOPTER ACCIDENT: A CASE OF AIRCRAFT FUEL ASPIRATION**

MALADIE PULMONAIRE DU ‘CRACHEUR DE FEU’ À LA SUITE D’UN ACCIDENT D’HÉLICOPTÈRE: UN CAS D’ASPIRATION DE KÉROSÈNE

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Introduction. The accidental aspiration of petroleum products is usually in minimal quantities. Inadvertent aspiration of large quantities of jet fuel is uncommon. This report reviews significant petroleum product aspiration following a helicopter crash into salt water. Clinical presentation, radiographic imaging findings, and recommended treatment will be discussed.

Case Report. Bell 206 L-4 helicopter was used to resupply a deep ocean petroleum drilling platform. During takeoff, aircraft cleared the edge of the platform, began a slow yaw right. 63-year-old male pilot reported loss of tail rotor effectiveness (LTE), deployed emergency flotation device, initiated autorotation. Helicopter impacted the water nose low, right drift, rolled, inverted, and sank. Pilot exited through the broken windscreen. Pilot and 22 year old female co-pilot were evacuated to trauma center. Passenger was uninjured. At trauma center, pilot indicated he swallowed little jet fuel and salt water with nausea, vomiting, low back pain, denied respiratory symptoms. Co-pilot reported severe back pain but no ingestion sea water/jet fuel or respiratory symptoms. Pilot received CT scan evaluation chest and lungs. During CT scan, became increasingly hypoxic, oxygen saturation of 81%. Oxygen 4 LPM provided saturation of 94%. X rays indicated rapidly progressing infiltrates bilaterally lung bases. Series of x-rays and CT scans indicated increasing lung infiltrates progressing to cystic for-

mation. Pilot treated symptomatically progressing to clear lungs without residual.

Discussion. Petroleum product aspiration has long been known as a consequence of fire eaters. Ingestion/aspiration of various types of petroleum products produces a “lipoid pneumonitis” with initial consolidation and subsequent cystic formation. The controversial use of antibiotics and steroids will be discussed.

Conclusion. This case represents an unusual case of aspiration of jet fuel and salt water producing a case of “fire eaters” disease in a 63-year-old helicopter pilot.

OP26

CURRENT TRENDS IN AEROSPACE MEDICINE AND HUMAN FACTORS RESEARCH AT THE FAA CIVIL AEROSPACE MEDICAL INSTITUTE

LES TENDANCES ACTUELLES EN MÉDECINE AÉROSPATIALE ET RECHERCHE SUR LES FACTEURS HUMAINS À L'INSTITUT CIVIL DE MÉDECINE AÉROSPATIALE DE LA FAA

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CAMI scientists employ sophisticated equipment and facilities to focus on the bioaeronautical aspects of safety and security, including forensic toxicology, toxicogenomics, biochemistry, accident research, passenger and crew protection, survival research, environmental physiology, and vision research. There are three main objectives in the Aerospace Medical Research Program: 1) investigation of the injury and death patterns in civilian flight accidents along with meticulous analysis to determine causes(s) and prevention strategies; 2) development of recommendations for protective equipment and procedures; and 3) evaluation of options, on behalf of FAA regulatory and medical certification staff charged with the proposal of safety and health regulations addressing all aircraft cabin occupants.

This research program identifies human tolerances, uneven flights, and during civilian inflight incidents and accidents. The research results enable the FAA to utilize new and evaluate existing bioaeronautical guidelines, standards, and models for aircraft cabin equipment, procedures, and environments. CAMI scientists also study the skills, abilities, behavior, and performance of personnel involved in aerospace operations. Researchers look for ways to optimize human performance, efficiency and safety, through the introduction of new work station/cockpit displays and controls, and the effective selection and training of personnel operating in highly complex technological environments.

CAMI's Aerospace Human Factors Research Division leads an integrated program of field and laboratory performance research in organizational and human factors aspects of aviation work environments. Research includes human performance under various conditions of impairment, human error analysis and remediations, training analysis and career enhancement, impact of advanced automation systems on personnel requirements and performance, human factors evaluations of performance changes associated with advanced multifunction displays and controls in general aviation and air traffic control, and the psychophysiological aspects of workload on job proficiency and safety in aviation-related human-machine systems.

OP27

PROGRAM UPDATE: NAVAL MEDICAL RESEARCH UNIT - DAYTON

MISE À JOUR DU PROGRAMME: UNITÉ NAVALE DE RECHERCHE MÉDICALE - DAYTON

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The Naval Medical Research Unit Dayton (NAMRU-D), located on Wright-Patterson Air Force Base, Ohio, is composed of two research areas. The Aeromedical Directorate conducts aerospace-relevant basic and applied research in the biomedical and behavioral sciences. Key areas of investigation include: spatial disorientation (SD), situational awareness, motion sickness, unusual acceleration environments, altitude, sustained operations and fatigue, personnel selection, and visual sciences. Research efforts focus on the transition of products from our basic and applied research base to Navy Medicine, Naval Aviation, and other governmental and civilian customers. Recent and anticipated transitions include: validated aviation selection tests, novel training media to reduce SD mishaps, and new medications for motion sickness. Our laboratory boasts a unique set of man-rated acceleration devices used by NAMRU-D researchers and visiting scientists to maintain a technology base critical to Naval Aviation and other aerospace customers. The Environmental Health Effects Directorate conducts basic and applied research to assess the toxicity of chemicals and materials used in military operations that may affect our military and civilian populations. NAMRU-D has the capability to study toxic effects of materials using *in vitro* and *in vivo* systems; then data are used to assess risk using *in silico* (modeling) approaches. Our *in vitro* approaches provide data on the cytotoxicity, mutagenicity, genotoxicity, and the mechanism of toxic action of these materials. We use animal systems to examine the toxicities of materials via various routes of exposure. Our inhalation capabilities are extensive, allowing for exposures to gases and vapors, aerosols, particulates, and nanoparticles, using both whole-body and nose-only inhalation chambers. We have the ability to assess the toxicities of chemicals and materials via various routes of exposure at the molecular, cellular, organ, and whole body levels. The results from these efforts have led to state-of-the-science health protective exposure standards for military and civilian populations.

OP28

UPDATE FROM THE US ARMY AEROMEDICAL RESEARCH LABORATORY: TRENDS IN ROTARY-WING AVIATION MEDICINE RESEARCH PROBLEMS AND SOLUTIONS

MISE À JOUR DE LA PART DU LABORATOIRE DE RECHERCHE AÉROMÉDICALE DE L'ARMÉE AMÉRICAINE: TENDANCES CONCERNANT LES PROBLÈMES ET SOLUTIONS DE LA RECHERCHE AÉROMÉDICALE SUR LES HÉLICOPTÈRES

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The US Army Aeromedical Research Laboratory, located at Fort Rucker, Alabama, the home of Army Aviation, has a 52-year history of applied aeromedical research in support of the unique

physiological and psychological needs of the military rotary-wing aviator. Over the years, research for the aviator has also been of direct benefit to other customers in the mounted and dismounted Army.

USAARLs 2015 research program is based on five competencies: 1) Aircrew Health and Performance which deals with a wide range of aviation medicine problems that include spatial disorientation, fatigue, waiver and retention policies, and health promotion; 2) Sensory Performance, Injury & Protection includes active research programs into the protection and enhancement of hearing (e.g., 3D auditory displays, criteria for hearing protection), and the protection and enhancement of vision (e.g., enabling safe flight through brownout conditions, and assessment of options for presbyopic HMD-users); 3) Crew Survival in Military Helicopters and Combat Vehicles assesses the performance of crash survival equipment/aircraft-mounted and aircrew-mounted; 4) Blunt, Blast, and Accelerative Injury & Protection developing new ways to protect aircrew and mounted Soldiers from operational injury hazards. Current programs investigate spinal injury in rotary-wing aircraft, standards for head-supported mass, and ways to measure head impact to help predict TBI; and 5) Enroute Care Environment - the effects of the transport environment on pathophysiology and patient outcome (e.g., neck injury, pain, vibration).

As always, USAARL is uniquely focused on the problems of the rotary-wing aviator, is well connected around the US and internationally, and is always interested in new opportunities for collaboration or synergy within the aviation medicine research community.

OP29

A NEW FACILITY FOR THE AVIATION MEDICINE COMMUNITY: PROGRAMMES AND RESEARCH AT THE SPANISH AIR FORCE INSTITUTE OF AVIATION MEDICINE

NE NOUVELLE INSTALLATION POUR LA COMMUNAUTÉ DE LA MÉDECINE AÉRONAUTIQUE: PROGRAMMES ET RECHERCHE À L'INSTITUT DE MÉDECINE AÉRONAUTIQUE DE L'ARMÉE DE L'AIR ESPAGNOLE

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The Spanish Air Force Institute of Aviation Medicine has a dual component, supporting Military Aviation and the Civil Aviation Authority (AESA/EASA). The Department of Aerospace Medicine constitutes the frame which supports the Clinical Area and the Research and Training Labs.

Research objectives are the aeromedical care of our aviators plus the technical support in accomplishing their tasks safely and efficiently. Main trends are related to human resources and budgetary support. In order to cope gaps and limitations, a go ahead strategic plan has been established, to assure we will reach the objectives at short and medium range.

Current and future lines of research are related to clinical aviation medicine, exposure to hostile flight environments and support to flight operations in new scenarios and operations theatre. Research lines and teaching/instruction objectives needs collaboration with national and international institutions, academy, agencies and industry.

OP30

AEROSPACE MEDICINE RESEARCH IN MEXICO

RECHERCHE EN MÉDECINE AÉROSPATIALE AU MEXIQUE

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Following the history of aerospace medicine in Mexico has been a history of research into aerospace medicine problems and solutions. From helicopters to commercial and fixed-wing problems, to the challenges of manned spaceflight, Mexican scientists have sought to provide solutions enabling the safe conduct of the full spectrum of aerospace operations. This presentation will update the Academy on recent developments and future directions for Mexican aerospace medicine research.

OP31

IMPROVING NIGHT VISION GOGGLE PERFORMANCE WITH HUMAN SYSTEMS INTEGRATION OF MATERIAL, PERCEPTUAL, COGNITIVE AND TRAINING FACTORS

AMÉLIORATION DE LA PERFORMANCE DES LUNETTES DE VISION NOCTURNE AVEC LES SYSTEMES HUMAINS D'INTÉGRATION DES FACTEURS MATÉRIELS, PERCEPTIFS, COGNITIFS ET FORMATIFS

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Night Vision devices were first utilized (and failed) in US military flight in 1969. The implications of night fighting in the 1973 Arab-Israeli War drove the existing technology straight to flying with NVGs in the US military with Army Combat Development Command, Night Vision Labs, and Honey Badger Projects. Numerous fatal mishaps occurred because the flying demands far exceeded the night vision technology, training, aircraft cockpit and exterior design and lighting. Many attempts were made but the human system was not integrated fully into the equation.

The technologies of Night Vision Devices have now progressed to be part of almost every US military aircraft Tactics, Techniques and Procedures (TTP), deployment and mission profile. They have become an essential component of military aviation providing superior visual capability over unaided night vision. There are several inherent limitations associated with human factors and systems limitations. Manufacturers such as ITT have greatly improved the image intensifier technology, while individual services have greatly improved cognitive and visual performance through surgery, aircrew selection and training.

A review of some of the best human system Integration in Night vision Systems from the three US military services (Army, Navy and Air Force) will be presented. The review covers technology and device characteristics (image quality and field of view), physical configuration (ocular configuration, NVG weight, and forward center of gravity), and contextual and environmental factors (mission and task aspects, lighting, weather, and terrain). The key human factors in NVG use of visual and cognitive performance (visual acuity and contrast sensitivity, stereopsis and depth perception, distance and size estimation, spatial orientation, and situation awareness), and physical and physiological aspects (neck strain and injuries, and headaches) will be discussed.

OP32

COLOR VISION NORMAL SUBJECTS PERFORM BETTER THAN ALL MILD, MODERATE AND SEVERE COLOR

DEFICIENT SUBJECTS IN DECREASED COLOR CONTRAST SENSITIVITY TESTING IN THE USAF OPERATIONAL BASED VISION ASSESSMENT (OBVA) HIGH FIDELITY, VISION LIMITING SIMULATION SYSTEM

LES SUJETS AYANT UNE VISION NORMALE DES COULEURS FONCTIONNENT MIEUX QUE TOUS LES DÉFICIENTS LÉGERS, MODÉRÉS OU SÉVÈRES DANS LES TESTS DE SENSIBILITÉ DES CONTRASTES DIMINUÉS DES COULEURS DE L'USAF (OBVA) SYSTEME HAUTE FIDÉLITÉ, SIMULANT LA VISION LIMITÉE

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Normal color vision is required for all US Air Force Pilot, Navigator, Remotely Piloted Aircraft (RPA-Pilot and Sensor Operator) and multiple other aircrew positions. This is primarily due to increased demands for normal color vision in modern aircraft including multi-function cockpit display and computer sensors. It has been assumed color vision deficiency likely causes decreased aircrew performance in operational tasks including reduced visual range, slower reaction times, increased processing errors and decreased discrimination sensitivity, but this has only been a hypothesis.

The purpose of the Operational Based Vision Assessment (OBVA) Program is to provide the USAF and Department of Defense (DoD) with operationally valid criteria and tests for assessment of aircrew vision performance in a high fidelity, vision limiting simulation system. The initial research project of OBVA is to evaluate the effects of high contrast as well as decreased amount of low contrast on the color performance of normal vs color deficient subjects.

Color testing of color normal and mild, moderate and severe color deficient subjects was conducted on a simulated PAPI landing system and a simulated fifth generation fighter aircraft multi-function cockpit display. Color normal and a few mild color deficient subjects performed similarly on high contrast color simulation. All moderate and severe color deficient subjects had statistically significant increased error rates and acquisition times on high contrast color testing. However, as levels of color contrast decreased, simulating the real world of canopy glare, decreased illumination and environmental factors, all mild, moderate and severe color deficient subjects had statistically significant increased error rates and acquisition times on lower contrast color testing compared to normal color subjects.

OP33

THE ANALYSIS OF CONTRAST SENSITIVITY FUNCTION FOR CIVIL AVIATION PILOTS AFTER CORNEAL REFRACTIVE SURGERY

L'ANALYSE DE LA SENSIBILITÉ AU CONTRASTE CHEZ LES PILOTES DE L'AVIATION CIVILE APRÈS UNE CHIRURGIE RÉFRACTIVE DE LA CORNÉE

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Introduction. Contrast sensitivity function (CSF) is an important field of visual quality evaluation for post-refractive surgery. We observe contrast sensitivity function of civil aviation pilots

who have undergone corneal refractive surgery and then investigate the role of CSF in aeromedicine assessment.

Methods. CSF data of 28 civil aviation pilots that underwent corneal refractive surgery were collected by Optec 6500. The effects of postoperative observation time, glare, and luminance on CSF of civil aviation pilots were analyzed.

Results. Average age of 28 pilots, including 18 LASIK cases, 5 PRK cases, 5 RK cases, was 32.1 ± 2.2 years old. Average follow-up time was 7.7 ± 1.3 years, average flight time in most recent year was 462.2 ± 73.6 hours. The CSF score at each spatial frequency among those post-operation of more than one year was significantly higher than that of within one year. The CSF score at each spatial frequency among whose flight time, of less than 100 hours in recent one year, was significantly higher than that of more than 100 hours. Under the lighting conditions of 85 lx, the CSF score at 1.5 C/D was significantly less than that of 3 lx, while at 12 C/D higher than 3 lx. Under the condition of glare level 2, the CSF score at 1.5 C/D and 18 C/D was significantly higher than that of no glare, glare and lighting have interaction effect.

Conclusion. Contrast Sensitivity Function is an important factor of visual quality assessment, especially after corneal refractive surgery. Postoperative period of corneal refractive surgery, illumination, glare and flight time might influence CSF. Aeromedicine should take into account the auxiliary value of CSF in assessment of civil aviation pilots after corneal refractive surgery.

OP34

COSMIC RADIATION INDUCED ENDOTHELIAL CORNEAL DAMAGED IN ARGENTINEAN INTERNATIONAL FLIGHT ATTENDANTS

LÉSIONS DES CELLULES ENDOTHÉLIALES CORNÉENNES INDUITES PAR LA RADIATION COSMIQUE CHEZ DES AGENTS DE BORDS ARGENTINS FAISANT DES VOLS INTERNATIONAUX

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Introduction. In Argentina, cabin aircrew members must submit to an annual medical examination by the National Administration of Civil Aviation. A medical symptom frequently reported by cabin crew is the gradual malfunction of vision, in spite of the normal results found from vision examination. One tissue that is not specifically studied during this examination is the cornea and its endothelium. Secondary diseases such as those possibly induced by ionizing cosmic radiation would not be discovered unless further medical testing is conducted.

Methods. Thirty flight attendants without ophthalmologic antecedents and with 5,000 to 20,000 hours of flight experience are currently occupationally exposed to cosmic radiation in the range between 2 and 7 milliSieverts per year. These personnel along with a control group of non-flyers volunteered to participate in a study that examined the anterior chamber of the ocular organ by means of a new automatic and non-invasive technique known as specular microscopy. The goal of the study was to assess the morphological and functional status of the monolayer corneal endothelium.

Results. It was found that the tissue of flight attendants presented several compromises to this particular tissue when compared with the control group. These differences included a decrease in

the number of cells, alteration of the size and distribution of the normal geometry (hexagonal), and polymorphism. These anomalies lead to a progressive alteration of the normal and important physiologic function of the corneal endothelium such as governing fluid and solute transport across the posterior surface of the cornea and actively maintaining the cornea in a dehydrated state that is required for optical transparency. For example, maintaining stromal deturgescence, acting both as barrier to fluid movement to the cornea and as an active pump that moves ions and water osmotically from the stroma into the aqueous humor.

Discussion. Flight attendants operating in international routes showed a significant alteration in the number, density, distribution and shape of their corneal endothelial cells when compared with those of control subjects.

OP35

GENE EXPRESSION LEVELS INDUCED BY COSMIC RADIATION IN ARGENTINEAN FLIGHT ATTENDANTS

NIVEAUX DE L'EXPRESSION DES GÈNES INDUITS PAR LES RADIATIONS COSMIQUES CHEZ LES AGENTS DE BORD ARGENTINS

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Background. Flight attendants are exposed to cosmic radiation and desynchronization that are involved in the development of several cancers, for example, breast cancer, melanoma and leukemia. The aim of this study is to determine the gene levels induced by ionizing radiation and desynchronization.

Material and Methods. 60 flight attendants participated in the study and signed informed consent and 20 administrative women participated as controls. Blood samples were taken and sent to the CAMI Genomic Laboratory to be processed.

Results. There were several genes up-expressed showing changes that are related to different regulatory functions on the cell cycle, DNA repair, apoptosis, genomic stability, cell proliferation, angiogenesis and circadian clock.

Conclusion. This study indicates that even low and chronic levels of ionizing radiation exposure can induce stable transcriptional changes of genes in flight attendants and their altered expression can play specific functions with DNA repair and cell cycle control that maintain the Genomic Integrity. The defective activity of DNA is recognized together with mutations as related to early event detection as are the most important risk factors for the development of carcinogenesis in the human economy. For these reasons we suggest the necessity to be implemented as a recommendation for the genetic study in the periodic medical controls in this specific occupational activity.

OP36

MENTAL WORKLOAD ASSESSMENT DURING SIMULATED FAST JET LANDING AT NIGHT, AKIN TO A BLACK HOLE APPROACH

L'ÉVALUATION DE LA CHARGE DE TRAVAIL MENTALE PENDANT UN ATTERRISSAGE SIMULÉ D'UN AVION À RÉACTION RAPIDE DURANT LA NUIT, QUI S'APPARENTE À UNE APPROCHE DITE DU 'TROU NOIR'

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Introduction. Approach to land at night is considered stressful by most military aviators. Mental workload assessment during this critical phase of flight helps us understand the likely cognitive demands on the pilot. A study of psychophysiological variables in real time was conducted to assess the mental workload while making an approach to land on a dark night, akin to a "black hole", in a simulated single cockpit fast jet aircraft.

Material & Methods. 20 trained military pilots, mean age 34 years (SD 7) and mean flying experience of 1857 hours (SD 1274), voluntarily participated in this study. This within-subject, cross over design study was conducted on a proprietary spatial disorientation trainer. The profile for landing during day and night visual meteorological conditions (VMC) was based on an approach initiated from 8 nm inbound until touchdown. The dependent variables were heart rate, respiratory rate and galvanic skin response. MS Excel® and Statistica® were used for data processing and statistical analysis, respectively.

Results. Time to land between day (control) and night (test) VMC conditions was not significant ($t = 0.54$, $p = 0.59$). The measured parameters between control and test conditions were found to be not significant. This included heart rate ($F(2, 32) = 0.02$, $p = 0.97$), respiratory rate ($F(2, 38) = 0.13$, $p = 0.87$) and galvanic skin response ($F(2, 38) = 0.17$, $p = 0.83$).

Conclusion. The results indicated that the two profiles - approach to land during day and night VMC-inflicted comparable mental workload. This could be because the study was conducted in a simulated crash proof environment and the level of flying experience of the participants.

OP37

AEROSPACE MEDICINE IN MEXICO: HISTORICAL ASPECTS

MÉDECINE AEROSPATIALE AU MEXIQUE: ASPECTS HISTORIQUES

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Aerospace Medicine (MA) in Mexico, started in the 20's with the self-enthusiasm and professionalism of the doctors, then with simple medical pioneers Mexico pilots exams. Over the years the need for specialty led to military medical, RAUL PRIETO-TERRES, to pursue the specialty of Aviation Medicine in the United States of America (USA) in the mid-30s, granting his return to office Aviation Medical Examiner, along with other doctors; however, the lack of government support disenfranchised specialists, who lost interest in it.

Subsequently Major surgeon, LUIS ANGEL AMEZCUA-GONZÁLEZ, specializing in the U.S., established the scientific application of the art, and supported academic education by founding the Mexican Association of Aviation Medicine in 1982. Continuing with the task, AMEZCUA, Brigadier General Surgeon, VICTOR MANUEL JAIME-RICO, momentum scientific and professional application of the MA in the military environment, created the field of MA in the curriculum of the Military Medical School. With a specialty MA in Military Graduate School of Health in 1985-only school, I taught this specialty in Latin America at that time; Primary Course and MA in 1990, all branches of the

University of the Army and Air Force. Meanwhile, the civil sector was highlighted by the creation of the National Center for Aviation Medicine in 1988 under the Ministry of Communications and Transportation.

To date there are military specialists in Mexico, civilians and foreign nationals, faced with capacity strong commitment and professionalism involving human factor aerospace safety.

OP38

PILOTS AND ANKYLOSING SPONDYLITIS: AEROMEDICAL ISSUES

PILOTES ET SPONDYLARTHRITE ANKYLOSANTE: IMPLICATIONS AÉROMÉDICALES

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Introduction. La spondylarthrite ankylosante est une maladie relativement peu fréquente lors de la pratique quotidienne de la médecine aéronautique. Elle pose le problème de son diagnostic, de son retentissement fonctionnel, ainsi que des effets indésirables potentiels des médicaments utilisés.

Observations. Nous présentons trois cas de spondylarthrite ankylosante chez des personnels navigants techniques. Dans un cas, des considérations fonctionnelles et psychologiques ont été à l'origine de l'inaptitude définitive. Dans les deux autres cas, les pilotes ont été déclarés aptes. Nous discutons des implications médico-aéronautiques.

Conclusion. Devant une spondylarthrite ankylosante, la décision d'aptitude aéronautique repose essentiellement sur des aspects fonctionnels et thérapeutiques. Le retentissement sur le psychisme de cette maladie chronique ne doit toutefois pas être négligé.

OP39

AEROMEDICAL IMPLICATIONS OF MYASTHENIA GRAVIS

IMPLICATIONS AÉROMÉDICALES DE LA MYASTHÉNIE GRAVE

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Introduction. Myasthenia gravis is an autoimmune neuromuscular disorder characterised by weakness and fatigability of skeletal muscles. This study examined the United Kingdom Civil Aviation Authority's experience of myasthenia gravis and the aeromedical implications of the condition.

Methods. A search of the UK Civil Aviation Authority medical records database from 1990 to 2014 revealed eight subjects with a reported diagnosis of myasthenia gravis.

Results. The clinical features and certificatory status of these subjects will be described.

Conclusion. The clinical features and aeromedical implications of myasthenia gravis will be discussed. Guidance for the certificatory assessment of individuals with a diagnosis of myasthenia gravis will be proposed.

OP40

DISEASED STATES IN OBESE AND OVERWEIGHT IN IRANIAN CIVILIAN PILOTS

ÉTATS DE SANTÉ CHEZ LES PILOTES CIVILS IRANIENS OBÈSES ET EN SURPOIDS

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Introduction. Obesity is generally defined as an excess concentration of body fat or adipose tissue. Obese and overweight are terms often used interchangeably, but they do not necessarily represent the same situation. Excess bodyweight is known to be associated with many medical disorders which can be disqualifying for aviators. This project investigated overweight and obesity in valid holders of IRAN civilian medical certificates as of January 2012 to December 2013.

Methods. A license holder is legally obligated to undergo regular health examination, performed by designated medical examiner in an aero medical center (AMC). A recognized database of all holders of valid civil aviation organization medical certificates was queried for pilots BMI and a variety of disease states that have been associated with obesity and weight. There were a total of 10,000 airmen. Diseases included: hypertension, diabetes, cardiovascular disease, kidney stones, gall bladder disease, and others.

Results. The total prevalence of overweight and obese from 10,000 holders (all men) are as follows: 3004 (30 %) are overweight and 408 (4%) obese. In regards to class of holders: 57% of 1st class pilots are overweight and 78% obese.

Discussion and Conclusion. The morbidity and mortality of overweight and obesity have been well recognized in the medical community for many years. Most associations between BMI and health conditions were expected. A unique finding was that overweight and obese pilots are more likely to require a special issuance certificate than normal weight pilots. This data for all Iranian certificate holders suggests that conditions associated with excessive bodyweight will account for disqualification of a significant number of aviators.

OP41

CLINICAL PRACTICE AND AEROMEDICAL CERTIFICATION OF CIVIL AVIATION PILOTS WITH RENAL CALCICEAL CALCULI

PRATIQUE CLINIQUE ET CERTIFICATION AÉROMÉDICALE DES PILOTES DE L'AVIATION CIVILE PRÉSENTANT DES CALCULS RÉNAUX CALCICIELS

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Objective. To investigate the clinical value of flexible ureteroscopy in civil aviation pilots with renal caliceal calculi, and to evaluate the diagnostic value of non-enhanced helical computed tomography (NHCT) in aeromedical certification. To formulate standard of diagnosis and treatment, propose the suggestions of prevention and follow-up.

Methods. To retrospectively analyze the clinical data of twenty-seven pilots, who were diagnosed and treated with flexible ureteroscopy from May 2013 to April 2014.

Results. 96.3%(26/27) of pilots were verified to have renal caliceal calculi and the stones were taken out among 27 pilots who were suspected. One did not find identified stones. The results show that those who pass the medicine certification are qualified, and they are all allowed to fly. Related evaluation index of NHCT in the diagnosis of suspected renal caliceal calculi are: sensitivity (71.0%), specificity (78.6%) and accuracy (72.3%). The diagnostic calculi threshold of mean CT values of NHCT (slice thickness is 1.25mm) is 120.42Hu in the interesting areas of 10mm², Youden index is 0.2351, and area under the ROC curve (AUC) is 0.617. Calculus analysis: 100% (26/26) is mainly calcium oxalate, 61.5% (16/26) is combined with calcium phosphates.

Conclusion. Flexible ureteroscopy is a safe, effective, almost noninvasive test method, it can be used as a golden standard to make differential diagnosis of suspected renal caliceal calculi of civil aviation pilots. NHCT is a good way to diagnose urinary calculus, it can be used as a accessory examination for suspected renal caliceal calculi, but it is not appropriate for differential diagnosis between caliceal calculi or renal papilla calcification. Stone component of civil aviation pilots with renal caliceal calculi is mainly calcium, it is suggested that we can decrease the recurrence risk of stone by medical intervention aiming at calcium stones.

OP42

CONSERVATIVE MANAGEMENT OF MECHANICAL NECK PAIN IN A HELICOPTER PILOT- CASE STUDY

GESTION CONSERVATRICE DE LA DOULEUR CERVICALE MÉCANIQUE CHEZ UN PILOTE D'HÉLICOPTÈRE - ÉTUDE DE CAS

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Introduction. Acute and chronic spinal symptoms such as neck pain may limit flying performance significantly and disqualify the pilot from flying duty. Mechanical neck pain is common among military pilots due to exposure to vibration, +Gz forces, helmet weight, poor neck posture during air combat maneuvers (ACM), previous neck injuries and poor previous treatment plans. It needs appropriate therapeutic procedures as well as aeromedical assessment. Although the air force and navy waiver guides recommended non-steroidal anti-inflammatory (NSAID) medications as well as spinal manipulative therapy (SMT) and exercise therapy (ET), there are currently very few published studies that describe the benefits of SMT and ET for managing mechanical neck pain for aviators-especially military pilots. The aim of presenting this case study is to demonstrate the benefits of manipulative and exercise therapy in treatment of chronic mechanical neck pain in an Iranian helicopter pilot.

Case Report. A 36-year-old male patient presented to clinic with intermittent non-radicular chronic moderate neck pain over a period of two years duration. The pain was mostly located on the left side of neck and was aggravated during head rotation to the left and left lateral bending. Some activities such as driving and head rotation during ACM increased the pain severity as well.

Intervention and Outcome. The patient was treated by cervical and upper thoracic spine manipulation procedures followed by home exercise therapy for 5 weeks. After this period, the patient reported significant recovery from neck pain.

Conclusion. It seems that spinal manipulation therapy and home exercise therapy may be a safe and effective treatment of uncomplicated mechanical neck pain in military helicopter pilots.

OP43

IS THERE A DOCTOR ON BOARD?

Y-A-T-IL UN MÉDECIN DANS L'AVION?

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International travel is becoming more popular. This is attributed to higher standards of living, cheaper costs of travel and improved affordability. The incidence of inflight emergency is low, estimated to 22 medical complaints per million travelers with a death rate of 0.1 deaths per million travelers, and a need of flight diversion of approximately 7-10%.

In 2013, Australia had 30.5 million international crossings, compared to 16.6 million in 2003 of which 15.5 million are international visitors. In 2013, 8.4 million Australians departed the country. Up to March 2014, we had an inbound of 6.5 million tourists, of which 8.4% account for holiday and 10.3% account for VFR (Visiting Family and Relatives). The most common causes of inflight emergency are attributed to (50%), gastrointestinal (9%) and cardiac (5%) reasons. If a physician is involved, the diversion rate is approximately 7% (with admission rate on arrival of 50%), compared to the physician assistant rate of 48% (admission rate of 15%). IATA (International Air Travel Association), accompanied by AsMA (Aerospace Medical Association), has set up recommendation of medical facilities on board to assist staff and physician or physician assistant.

In conclusion, with escalating trend of air travel, there is a potential increased need of physician help on board. The understanding of the common causes of the medical incident, the tools available on board, and tips to handle the call may enable safe and smooth travelling for all passengers.

OP44

A SURVEY OF A PHYSICIAN COHORT IN ASSESSING KNOWLEDGE REGARDING IN-FLIGHT MEDICAL EMERGENCIES

SONDAGE D'UNE COHORTE DE MÉDECIN POUR ÉVALUER LEURS CONNAISSANCES EN CE QUI CONCERNE LES URGENCES MÉDICALES EN VOL.

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Introduction. Community physicians who are passengers on commercial flights are often asked for assistance in the event of inflight medical emergencies. We performed a survey to assess the knowledge that community physicians have about the medications and equipment, procedures and protocols in place to handle medical emergencies.

Methods. We designed a survey of 20 questions to assess physician knowledge of in-flight emergencies on U.S. passenger flights. The survey was distributed in both written and electronic forms to all physicians on staff at one or more of the 3 Peoria, IL hospitals metropolitan population 373,600, approximately 1300 physicians. 418 responses were collected (~32% response rate). Responses were analyzed by percentages and cross-tabulated with specific

questions including years of practice experience, number of flights taken per year, and number of incidents responded to.

Result. Our respondents were comprised of 70% medical specialties, 20% surgical, and 10% other specialties including radiology, anesthesiology, and pathology. 40% had been in practice 20 years or more, 25% 0-4 years (residents in training). Of those out of medical school at least 5 years, 73% fly 1-5 times a year, 20% more than 5 times. 20% were sure that airlines were required to have medical supplies. 50% had no knowledge about which medical supplies were available; only 1% expressed that they were very familiar with what medications and equipment were available. 18% knew that the US has a Good Samaritan law that applies to in flight medical emergencies.

Conclusion. Community physicians have a relative lack of knowledge regarding in-flight medical emergencies. Physicians might be more effective at assisting in emergencies if they were better informed. Improvement in physician knowledge through education efforts may be worthwhile.

OP45

IN-FLIGHT MEDICAL EVENTS AND DEATHS AFFECTING CHILDREN IN COMMERCIAL AVIATION

INCIDENTS MÉDICAUX ET DÉCÈS EN VOL TOUCHANT LES ENFANTS EN AVIATION COMMERCIALE

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Introduction. The incidence of in-flight medical events (IFMEs) affecting the pediatric age range is not fully known. The purpose of this paper is to review IFMEs affecting children, with focus on injury-related episodes and deaths.

Methods. A database of 114,222 in-flight cases, reported to MedAire, from 2009 to 2013 was queried for passengers aged zero to 18 years. Cases were divided in two groups whether an in-flight injury (IFI) occurred or not (AO All other). Lap infants (LIs) were considered up to 2 years of age.

Results. 12,243 cases were found, coming from 77 different airlines. Gastrointestinal was the most frequent category representing 35.4 % of the cases, followed by infectious (20.3%), neurological (12.3%), and allergic diseases (8.6%). 351 cases (2.9%) were found to be IFIs. The median age was 2 (IFI) and 7 (AO). LIs contributed with 16% of AO and 38% of IFI cases. Most cases came from international flights (81.1%) and from flights longer than 6 hours (53.1%). IFIs were more associated with diversions (1.42% versus 0.92%), but the difference was not statistically significant. IFMEs involving LIs were significantly associated with a diversion outcome (Odds ratio: 2.8, 1.9 in lap infants. Eight cases were diverted. In 7 cases, 5 of which LIs, there was no reported pre-existing health condition.

Conclusion. Pediatric in-flight medical events are relatively infrequent given the total passenger traffic. However, in our series the actual number of cases was not negligible. Small children are prone to accidents in-flight. Sleeping with adults also carries risks on their own. The protection from using child restraints in-flight possibly extends beyond take-off and landing operations. Small children should not sit in aisle seats.

OP46

EVALUATION OF THE PHYSICAL WORKLOAD OF CABIN CREW ON LONG HAUL FLIGHT

EVALUATION DE LA CHARGE PHYSIQUE DE TRAVAIL DU PNC SUR LE LONG COURRIER

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Connaître la charge de travail des PNC en situation réelle de travail est une condition essentielle à l'élaboration de mesures préventives par le Service de Santé au Travail.

La charge physique de travail approchée par l'analyse métrologique de leur activité a été choisie comme outil méthodologique d'évaluation auprès d'un échantillon de PNC en vol long-courrier.

Cette évaluation semble être un facteur déterminant probable de la survenue des TMS (Troubles Musculo Squelettique) et fait l'objet d'hypothèse de recherche visant à définir des valeurs de références comparatives.

La volonté légitime de réduire la pénibilité de l'activité et l'incidence des accidents de travail s'adresse à l'ensemble des préventeurs de l'entreprise sous l'expertise médicale du Service de Santé au Travail.

OP47

AIR CREW AND JET-LAG

PERSONNEL NAVIGANT ET DÉCALAGE HORAIRE

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Introduction. Air crews are repeatedly exposed to jet lag. They are frequently given recommendations, but nevertheless few crew members follow them.

Methods. Here we studied more specifically the strategies which these crew members finalize during their career, with the use of questionnaires during medical examinations. 1,000 questionnaires were completed and used.

Results and Conclusions. The majority of crew members try to live according to the time in the country where they are, even for short-term stopovers. We are trying to understand how such a strategy remains bearable.

OP48

FLIGHT ATTENDANT PERCEPTIONS OF THEIR WORK ENVIRONMENT AS INFLUENCED BY CARRIER TYPE

PERCEPTIONS DES AGENTS DE BORD DE LEUR ENVIRONNEMENT DE TRAVAIL SELON LE TYPE DE TRANSPORT

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Introduction. There are a number of operational factors that contribute to flight attendant (FA) perceptions of their work environment: early departures, multiple flight legs, back of the clock operations, reduced sleep, type of aircraft flown, along with the corporate culture. Service patterns associated with the rise of regional carriers and recent mergers have also contributed. In addition, system-wide domestic load factors have increased to 82% from 2000-2010. This study was focused on the relationship between carrier type and flight attendant perceptions of their work environment.

Methods. In response to Congressional direction, CAMI scientists conducted a survey of flight attendants regarding their work background, workload and duty time, sleep, health, fatigue, work environment, and general demographics. Reliable data was gathered from 9,180 FAs. Crosstabs, ANCOVAs and regression analyses were used to assess differences between FAs from three carrier types: Low-Cost, Regional, and Network.

Results. Included in these analyses were FAs from Low-Cost (2,655), Regional (2,893), and Network (3,511) carriers. Differences between carrier types were evident in a number of areas; overall, FAs from Low-Cost and Regional Carriers were younger, they generally served on smaller aircraft (85% and 99.8% were 150 seats or less), and their flight segments were shorter (50.2% and 91.6% were 2hrs or less). While only 6.4% of the Regional FAs flew only 1-2 flight segments on average, this was true for 31.3% of Low-Cost and 68.7% of Network FAs. Even though differences in overall job satisfaction were statistically significant, from 81.4% (Network) to 84.6% (Low-Cost) of FAs agreed that they were satisfied.

Conclusions. While a majority of the comparisons were significant, there was considerable overlap in FA perceptions of their work environment and overall job satisfaction. Nonetheless, FA job satisfaction was clearly related to employee perceptions of their airline as well as their quality of life, fatigue, and body mass index (BMI).

OP49

CEREBROVASCULAR ACCIDENT IN YOUNG CABIN CREW: A REVIEW OF CASES

ACCIDENT VASCULAIRE CÉRÉBRAL CHEZ LE JEUNE PERSONNEL DE CABINE: REVUE DE CAS

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Introduction. Cerebrovascular Accident (CVA) in young cabin crew is a rare event. However, cases do occur and these cases, usually without any obvious underlying cause, require a vigorous risk assessment.

Discussion. A short series of cerebrovascular accidents in young cabin crew working for a commercial airline will be presented. The cases will be followed from diagnosis to final aeromedical disposition addressing the following questions: How common is CVA in young cabin crew? How should such cases be investigated? What is the significance of findings such as Patent Foramen Ovale (PFO) or migraine headache in this group? What factors may influence the likelihood of recurrence? As some states introduce more stringent assessments for cabin crew medical licensing it must be noted that, although there may be a higher tolerance to risk compared to the flight deck, an attempt still needs to be made to quantify this risk. The management of the cases and the approach to aeromedical disposition will be discussed. This needs to be based both upon a functional assessment and a risk assessment taking into account the likelihood of recurrence along with the potential consequences.

OP50

CAUSES OF PERMANENT MEDICAL DISQUALIFICATION IN FLIGHT ATTENDANTS OF ONE IRANIAN AIRLINE FROM 2002 TILL 2012

RAISONS DES DISQUALIFICATIONS MÉDICALES PERMANENTES CHEZ LES AGENTS DE BORD D'UNE COMPAGNIE AÉRIENNE IRANIENNE ENTRE 2002 ET 2012

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Introduction. Cabin crew members have a unique occupation. Flight attendants, more than any other group of employees, are the public face of an airline. The actual physical demands of being a flight attendant vary, and often peak for short periods, but the mean workload is usually of the order of 35 Mets average over a flight. Pronouncing cabin crew permanently unfit to fly is a difficult decision involving personal, professional, ethical, and corporate aspects. I analyzed the causes of permanent medical disqualification in cabin crew in one commercial airline in Iran for the period 2002-2012.

Methods. According to the Iran civil aviation organization, cabin crew medical assessment is categorized in class 2, and are assessed every year by airline aviation medical department.

Results. The outcomes of all flight attendant medical examinations are gathered in the archive of the Aero medical center of the airline company. A total of 132 flight attendants were permanently medically disqualified. The medical conditions most frequently responsible for grounding were low back and extremities in pain (38.1%), psychological problems (21.3%), and ENT problems (12.5%). The disqualification rate was 10.2 for every 1000 cabin crewmembers per year. More than 75% of cases were women, and they had been working with the company airline for 5 to 12 years.

Discussion & Conclusion. The annual disqualification rates found in this study were higher than those for airline pilots; the results indicate the relevance of early detection as well as clinical and occupational follow up.

OP51

HEALTHY AND OPERATIONALLY SAFE AIRPORTS: FINDING THE IDEAL PROTOCOL FOR THE VERIFICATION OF HYGIENE AND OPERATIONAL SAFETY IN IBEROAMERICAN AIRPORTS

AÉROPORTS SAINS ET SÉCURITAIRES SUR LE PLAN OPÉRATIONNEL : TROUVER LE PROTOCOLE IDÉAL POUR LA VÉRIFICATION DE L'HYGIÈNE ET LA SÉCURITÉ OPÉRATIONNELLE DANS LES AÉROPORTS IBÉRO-AMÉRICAINS

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Introduction. We have noticed significant differences between the hygienic and operational safety conditions in different airports in Latin America and consider it an important step to suggest a complete protocol to ensure the readiness of airports to handle the transmission of epidemic illnesses.

Methods. There are two aspects to be considered: The conditions of the airport facilities and the level of capability of the people working in the terminal. The protocol involves gathering the the information regarding the current routines of hygiene and operational safety, including the details the verification visits, focusing in the capability of the air terminal personnel to detect and handle transmissible illnesses, monitoring environmental hygiene, operational safety protocols, CPR and first aid competency training of personnel and interactions with the local health authority.

Results. We will put together a program called Safe and Healthy airports, containing a scheme of verification of the air terminals capabilities, including sanitary protocols to deal with infectious diseases potentially considered to be pandemic.

Conclusion. Different regions and different countries of the world will have different protocols to verify the proper functioning of an airport as far as sanitization and operational safety protocols. Putting together a common scheme will help to reassure the efficiency of those functions.

OP52

SUSPECTED MALARIA WITH NEGATIVE LAB RESULTS: TO TREAT OR NOT TO TREAT?

FORTE SUSPICION DE PALUDISME MALGRÉ UN TEST DE LABORATOIRE NÉGATIF NON CONFIRMÉ: TRAITER OU NE PAS TRAITER?

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Background. Despite improvements in prevention and treatment, Malaria still causes fatal outcomes both in regular populations and airline crew members. This presentation addresses the dilemma of treating or withholding treatment if the laboratory fails to confirm the diagnosis.

Case reports. An airline crew member, Age 38, developed fevers, prostration, severe chills and rapid deterioration of his general condition. He had traveled to Africa three (3) weeks earlier and the test for Malaria (Thick Smear) was positive. Treatment was administered and he improved markedly in a few hours. On the same day, another crew member, Age 27, developed a similar clinical picture. He had also been in Africa three (3) weeks earlier and had tested negative twice for Malaria. As his condition was rapidly deteriorating, he was treated despite negative lab results with significant resolution of fever and symptoms in a few hours. Weeks later, another crew member with history of visits to Africa presented with a clinical picture of Malaria, with quick worsening of his general condition. Laboratory testing, on timely basis, was impractical and he was treated empirically with Antipaludics anyway. His fever and symptoms disappeared in a few hours.

Interventions. Malaria testing was done by means of a blood Thick Smear. The first patient showed the parasite in his red blood cells. The second was negative twice. The treatment consisted of Melarone 1000-400 Daily x 3.

Discussion. What to do with a patient with a clinical picture and travel history suggestive of Malaria who tests negative twice and keeps getting worse, or with a patient when testing in not feasible? The answer is probably to treat anyway, as the side effects of the medication are much less serious than the outcome of untreated Malaria.

Conclusion. When strong suspicion exists of Malaria, airline crew members should be treated even without laboratory confirmation. Withholding therapy may lead to poor outcomes, including death.

OP53

ROLE OF PHYSICAL ACTIVITY IN DECOMPRESSION SICKNESS (DCS) RISK

RÔLE DE L'ACTIVITÉ PHYSIQUE COMME FACTEUR DE RISQUE DE LA MALADIE DE DÉCOMPRESSION

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Introduction. Previous research described a linear relationship between the highest 1 minute of oxygen consumption (VO₂) during a repeated physical activity and incidence of DCS during research chamber exposures to 30,000 ft (226 mmHg). This study used DCS incidence from previous exposures and prospective VO₂ data from a different group of similar subjects. To evaluate the relationship using prospective DCS data at a lower VO₂ level, a protocol was conceived and approved by a U.S. Air Force Institutional Review Board and is being accomplished at Brooks City-Base, TX.

Methods. The hypothesis states that the reduction in DCS risk with decreased VO₂ during exposure as described in the earlier paper would also be shown at a seated resting level of VO₂. The control zero-prebreathe exposures to 22,500 ft for 4 h performing ambulatory rest or simulated extravehicular activity were compared to identical exposures with the exception of activity during exposure. Seven of the 38 planned exposures have been accomplished.

Results. The preliminary results indicate agreement with the hypothesis that very low levels of DCS would be observed or reported at the lower VO₂ activity of seated rest. The zero-DCS result thus far suggests that seated resting exposures untested during exposures at or below 30,000 ft during the 3000+ subject-exposures accomplished at Brooks AFB/City-Base could be relevant to low-activity pilot exposures during high altitude cruise.

Conclusion. The data, if current results are sustained by additional human subject-exposures, may allow CV-22 and high-altitude fighter aircraft pilot aircrew to expand physiologic altitude envelopes currently restricting some operational scenarios without prebreathe. The data may allow an update to the Altitude DCS Risk Assessment Computer model due to correction of the effect and level of exercise during exposure. It may also allow development of a stochastic model based on part of the AFRL DCS Research Database information as validated by other profiles.

OP54

CHANGE OF SLEEP ARCHITECTURE OF NEW ARRIVERS AT HIGH ALTITUDE THROUGH A NEW OXYGEN DIFFUSION SYSTEM

CHANGEMENT AU NIVEAU DE LA STRUCTURE DU SOMMEIL CHEZ LES NOUVEAUX ARRIVANTS EN HAUTE ALTITUDE GRÂCE À UN NOUVEAU SYSTÈME DE DIFFUSION DE L'OXYGÈNE

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Introduction. High-altitude environments have adverse effects on sleep and recognition of people accustomed to living at low altitudes because of the change in barometric pressure. However, more and more civil aviation pilots need to stay overnight at high altitude in China. It is an important work to ensure their sleep quality and reaction ability through oxygen supply. Here we examined the change of sleep architecture of 5 new arrivers at high altitude through a new oxygen diffusion system at Lhasa, capital of the Tibetan.

Methods. Five new arrivers aged 25-50 years, who have never arrived at high altitude in 1 months were selected to travel by air

from Beijing (50m above sea level) to Lhasa (3600m above sea level). Sleep assessments were conducted from 22:00 - 6:00; all cognitive assessments were performed 20 min after awakening. The assessments were conducted for three times each in normoxic conditions (Beijing) ; hypoxia conditions(Lhasa); and oxygen enrichment conditions(Lhasa, with oxygen).

Results. The 5 subjects all manifested decreased total sleep time, increased superficial sleep and arouse; decreased deep sleep and rapid eye movement (REM) sleep, significantly decreased oxygen saturation (SO₂) and end- tidal carbon dioxide (ETCO₂) at Lhasa. Through the new oxygen diffusion supply system in the second night, with an room oxygen concentration of 26%, sleep architecture and reaction time improved significantly.

Conclusion. People who go to high altitude at the first time have obviously decreased sleep quality; and it will affect working efficiency at day time. The new oxygen diffusion supply system was proved to be safe and effective.

OP55

SUDDEN INCAPACITATION IN FLIGHT *INCAPACITÉ SOUDAINE EN VOL*

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Background. Sudden incapacitation in flight can be defined, from the medical point of view, as reduced psychophysiological fitness, which endangers the safety of air operations. Even if the psychophysiological state is suitable, the pilot may suffer an incapacitation by external factors such as inhalation of toxic gases or hypobaric decompression. When a psychophysiological examination is conducted, the aviation medical examiner and aeronautical staff will aim to verify that the pilot is healthy and will assess for the existence of any pathology that could invalidate the pilots fitness to fly to avoid incidents or accidents in flight. In commercial aviation, accidents caused by sudden incapacitation are rare, because the copilot would respond to such situation by taking command of the flight. When we refer to a pilot flying; the incidence of sudden incapacitation may be much higher, possibly resulting in injury or death. From the epidemiological point of view, and from age of 45 years in men and 48 in women, an increase in cardiovascular disease can produce sudden events, such as acute myocardial infarction; syncope; arrhythmia; severe hypertension; stroke; and neurological diseases of vascular, infectious and/or cancer, presenting with seizures, epilepsy, or absences.

Case Report. An example occurred in the year 2010, which refers to a crash where a 47-year-old died. The autopsy findings indicated the cause of death as acute myocardial infarction, occurring minutes before the aircraft collided. It is noteworthy that the stricken pilot was flying without a valid medical license (the psychophysiological examination was overdue).

Discussion. Given that coronary disease is increasingly common worldwide, the annual or semi-annual medical exam alert us regarding this disease, which prevention and treatment modalities have advanced markedly in recent decades.

OP56

SAFETY MANAGEMENT SYSTEMS: AEROMEDICAL RESEARCH TOOLS

SYSTÈMES DE GESTION DE LA SÉCURITÉ: OUTILS DE RECHERCHE AÉROMÉDICALE

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The purpose of a safety management system (SMS) in the aviation industry is to provide a systematic way to control risk and to provide assurance that those risk controls are effective. SMS is a requirement of member States posed by the International Civil Aviation Organization (ICAO). The first Federal Aviation Administration (FAA) SMS standard was delivered on June 2006 as Advisory Circular 120-92. The current US policy is described in FAA order No. 8000.369A, updated in May 2013 and managed by the FAA Office of Aviation Safety (AVS). This document describes SMS under four pillars: safety policy, risk management, assurance, and promotion a construct originated by Francis Bacon in 1609 and which evolved to Demings Plan-Do-Check-Act paradigm. The FAA Civil Aerospace Medical Institute (CAMI) has developed several research tools towards an aeromedical SMS. The presentation will discuss these tools in terms of ICAOs safety management standards and practices (SARPs). Specifically, Personnel Licensing, Recommendation No. 1.2.4.2, which states: From 18 November 2010 States should apply, as part of their State safety programme, basic safety management principles to the medical assessment process of license holders, that as a minimum include: (a) routine analysis of in-flight incapacitation events and medical findings during medical assessments to identify areas of increased medical risk; and (b) continuous re-evaluation of the medical assessment process to concentrate on identified areas of increased medical risk. Fundamental cornerstones supporting these tools are the AVS organizational infrastructure, in the form of its Quality Management System, and the recent acquisition by CAMI of high performance computing technology. The following tools will be described: (1) Aeromedical Scientific Information System, (2) Aircraft Accident Medical Review Workflow System, (3) Aerospace Accident Injury and Autopsy Data System, (4) Aeromedical Data Visualization Operational Reporting Safety System and (4) Probabilistic Risk Analysis Methodologies.

OP57

THREE CORNER'S COLLABORATION FOR ESTABLISHING A TRAINING PROGRAMME IN AVIATION MEDICINE: ACADEMY, INDUSTRY AND CIMA

COLLABORATION A TROIS NIVEAUX POUR L'ÉTABLISSEMENT D'UN PROGRAMME DE FORMATION EN MÉDECINE AÉRONAUTIQUE: L'UNIVERSITÉ, L'INDUSTRIE ET LE CIMA

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Introduction. The new Spanish Air Force Aeromedical Center (CIMA), opened activities at beginning of March 2014. This facility wants to be a reference for the field of Aviation Medicine by combining research, education and innovation. Those three key stones are directly related to the headline of this presentation with two major objectives: first to develop a joint project where classroom training, on hands aviation lab practice and full participation

in aviation research lead to a recognized syllabus, granted by the competences of the University. Secondly, to export this capability to the Spanish domestic needs and any other nations around the world, but mostly focused in Iberoamerica. This particular initiative supports AsMA proposal for an international recognition of the specialty in Aviation and Space Medicine.

Methods. Syllabus is presented with a total of 600 hours (60 Bologna credits) and divided in 3 major blocks: 300 hour classroom lessons (generic and specific training, such aviation physiopathology, physiological training, toxicology, forensic aviation and aircraft accident investigation, hyperbaric medicine, medevac, clinical aviation medicine and international aviation regulations), 200 hour aviation lab practice (Altitude Lab, SD Lab, Night Vision Lab, among others physiology Labs), and 100 hour research time participation in basic and aviation research lines established by CIMA and University. Access to this Master training will be conducted throughout the Ministry of Defense and the support of Airbus Defence & Space, in order to facilitate entry and potential grants for candidates.

Conclusion, Stream of training that combines all areas of interest, and allows the future specialist to be ready for plain aviation practice or research.

OP58

COGNITIVE PROFILE OF MEXICAN MILITARY PILOTS FLYERS NOVICE AND EXPERT AND ITS RELATION TO THE EXECUTION OF A SIMULATED FLIGHT

PROFIL COGNITIF DES PILOTES MILITAIRES MEXICAINS, NOVICES ET EXPERTS, ET SA RELATION AVEC L'EXÉCUTION D'UN VOL SIMULÉ

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Introduction. Despite the importance of the cognitive performance of military pilots to mission success, paradoxically there are few studies in middle-aged adult pilots from 30 to 45 years-of-age.

Objective. Identify the cognitive profile of Mexican military expert and novice aviators and their relation to the implementation of a simulated flight (SV).

Methods. 40 male pilots, Mexican military experts (N = 20) and novice (N = 20) 30.55 (mean) age (SD ± 7.18 years) completed the General Weschler Intelligence Scale (WAIS) and the Neuropsychological Battery CogScreen-AE. They also executed a SV Frasca 141 simulator single-seater; through faulty navigational instruments and bad weather as they performed various maneuvers.

Results. WAIS showed: improved performance in abstract reasoning processes, long-term memory, concept formation, and visual-motor coordination for all participants; CogScreen-AE: better performance in working memory processes of care and changes in all participants; reaction time (RT) for divided attention and dual tasks; SV: better performance monitoring procedures and course deviation; TR: for reporting emergencies and changing maneuvers, observing a "ceiling" effect for reporting emergencies. There were significant negative correlations between altitude and forwarding SV overall score with long-term memory, working memory and abstract reasoning WAIS. The same trend was observed with altitude deviation SV, verbal working memory, shifting attention and divided attention (dual task) of CogScreen-AE.

Conclusions. Cognitive profiles obtained were very similar. We observed better performance of experts in working memory, changes in attention, divided attention, tracking and spatial relationships. The diversion of altitude and RT for reporting emergencies were more sensitive, better correlated with WAIS and CogScreen-AE.

OP59

THE USE OF A HYPOBARIC CHAMBER TO INDUCE HYPOXIC HYPOXIA AS A CLINICAL PROVOCATIVE TEST FOR AEROMEDICAL CERTIFICATION; A CASE PRESENTATION

UTILISATION D'UNE CHAMBRE HYPOBARE EN VUE D'UN TEST CLINIQUE PRODUISANT UNE HYPOXIE HYPOXIQUE POUR UNE CERTIFICATION AÉROMÉDICALE; PRÉSENTATION D'UN CAS

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Introduction. Traditionally, hypobaric chambers are used to train aircrews to acknowledge hypoxic hypoxia and dysbarism. For the first time in our clinical aerospace medicine practice, we employed a hypobaric chamber to induce hypoxic hypoxia as a provocative test in a military pilot who underwent a cranial surgery to resect a frontal transitional meningioma.

Case presentation. We will describe a clinical history of a 41 years old MAF pilot Colonel, who had flown different aircraft, and presented two episodes of generalized clonic-tonic seizures, while performing sport and driving activities. He was hospitalized in August 1996. The laboratory findings were normal. The electro-physiological tests showed a normal ECG; his EEG was abnormal showing focal paroxystic outbreaks with acute waves in the temporal and frontal areas. An arteriography corroborated a mass in the frontal region. In 1996, he underwent a cranial surgery to resect the tumor. His postoperative recovery was satisfactory, with one complication attended adequately. In 2002, we faced a decision about his discharge from military service, therefore we decided to use our hypobaric chamber to perform a provocative hypoxic test to evaluate his capabilities to fly safely. The test altitudes were 25,000 and 29,000 ft. ASL. Satisfactorily, he could stand both tests for more than 3 minutes.

Results. We demonstrated that he was safe to fly under a very extreme hypoxic environment otherwise not found in real flight military operations. Therefore, we granted him a waiver to fly. Accordingly, he has been on duty, without reporting any symptoms while flying.

Conclusions. As we demonstrated that a provocative hypoxic test using a hypobaric chamber is useful to assess flight safety given the subject pathology, we concluded that this device is a useful tool to medically certificate this kind of patients or other patients with similar diseases where hypoxia may pose a threat to flight safety.

OP60

ALARM SYSTEM FOR PILOT FATIGUE *SYSTÈME D'ALARME POUR DÉTECTER LA FATIGUE DES PILOTES*

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Introduction. When individuals start sleeping, their brain signals change and change again when they wake up. We have invented a system that detects this change, called Physiobank. It processes brain signals and based on these signals, it may send two alerts: one is a mild electric shock delivered to the individuals earlobe and the other is the presentation of visual stimuli.

Methods. The Physiobank was used to detect electroencephalographic signals such as alpha (8-13 Hz), beta (greater than 14 Hz), and theta (4-7 Hz), where alpha-beta brain waves begin to change during the sleep phase. We used a wavelet transform to undertake the function of detecting when the alpha-beta brain signals changed to 50 microvolts, which signaled when the sleep phase commenced, and then applied associative memories with the modified Johnson Möbius code. The optimization approach utilized simple genetic algorithms, a computational search heuristic that mimics the process of natural selection. The process involved 100 generations and associated mutation, selection, and crossover processes. The alarm system was based on a surface electrode that transmitted less than 5 V/1 mA charge when the sleep condition was met. Also, a secondary stimulus was provided by an orange light emitting diode (LED).

The power to the system was supplied by a set of 8 solar cells at 0.5 V and 280 mA.

Results. The system was 95% efficient in detecting sleep. When applying genetic algorithms with fewer than 100 generations, the detection rate dropped to 80%, and when more than 100 generations were used, this rate dropped further. Therefore, the optimization process with 100 generations was shown to be the most efficient.

Conclusion. Artificial intelligence and signal processing techniques are excellent tools for the development of biomedical devices for use in aerospace operations. The Physiobank was shown to be a highly efficient device to detect sleep and wakefulness and thus can be a useful for pilots performing long-haul flights.

OP61

THE DISTRIBUTION OF REACTION TIMES AND COGNITIVE PERFORMANCE IN A COMPUTERIZED COGNITIVE ASSESSMENT BATTERY

LA DISTRIBUTION DES TEMPS DE RÉACTION ET DE LA PERFORMANCE COGNITIVE DANS UNE BATTERIE DE TESTS D'ÉVALUATION COGNITIVE INFORMATISÉE

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Introduction. Reaction times are distributed asymmetrically according to Miller as well as cognitive performance. This was assessed in 3,717 pilots with the MSG battery, which assesses the ability to solve simple arithmetic problems and execute orders as two separate goals are followed with two mouse controllers.

Method. Battery MSG was given to 3717 civil and military pilots-the total national population of the school. Asymmetry was measured using Pearson test.

Results. The results had a skewed distribution in all cases with positive asymmetry in both hands distance test. Distance left hand target, Pearson: 19.3522111, Right Hand Target Distance, Pearson: 7.26853574; Hit- calculations: -9.7915315; Omissions-calculus, Pearson: 8.45218724.

Conclusion. Cognitive performance is asymmetrically distributed showing that the values representing better performance are more expected than the average. This is because the average includes cases of aspiring pilots or pilots who are performing poorly.

OP62

FLEXIBLE HOURS AND/OR NIGHT SHIFT WORK IN INDUSTRIAL AERONAUTICAL ENVIRONMENT

TRAVAIL EN HORAIRES DÉCALÉS ET/OU DE NUIT EN MILIEU INDUSTRIEL AÉRONAUTIQUE

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Le travail en horaires décalés et/ou de nuit constitue un risque professionnel pouvant avoir un impact sur la santé, le risque d'accident du travail et la sécurité des vols. Dans un objectif de prévention, les médecins du travail de la maintenance aéronautique ont mis en place un certain nombre d'actions pour limiter ces risques. Ils ont notamment proposé à la direction, à l'occasion d'un projet majeur de transformation de l'entreprise, d'intégrer des critères médicaux dès le stade de conception des nouveaux plannings horaires. La démarche, construite en plusieurs étapes, a consisté à élaborer un outil informatique simple, basé sur dix-huit critères de protection de la santé. Il détermine pour chaque planning horaire analysé un score de conformité aux recommandations médicales. Cet outil est avéré facile à utiliser, permettant de donner un avis médical technique, argumenté, comparatif et homogène visant la préservation de la santé. De plus, il a très bien été perçu et accepté par de la direction et les partenaires sociaux.

OP63

THE DESCRIPTIVE EPIDEMIOLOGY OF MENTAL HEALTH DISORDERS IN AVIATION PERSONNEL COMPARED TO NON-AVIATION PERSONNEL IN THE US MILITARY

ÉPIDÉMIOLOGIE DESCRIPTIVE DES TROUBLES MENTAUX CHEZ LE PERSONNEL DE L'AVIATION COMPARÉ AU PERSONNEL NON-RELIÉ À L'AVIATION CHEZ LES MILITAIRES AMÉRICAINS

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Introduction. The objectives of this study are to determine the current incidence rates of mental health (MHD) among military aviators as compared to military non-aviators, aviation personnel compared to non-aviation personnel, as well as MH disorders with respect to platform type.

Methods. DMED was utilized to obtain data ranging from 2003-2012 for diagnostic codes specific for MHD in US military personnel (Army, Navy, Air Force, and Marines). DMED provided 13,938,595 person years of health data. Incidence density ratios (IDR) were calculated based on ICD-9 codes specific for MH disorders (number of events per patient years multiplied by 1000). MH ICD-9 codes included codes 300 through 312 (1,733,980 primary diagnoses and first occurrences). Fixed-Wing Fighter and Bomber Pilots (FWFBP), Other Fixed-Wing Pilots (OWFP), and

Helicopter Pilots (HP) were considered aviators for inclusion in this study constituting 339,109 PY (patient-years). The comparison group for this study included all other active duty personnel not in the inclusion group, constituting a combined 13,597,486 PY.

Results. The IDR of all MHD for non-aviators and aviators was 126.71/1,000PY and 33.52/1000PY, respectively. Incidence rate ratio (IRR) for non-aviators vs. aviators for all MHD was 3.7796, 95% CI = 3.7102-3.8513. The IDR of PTSD for all non-aviator personal was 14.36/1,000PY. Interestingly, the IDR of PTSD for HP was 2.94 compared to 0.043 for FWFBP with an IRR for HP vs. FWFBP of 6.8031, 95% CI = 4.7475-9.8467. The IDR of PTSD for Army HP was 4.03 compared to 1.19 for Navy, Air Force, and Marines HP (NAFMHP) combined. IRR for Army HP vs. NAFMHP diagnosed with PTSD was 3.3966, 95% CI = 2.5998-4.4114.

Discussion. This study suggests significant differences in MHD depending on population studied (i.e., higher IDR for PTSD in Army HP).

OP64

AUDITORY TESTING OF AERONAUTICAL TECHNICAL PERSONNEL: ERRONEOUS AEROMEDICAL CERTIFICATION FINDINGS

TEST AUDITIF DU PERSONNEL AÉRONAUTIQUE TECHNIQUE: ERRONÉES RÉSULTATS DE CERTIFICATION EN MÉDECINE AÉRONAUTIQUE

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The objective of the presentation is to gain more clarity regarding the procedures to consider in the aeromedical assessment of

aeronautical technical personnel, particularly with respect to psychophysical, ENT, and hearing requirements. The criteria to be applied during such assessments should be based on aeromedical knowledge, experience, and training, not the schematic view outlined in the regulations currently applied in Mexico.

Tonal audiometry should not be considered the ruling auditory diagnostic test. While it permits detecting a person's minimum hearing threshold, it is a subjective test that may lead to malingering of auditory behavior or condition.

There are inconsistencies in the interpretation of internationally accepted requirements established by ICAO and regulations formulated by the Mexican General Directorate of Protection and Preventive Medicine (SCT)-specifically those concerning hearing thresholds and language frequencies that may lead to personnel being erroneously found "unfit" in this regard. For example, in the audiogram, sound frequency is registered from left to right and sound intensity from top to bottom, so that, if considering that values above 20 dB are indicative of an unfit condition, the examiner would find all applicants with normal hearing as unfit.

The discussion will emphasize the importance of considering, conducting, and managing objective auditory studies, preferably interpreted by an aerospace medicine specialist. Two significant case reports will be presented, including their critical analysis, ICAO and SCT criteria, clinical history, and audio-vestibular testing, including tonal audiometry, logaudiometry, and impedance audiometry.

Currently, physicians generate certificates indicating personnel to be unfit based only on the schematic view of emblematic items and not on the knowledge, experience, and judgment offered by an aviation medicine specialist. The aeromedical findings are thus in error and therefore a limiting factor in labor relations, professional growth, and the financial development of the affected parties-the aeronautical industry and its personnel.

ICASM 2014 Scientific Agenda

Abstracts Posters

P01

A CASE OF CENTRAL SEROUS RETINOPATHY (CSR) IN AN F-15 PILOT

UNE RÉTINOPATHIE SÉRIEUSE CENTRALE CHEZ UN PILOTE DE F-15

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Introduction. We report the case of an F-15 pilot who developed CSR in his right eye.

Case Report. A 30 year old F-15 instructor pilot with over 1000 hrs on type noticed sudden distortion of vision in his right eye. The ground seemed to be sloping and objects appeared to have changed shape when viewed through the right eye (metamorphopsia). Symptoms resolved spontaneously after two days. Six months later he experienced similar symptoms in the same eye. This episode lasted longer and was associated with a central scotoma. Ocular coherence tomography (OCT) confirmed a diagnosis of central serous retinopathy in the right eye. He was temporarily grounded and his symptoms resolved completely over the following two months. Extensive tests showed that recovery was complete.

Discussion. CSR is a condition that occurs in the 20-50 year age group and is associated with accumulation of serous fluid under

the retina, causing a distortion of the image. Risk factors are known to be stress and steroid use; this pilot denied both. The condition is usually self-limiting with a good prognosis but in some individuals can follow a more aggressive course. Recurrence is common and repeated attacks can result in a degree of permanent damage. Aero-medical decision-making in this case had to take into account the chance of a further recurrence, given his status as an instructor pilot.

P02

EFFECTS OF VIBRATION ON THE URINARY TRACT IN MILITARY HELICOPTER AVIATORS

LES EFFETS DE LA VIBRATION SUR L'APPAREIL URINAIRE CHEZ LES MILITAIRES PILOTES D'HÉLICOPTÈRES

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Introduction. Eight major classic stresses influencing aircrew health include: hypoxia, thermal stress, radiation, fatigue, vibration, noise, air pressure changes, acceleration and gravitational factors. Continued exposure to whole-body vibration, considered to have high potential for producing bodily damage and increasing complications such as abdominal cramping and disorders of the solid organs (such as kidneys). This study set out to determine the incidence of hematuria and proteinuria before and after air duty, and the influence of vibration on renal function in pilots.

Methods. Thirty aviators served as subjects. Urine samples were collected pre-flight, post-flight and 8 hours later. Macroscopic and microscopic evaluation was performed for screening hematuria and proteinuria.

Results. In none of three samples taken was microscopic hematuria seen. Although the number of red blood cells per high-power field was changed between pre- and post-flight urine samples, this was not significant. The most striking result to emerge from the data is that in comparison between pre- and post-flight urine samples, the number of white blood cells per high-power field was significantly changed; mucus measured in the urine before and 8-hours after flight was significantly different with a significant difference in proteinuria. It is also worth mentioning that vibration was determined to be 11-14/2 m/s² in different parts of helicopters. The findings from this study make several contributions to the current literature.

Conclusion. The data would seem to suggest that the mechanical stresses imposed on the body during vibration exposure can potentially lead to interference with bodily functions and tissue damage, depending on the frequency range and exposure conditions. This is an important issue for future research.

P03

LOW BACK PAIN IN PILOTS AND MAINTENANCE TECHNICIANS IN A COLOMBIAN COMMERCIAL AIRLINE

DÉCRIRE LA DOULEUR LOMBAIRE CHEZ LES PILOTES ET LES TECHNICIENS DE LA MAINTENANCE DANS UNE COMPAGNIE D'AVIATION COMMERCIALE COLOMBIENNE

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Introduction. Lower back pain is the most common complaint worldwide and the leading cause of disability in the workplace.

Lower back pain has high prevalence in aviation; however, in Colombia there are no epidemiological data on low back pain in aviation.

Objective. Characterize low back pain in pilots and maintenance technicians in a Colombian commercial airline.

Methods. Information was collected from the total population of pilots and maintenance technicians in a Colombian commercial airline, in Bogotá, during the period from 2011 to 2013, using a voluntary survey in which we inquired on demographics, occupational (survey LEST) factors, back pain and chronic pain (grade scale similar chronic pain).

Results. The prevalence rate of LBP in respondents was 71%, and the factors associated previously have belonged to the military forces occupational exposure to physical load and work time. Chronic low back pain had a prevalence of 49%. The prevalence of LBP in maintenance technicians was 65%. Associated factors were formerly belonging to military forces and mental workload. Chronic pain has a prevalence of 65%. Factors associated with chronic low back pain are the technicians' time in office and physical load.

Conclusion. The prevalence of low back pain in these Colombian pilots is similar to reported prevalence in the world airline population. Maintenance technicians have a higher prevalence than other similar groups, but very similar to those presented in different business industries, including the transport sector.

P04

ONE HEALTH TRANSDISCIPLINARY EDUCATION UN ENSEIGNEMENT TRANSDISCIPLINAIRE EN SANTÉ

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Introduction. One Health is a concept described by Onehealthinitiative.org and underscores a complex systems approach to understanding opportunities for prevention and mitigation of emerging infectious diseases, translational medicine and effective strategies in humanitarian and disaster response. New transdisciplinary educational approaches are essential to effective clinical practice.

Methods. The authors will describe a trans disciplinary methodology employing an experiential problem based learning (PBL) platform. The components, metrics for success, and a real-world emerging infectious disease problem will be described.

Results. a template was developed and validated using a representative interdisciplinary student sample.

Conclusions. One Health strategies are essential to public health and prevention strategies to disease re-emergence. An effective educational methodology involves experiential, problem-based learning.

P05

SLEEP-RELATED BREATHING DISORDERS CAUSING EXCESSIVE DAYTIME DROWSINESS

SOMNOLENCE DIURNE EXCESSIVE EN RAISON DE PROBLÈMES RESPIRATOIRES DU SOMMEIL

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Introduction. People with obstructive sleep apnea syndrome frequently wake up during the night, are chronically sleepy and

inordinately tired during the day, aggravating the risk of causing a traffic accident. If the disorder is not treated soon enough, the patient is at an increased risk of brain stroke or myocardial infarction; significant decrease of cognitive abilities is also possible. As many as 20% of drivers report to have fallen asleep at the wheel in the previous two years. Main risk factors for drowsiness at the wheel are maleness, frequent driving, excessive daytime drowsiness and increased risk for sleep apnea. 7% of those who had fallen asleep at the wheel had already been involved in a traffic accident in the previous two years.

Methods. We used an adapted Epworth Questionnaire to survey pilots, flight attendants and other unlicensed employees of the Slovenian air carrier to detect individuals with increased daytime drowsiness and direct them to further diagnostics and treatment and to re-evaluate their ability to drive a vehicle.

Results. 24 percent of all respondents (23.5% of pilots) report audible snoring during the night, 5 percent of all respondents (2.9% of pilots) have already been told that they sometimes stop breathing when they sleep, and as many as 8 percent of all respondents (5.9% of pilots) have been involved in a traffic accident due to drowsiness in the past few years. Statistically significant divergence was also found for drowsiness during mid-day rest, when 48 percent of respondents would be likely to fall asleep; in this case the percentage among pilots is significantly higher (53%) than in the general population.

Conclusion. As we had no data regarding drowsiness, we used the questionnaire primarily to check for differences between pilots and other personnel, which we could then use as basis for the implementation of the adapted questionnaire alongside other risk factors (body mass index, blood pressure, neck circumference) for evaluations for commercial flying.

P06

EFFECTS OF MICROGRAVITY ON MUSCULOSKELETAL PHYSIOLOGY

EFFETS DE LA MICROGRAVITÉ SUR LA PHYSIOLOGIE MUSCULOSQUELETTIQUE

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Introduction. The human body is an amazing machine that has adapted itself well to gravity and the surrounding environment on Earth, enabling it to function at optimum capacity under such conditions. Short and long-term exposure to microgravity can lead to some adverse responses from a physiological and cellular metabolic standpoint, which can have serious medical implications on the physical and mental health of humans while living in space and during the return to earth.

Background. Astronauts exposure to microgravity results in a headward shift of bodily fluids and the removal of weight from otherwise weight-bearing bones. These effects can result in significant changes to the cardiovascular system as well as muscle atrophy in antigravity muscles, which can ultimately increase the risk of fractures, premature osteoporosis, back pain and injuries to soft tissues both during and after the flight. Exercise is an important countermeasure to reduce the rate of deterioration in the musculoskeletal system; however, significant physiological decline still occurs.

Discussion & Conclusion. This paper reviews the physiological changes in the human musculoskeletal system that are asso-

ciated with exposure to a microgravity environment and outlines practical countermeasures that can help mitigate such effects for short and long-term space flights.

P07

INCREASED SERUM TOTAL ANTIOXIDANT CAPACITY IN PILOTS

AUGMENTATION DE LA CAPACITÉ ANTIOXYDANTE TOTALE CHEZ LES PILOTES

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Background. Pilots are exposed to several types of stress. Biological or mental stress significantly increases oxidative stress markers. The aim of this study was to compare mean serum Total Antioxidant Capacity (TAC) between pilots and non-flight staff of the army force.

Methods. This study was a descriptive analytical cross-sectional study. 45 pilots and 45 non-flight staffs were randomly selected. Serum TAC level were measured using spectrophotometry method.

Results. The mean serum TAC was significantly higher in pilots than the non-flight staff (4.54 ± 0.37 vs. 3.4 ± 0.62 [g/dL Alb]).

Discussion. The results of the present study suggest that pilots have higher levels of blood antioxidant as compared to the non-flight staff. The reason is that pilots are exposed to different stressors that result in a compensatory increase in antioxidant enzymes.

P08

PREVALENCE OF TRAUMATIC AERONEUROSES IN MEXICAN NAVAL MILITARY PILOTS SECONDARY TO MILITARY HIGH IMPACT OPERATIONS

PRÉVALENCE DES AÉRONÉVROSES TRAUMATIQUES CHEZ LES PILOTES DE LA MARINE MEXICAINE SECONDAIRES À DES OPERATIONS MILITAIRES À FORT IMPACT

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Introduction. Traumatic Aeroneurosis (AT) is a psychological-psychiatric syndrome associated with operational fatigue that produces fear of flying, suddenly misfit military pilots, affecting their emotional stability and operational performance. Its incidence is mainly observed during armed confrontations, causing temporary and permanent low. There are currently no reliable information on the prevalence of this disorder.

Objective. Identify the prevalence of AT in a group of naval pilots of the Navy Secretariat (SEMAR) who participated in Operation High Impact (OAI).

Methodology. 21 pilots (SEMAR) who participated in OAI answered the survey via internet personal/business data; fatigue scale; questionnaire designed from the diagnostic criteria for PTSD Posttraumatic Stress Disorder DSM-IV; level of physical and psychological symptoms of acute stress. Integrating analysis 4 groups: flight experience, seniority SEMAR, frequency of participation in OAI and exposure time.

Results. The overall prevalence of AT was 23.7%, with the trend to low flying experience higher prevalence of AT, except for groups with low and high experience (zero cases), in all groups greater psychological symptoms were observed respect of the physicists. A positive relationship between physical and psychological symptoms with fatigue level found was appreciated. Only 3 patients deserved individual attention by specialized cognitive desensitization therapy, imagery and progressive relaxation.

Conclusions. The prevalence of AT is very similar to that reported for PTSD in other populations previously analyzed. It is observed that fatigue is a risk factor for the genesis of the AT. Experience and age may be protective factors and family stability. It is suggested to continue the research to design prevention programs and administration of the human factor during these operations.

P09

P300 COMPARISON AS A WORKING MEMORY (MT), TWO CONTINUOUS PERFORMANCE TASKS (TEC) AND N-BACK IN MEXICAN MILITARY PILOTS FLYERS

COMPARAISON P300 COMME MÉMOIRE DE TRAVAIL (MT), DEUX TACHES DE PERFORMANCE CONTINUE (TEC) ET N-RETOUR CHEZ LES PILOTES MILITAIRES MEXICAINS

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Introduction. Situational Awareness (SA) by military aviators pilots depends on the capacity of their working memory (WM); this failure may affect the results of air missions, being transcendental evaluation. The Continuous Performance Task (CPT) was evaluated for behavioral and electrophysiological assessments, producing a clear electrophysiological P300-component associated with the update of the information in the WM.

Objective. To compare the characteristics of P300 produced by n-Back and CPT, in a sample of Mexican military aviators pilots (PAMM), to assess the demands of attentional resources and WM each.

Methods. 10 male PAMM, healthy volunteers and executed the CPT and n-back to produce P300, using the oddball paradigm. CPT consisted of stimuli: aircraft detection and warning stimulus white distracting stimulus randomly mixed with a 30/70 ratio, respectively, oriented in four positions shown by 100 ms, with inter-stimulus interval of 1.3-2.5 s. Subject was asked to respond with a key when the «white» was preceded by a warning stimulus and with another key in any other case. Earlier, memorized for 15 seconds to 6 monitors simulated navigation instruments.

Results. It was observed that P300 effect (greater amplitude response over the distractor white) was clearer than in n-CPT back reflecting less available resources for the latter. P300 latency was larger n-back, which may indicate greater effort in finding information on the WM.; however, recovery was observed in 2-back accuracy, which could indicate the use of some type of cognitive strategy by the subjects at the novelty of this condition.

Conclusions. The n-back requires more effort in implementation compared to CPT, which produces a lighter n-back P300 effect. The results will be used to compare the capacity of WM in different populations of pilots.

P10

POST BIRD STRIKE EJECTION CASE

UN SUIVI APRÈS UNE ÉJECTION EN RAISON D'UNE COLLISION AVEC UN OISEAU

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Introduction. We report the case of a bird strike that shattered the canopy of a fighter aircraft, followed by ejection. Bird strikes are a significant threat to flight safety and have caused a number of accidents with human casualties.

Case Report. A young male WSO ejected from a fighter aircraft at high speed, low altitude after a bird strike shattered the canopy. The pilot didn't eject and managed to return the damaged aircraft to base. At the hospital the WSO presented with loss of consciousness (unknown duration), amnesia, headache, shoulder and neck pain. He was admitted to the hospital where a CXR and a CT of the brain and neck were done. The CT showed suspicion of intracranial bleeding and was held for observation. After stabilization he was discharged. He later returned to the flight surgeon complaining of left shoulder pain with stiffness, headaches, disturbed sleep and anxiety. He was referred to orthopedics, psychiatry and neurosurgery. Medical investigations were completed, the clinical reports showed that he had a left scapula fracture, chronic headaches and post-traumatic flying phobia. The aeromedical decision was unfit for all flying duties.

Discussion. Bird-aircraft collisions pose a major threat to aviation safety worldwide. Egress from fighter aircraft by ejection seat can lead to serious injuries. The WSO in this case ejected after the bird strike at high speed, low altitude. According to him, he suffered loss of consciousness of uncertain duration with amnesia. As complications of the ejection, he had a left scapula fracture, residual chronic headaches and post-traumatic flying phobia. He was unmotivated to make any effort to return to flying. The medical board recommended that he is unfit for all flying duties.

P11

TURBULENCE-RELATED INJURIES IN CABIN CREW OF ONE IRANIAN AIRLINE FROM 2003 TO 2013

BLESSURES RELIÉES À LA TURBULENCE CHEZ LES AGENTS DE BORD D'UN COMPAGNIE AÉRIENNE IRANIENNE DE 2003 À 2013

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Background. Cabin crew members have a unique occupation. The work typically undertaken by the flight attendant includes: public relations, supervision and management, food handling and waiting, emergency evacuation, and baggage stowage. The purpose of this study was to determine the occupational health hazards of flight attendants from 2003 to 2013.

Methods. The Airline Medical Department records were searched for the period 1 January 2003 through 31 December 2013 for all records involving in Airline Medical department air carrier turbulence-related injuries. Examples of turbulence-related

flight attendant injuries were classified by: phase of flight, injury severity, status of the seat belt sign, season and year of occurrence, prevailing meteorological conditions, aircraft type, air carrier, type of injury, and location in the aircraft where the injury occurred.

Results. From 129 cases, 102 cases were women and 27 cases were men. The most injuries were in lower limb and lumbar region, and 61 (46.8%) involved serious injuries, while 68 (51.2%) involved minor injuries.

Discussion and Conclusion. Accidental injury is certainly the most common and most serious occupational hazard to flight attendants. A major cause of flight attendants injuries is from aircraft entering an area of sudden turbulence. Flight attendants are unlikely to be seated during unexpected turbulence, when the fasten seat belts signs are not illuminated. The most frequent turbulence-related injuries were physical, biological, and psychological.

P12

TILT-TEST AS +GZ TOLERANCE ASSESSMENT METHOD

TEST D'INCLINAISON (TILT-TEST) COMME MÉTHODE D'ÉVALUATION DE LA TOLÉRANCE AUX +GZ

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Background. G tolerance assessment is an essential element of both military pilot and pilot candidate evaluation. Loss of consciousness resulting from acceleration stress has been described as an exaggerated case of orthostatic stress at these aviators, who haven't anti-G suits during centrifuge examination. Head up tilt-test (HUT) is a fundamental test in diagnosis syncope episodes caused by aberrant cardiovascular reflexes for orthostasis in clinical practice. With assumption that during centrifuge examination and tilt-test pilots body is under the influence of the same stimulus the goal of this study was set to establish whether tilt-test results can predict individual G tolerance.

AIMS. Attempt at prediction of individual relaxed + Gz tolerance on the basis of HUT testing.

Settings and design. In two stages, 20 healthy men at the mean age 21.5 years took part in this study. The first stage, a 45 min, HUT test was performed using the Westminster protocol. During the second stage each underwent a centrifuge evaluation in response to gradual onset rate profiles.

Methods and Materials: In each subject, heart rate (HR) and blood pressure (BP) before and at 2, 15 and 45 min of the tilt-test were recorded. The gravity-load centrifuge (GOR) studies were carried out. Relationships between variables were explored using Kendall's tau-B correlation coefficient. TI P-level was one-tailed 0.05.

Results. In four of 20 subjects (20%), vasovagal syncope occurred during the tilt test. G-level tolerance of this G-level tolerance of this group (of +Gz accelerations) lay in the range from +4 to +8.1 Gz, (+5.72 ± 0.86 Gz average) and was comparable to the group without syncope. Loss of consciousness did not occur in any subjects during the centrifuge test. No statistically significant correlation was observed between HR and BP during tilt test and tolerance to +Gz accelerations.

Conclusions. The result of tilt testing, carried out according to the Westminster protocol, was not predictive of +Gz tolerance.

P13

RAPID DECOMPRESSION FROM 3 000 TO 7 000 M.A.S.L. IN 2 SEC - ALTITUDE DCS PROPHYLAXIS ASSESSMENT *DÉCOMPRESSION RAPIDE DE 3000 À 7000 MÈTRES A.S.L. EN 2 SECONDES - ÉVALUATION DE LA PROPHYLAXIE DE LA MALADIE DE DÉCOMPRESSION À ALTITUDE*

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Introduction. One of the tasks during Polish military aircraft's staff training is to familiarize the crew with the physical effects occurring during inflight rapid decompression. For this purpose trainees are subjected to exposure of barometric pressure change from 3000 m a.s.l. to the barometric pressure at 7000 m a.s.l. during 2 sec. Such decompression is preceded by 30 minutes prebreathing of 100% oxygen in order to reduce the risk of DCS. The aim of this study was to evaluate the effectiveness of prebreathing of pure oxygen in the prevention of altitude DCS.

Methods. Nineteen healthy male volunteers (fit to fly, age 26 - 49) with no previous DCS, who were not exposed to elevated nor to reduced pressure within the previous 24 hours, underwent a 30 minute uninterrupted prebreathing of pure oxygen prior to exposure to rapid decompression (from 3000 to 7000 m a.s.l. in 2 sec). After a single exposure the subjects underwent echocardiography (2D) examination to detect decompression induced vascular precordial microbubbles at rest. The grade of microbubbles was assessed using Spencer scale. Main medical, biometric and social data was collected from all subjects.

Results. In all of the 19 subjects no bubbles count differences were observed. All measurements were classified as grade 0 of Spencer scale. This corresponded with clinical state of examined, were no musculoskeletal, cutaneous or cardiopulmonary manifestations were reported.

Conclusion. 30 minutes uninterrupted prebreathing of pure oxygen in the rapid decompression training for Polish AF crew seems to be sufficient in the DCS prophylactics, assessed with the number of microbubbles in right atrium and right ventricle. In such training echocardiography rating correlate with the clinical condition of patients.

P14

OXYGEN THERAPY AFTER HIGH ALTITUDE CHAMBER TRAINING IN POLISH AIR FORCES

OXYGÉNOTHÉRAPIE APRÈS UNE FORMATION EN CHAMBRE HYPOBARE DANS L'ARMÉE DE L'AIR POLONAISE

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Introduction. The aim of this study was to establish an appropriate way of proceeding after DCS during high altitude training in Polish Air Force and Special Forces parachutists. The final result should be the manual instruction for high altitude training in Polish Air Force Institute of Aviation Medicine (PAFIAM).

Methods. 9 males took part in this study. All of them were volunteers, healthy (fit for fly by Polish AF Aeromedical Board)

aging from 24 to 42 years old. Subjects performed high altitude training in PAFIAMs low pressure chambers. After each flight echocardiography was performed in all subjects. Spencer Grading Scale for venous gas embolism (VGE) was used. Each male with I or higher VGE grade was subjected to 1 hour with 100% of oxygen breathing and echocardiography afterwards. In case of VGE persistence US Navy Oxygen Treatment Table 6 was deployed.

Results. No DCS symptoms were found. After low pressure expositions 6 cases of I grade and 3 cases of II grade were reported. In echocardiography examination just after 1 hour with 100% oxygen breathing 2 cases of I grade were recorded. Both of them were found in subjects with II grade VGE after low pressure exposure. Navy Oxygen Treatment Table 6 was used in both cases. We found no bubbles after HBO therapy during echocardiography examination in those subjects.

Conclusions. 30 min of 100% oxygen prebreathing seems to be sufficient countermeasure to avoid DCS symptoms in high altitude training in Polish AF. Due to nitrogen bubbles influence on human health, especially after repeated high altitude expositions, it is suggested to perform echocardiography after every high altitude training exposure. 1 hour of 100% oxygen breathing in I or II VGE grade seems to be a sufficient way to reduce VGE at least by one grade. In case of persisting bubbles after 1 hour of oxygen breathing, HBO therapy may be considered.

P15

ECHOCARDIOGRAPHY BUBBLES DETECTION AFTER HIGH ALTITUDE CHAMBER TRAINING FOR POLISH AIR FORCE

DÉTECTION DE BULLES PAR ÉCHOCARDIOGRAPHIE APRÈS UNE FORMATION EN CHAMBRE HYPOBARE DANS L'ARMÉE DE L'AIR POLONAISE

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Introduction. Altitude decompression illness (DCI) is generally considered to be a risk at altitudes in excess of about 5500m asl. Polish AF aircrew during aeromedical training are routinely exposed to high altitudes in profiles 7,500m or 10,000m asl. Prebreathing 30 minutes 100% oxygen at ground level prior to hypobaric exposition should provide effective prevention against development of DCI. The aim of this study was to establish how effective is this type of prevention. To evaluate the risk of development DCI symptoms after altitude expositions echocardiography bubbles detection method was used.

Methods. Forty-five healthy male subjects were exposed in the present study (volunteers, fit to fly, aged 24-49). 30 subjects performed high altitude training in a low pressure chamber at 7500m asl. and 15 subject at 10000m asl. The day before an exposure at 7500m asl. a 19 subjects were exposed on rapid decompression from 3000 to 7000m asl. in 2 sec. We collected main medical, biometric and social information of all respondents. After each flight echocardiography (2D) was performed in all subjects. Spencer Grading Scale for venous gas embolism was used.

Results. There were no clinical symptoms of DCI in all cases. Spencer scale grades I were present in 3 cases and one case of II grade after flight at 7,500m asl. In this 4 cases, all of them were a day after exposition on rapid decompression. 3 cases of I and 2 cases of II grade were found after 10,000m asl. exposure.

Conclusions. 30 min of 100% oxygen denitrogenation seems to be sufficient countermeasure to avoid DCI symptoms in training at 7,500m asl. However is this important to avoid repeated expositions on high altitude in 24 hours. Regarding to training at 10,000m asl. with more than 33% subjects with detected bubbles, a longer time than 30 min prebreathing has to be considered.

P16

THE LF/HF RATIO AS AN INDICATOR FOR ESTIMATING DIFFICULTY LEVEL OF FLIGHT TASKS: PRELIMINARY RESULTS OF THE HRV ANALYSIS OF DATA GATHERED IN-FLIGHT

LE RATIO BF/HF COMME INDICATEUR POUR ESTIMER LES NIVEAUX DE DIFFICULTÉ DES TÂCHES DE VOL: RÉSULTATS PRÉLIMINAIRES DE L'ANALYSE DES DONNÉES CUEILLIES EN VOL SUR LA VARIABILITÉ DE LA FRÉQUENCE CARDIAQUE

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Introduction. An increase in cognitive load induced by a specific task contributes to the decrease in the heart rate variability (HRV) indices, even if the heart rate (HR) itself is subjected to minor changes. The main aim of the study was to differentiate the size of a pilots HRV when performing assisted and unassisted flights, as well as simple and complex flight tasks.

Methods. The study involved 59 cadets of the Air Force Military Academy, Deblin, Poland, during their flights around the circle, flights to the zone, and during the zone maneuvers performed under the Basic Aviation Training Program within the period 2010-2013. Cardiac monitoring in pilots during flights realized by them was carried out using a compact, mobile ECG recorder. A frequency analysis of the HR signal was performed to determine the ratio of low-frequency spectral power (LF) to high-frequency spectral power (HF).

Results. A significant increase of more than 16% in the LF/HF ratio during the flight in relation to its value before the flight was observed. After the flight, the LF/HF value reduced, even below the level recorded before the flight (decrease of over 9%). The average values for the LF/HF ratio were higher for the unassisted training flights in comparison with those obtained for the flights with an instructor. Greater psychophysiological load of a pilot was also observed in flights to the zone when compared to simple flights around the circle.

Conclusion. The HRV LF/HF is a good indicator of a pilots physical and mental load, depending on the phase, type and level of difficulty of the flight tasks performed. Hence, this allows us to predict the risk of excessive arousal and stress of a pilot during a flight.

P17

PREVALENCE OF MUSCULOSKELETAL DISORDERS IN A PERSONAL LEVEL LUMBOSACRAL MILITARY PARACHUTISTS

PRÉVALENCE DES TROUBLES MUSCULOSKELETTIQUES LOMBOSACRÉS CHEZ LES PARACHUTISTES MILITAIRES

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Introduction. Musculoskeletal lumbosacral disorders are some of the most common disorders in the general population and are a common cause of consultation at different levels of care. While these changes are asymptomatic in most cases, during adulthood and coupled with arduous operations could determine the onset of low back pain. This disorder ranks as the most frequent complaint of musculoskeletal disease at any age and social strata of the population. It is noted that 80% of people at some point have had low back pain throughout his life. Objective. Identify the prevalence of musculo-skeletal among military personnel parachute alterations.

Methodology. Field study, transversal and descriptive that included a statistically representative sample (CI = 95%) of 120

paratroopers, to which we applied a survey on back pain, radiographic lumbar spine (anteroposterior, lateral, and oblique views were obtained lumbosacral) column. The interpretation of the radiographs was performed by two medical specialists (radiologist and aerospace).

Results. We found that 76 (63%) of the paratroopers were healthy and 44 (37%) had a musculo- skeletal disorder. Paratroopers with alterations, 14 had more than one musculo- skeletal disorder. The main musculoskeletal disorders scoliosis were 31% (n = 18), lower limb shortening 19% (n = 11), rotoescoliosis 17% (n = 10), spina bifida occulta 12% (n = 7) and sacral lumbarization 7% (n = 4).

Conclusions. The prevalence of patients with musculoskeletal disorders in the study group was 37%. It is recommended that basic radiological studies of lumbosacral spine in aspiring military paratroopers at the time of selection, in order to make a more objective assessment of such personnel.

