



Oral Abstracts

OR01

English: **THE UAS EVOLUTION FROM PAST TO FUTURE - IN THE EYES OF AN OPERATOR**

French: **L'ÉVOLUTION UAS DU PASSÉ AU FUTUR - SELON UN OPÉRATEUR**

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UAS (Unmanned Aerial Systems), previously known as RPVs (Remotely Piloted Vehicles) and lately coming back as RPAs (Remotely Piloted Aircraft), were initially designed to overcome limitations of manned airborne systems but also to support the increasing surge of operational requirements.

Today UAS perform more flight hours than manned Systems. While in the past most UAS operators were certified pilots, today more and more of them are non-pilots. Advanced UAS capabilities such as long endurance, low risk for mission crew, interconnection with all available sensors as well as multilayer C4I, require enhanced team interaction like never before.

UAS interconnection with both the front and the back lines is now one big battlefield, and this will dramatically change not just the tactics but also the strategic vision of present and future conflicts in all levels of intensity.

The evolution in the Technology, automation and autonomy in the UAS will be presented. Why is this happening? How will UAS be handled to provide maximum efficiency of both Operator and System? This and more will be addressed. Emphasis will be given to the human factors.

OR02

English: **CURRENT TECHNOLOGIES IN UAV SYSTEMS**

French: **TECHNOLOGIES À JOUR POUR LES SYSTÈMES D'AÉRONEFS TÉLÉPILOTÉS**

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The overall design philosophy of UAV Systems is to enable the operators to focus their attention on the operational mission without the need to continuously monitor (and control) the air vehicle.

This philosophy requires the air vehicle to be highly autonomous and able to automatically respond to failures and emergency conditions.

The UAV design features highly efficient aerodynamics, composite structure, and a high level of system redundancy. Its high maximum to empty weight ratio enables high mission effectiveness, supporting various payloads, with long endurance and a small logistic footprint.

The Ground Control Station (GCS) has been designed and developed complying with Human Factors Engineering standards to support the entire mission phases includes Mission Planning, Pre-flight checks, Transit, Take-off, Landing, Flight and Mission monitoring and control of the UAV, monitoring and control of payloads and systems , as well as post-mission debriefing.

The GCS Man Machine Interface (MMI) has much in common with modern airliner cockpit layout, as it was designed according to the same concepts and methods of implementation. Thus the impact of customization to further reflect such a layout would be minimal, and could be readily accomplished due to the modularity of the design.

OR03

English: **OPERATIONAL ASPECTS OF UAS OPERATIONS**

French: **ASPECTS OPÉRATIONNELS DES OPÉRATIONS DE SYSTÈMES D'AÉRONEFS TÉLÉPILOTÉS**

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The Israeli air force has over 40 years of operational experience with UAS missions. The presentation will describe some of the operational issues based upon this experience, with special focus on the "human" behind the UAS sources and routines.

A special focus will be stress, fatigue and erosion related issues.

OR04

English: **THE HUMAN FACTORS IN OPERATING UAS**

French: **LES FACTEURS HUMAINS DANS L'OPÉRATION D'UAS**

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The introduction of UAS into the battlefield has changed the philosophy and the tasks of the "Pilot" UAS Operator.

With a growing complexity of missions and a dynamic environment, the Pilots need to adapt to many changing factors such as the size of the mission crew, the duration of the mission, the density of the airspace, more and more complicated payloads on-board and also a growing demand for coordination with different data consumers.

While in the cockpit a pilot perceives the environment and the platform directly through his senses, the UAS operator perception has no direct feedback and must rely on onboard sensors and telemetry in order to understand what is going on somewhere far away.

These "unseen threats" create new challenges for human operators such as Remote Situational Understanding, ability to concentrate even during long and dull missions and ability to react quickly and correctly to any combat or emergency situation.

The levels of automation of modern UAVs, as well as their sophisticated logic, add new dimensions of complexity to the human operator who must be able to predict the behavior of the aircraft in different modes of routine and emergency operation. Therefore there is a growing need to involve experienced operators in the design of the system and its autonomous logic.

The lecture will present the approach and solutions to enhance the human ability to cope with these evolving challenges.

OR05

English: **SENSORY INFORMATION, AUTOMATION, AND PILOTING EXPERIENCE ON UAS OPERATOR PERFORMANCE**

French: **LES INFORMATIONS SENSORIELLES, L'AUTOMATISATION ET L'EXPÉRIENCE EN PILOTAGE SUR LA PERFORMANCE D'OPÉRATEUR UAS (SYSTÈME D'AÉRONEF SANS PILOTE)**

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Introduction: A pilot's ability to respond to UAS system failures is influenced by the sensory information available, the type and level of automation employed, and the control-interface requirements on the pilot. This study analyzed the effect of sensory information on pilot reactions to system failures within a UAS control station simulation, the level of automation used in controlling the aircraft, and the level of manned flight experience of the participants. Methods: 32 participants. 16 had flown as pilot-in-command of a manned aircraft and held at least a private pilot certificate. Minimum manned flight time experience was 73 hours and maximum 3,000 hours. 16 had no flight experience. A UAS simulation was created using Microsoft Flight Simulator 2004© (MFS04) as the flight model. A separate UAS pilot control station was developed using Flight Simulator Universal Inter-Process Communication software package. There were 3 potential control schemes: manual, vector, and waypoint. There were 4 types of potential inflight failures: loss of data link, altitude control, heading control, and engine. This study only included heading control failure and engine failure. Each failure included a visual warning and a sound alarm. Three independent variables were manipulated: 1) Visual information only vs. sound-visual combined, 2) Waypoint control vs. vector control, 3) Pilots vs. non-pilots. For each failure the proper response was to press a recovery button. Measured response to system failures, ability to monitor traffic, flight control accuracy, awareness of relative position, subjective workload estimates, and display interaction level were analyzed.

Results: Sound improved response to engine failures but not heading control failures. Pilots demonstrated superior response to heading control failures in the no sound condition. No differences in ability to monitor traffic or in ability to estimate relative position. Pilots had significantly lower flight technical error than non-pilots. Pilots showed significantly higher control interface interaction than non-pilots (vector control mode only). Workload estimates were affected by level of automation.

OR06

English: **SAFE RIDE STANDARDS FOR CASUALTY EVACUATION USING UNMANNED AERIAL VEHICLES**

French: **NORMES DE TRANSPORT SANS DANGER POUR L'ÉVACUATION DES BLESSÉS PAR VÉHICULES AÉRIENS SANS PILOTE**

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Introduction: Aerial evacuation has become the 'gold standard' of all evacuation mechanisms. Flight parameters of conventional aircraft are controlled by on-board pilots. There are no internationally recognized physiological standard for casualties which can be used in the development of flight profiles for UAVs. Logistics-capable UAVs capable of carrying casualties will be present on the battlefield within the short to medium-term. These UAVs could be used for casualty extraction/evacuation on 'back-haul' after the UAV has delivered their cargo. The NATO Task Group HFM-184 (2009 – 2012) investigated the possibility and acceptability using Unmanned Aerial Vehicles (UAVs) for the transportation of casualties.

Methods: In order to determine the safe ride standards for casualty evacuation, all aspects of UAVs were examined. The current state of UAV development, NATO doctrine and policy, legal, ethical, regulatory as well as clinical aspects were examined. Possible scenarios were developed. A human systems integration analysis was subsequently conducted.

Results: UAVs are likely to be used for casualty movement soon after their appearance on the battlefield, with or without doctrinal guidance. Changes and additions to NATO doctrine was recommended. Continued research to develop evidence-based safety-of-flight recommendations is needed. The HSI analysis confirmed the work already undertaken.

Analysis: The potential use for UAVs for casualty evacuation is ethically, legally, clinically and operationally permissible, so long as the relative risk for the casualty is not increased through the use of the UAV. Presently, the use of UAVs for medical evacuation is not technologically possible or acceptable at this time, however may be in the medium to distant future.

Discussion: Recommendations were made for future research and development to support potential UAV casualty evacuation usage, as well as doctrine development by various NATO bodies and clinical guidelines for such usage.

OR07

English: **HYPERBARIC OXYGEN THERPAY FOR CHRONIC COGNITIVE IMPAIRMENTS DUE TO TRAUMATIC BRAIN INJURY- RANDOMIZED PROSPECTIVE TRIAL**

French: **L'OXYGÉNOTHÉRAPIE HYPERBARE POUR LES DÉFICIENCES COGNITIVES CHRONIQUES LIÉES À UNE LÉSION CÉRÉBRALE TRAUMATIQUE - ÉTUDE PROSPECTIVE RANDOMISÉE**

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Introduction: A common sequelae of mild traumatic brain injury (mTBI) is the so called postconcussion syndrome, a complex of symptoms that includes neuropsychiatric symptoms, and cognitive impairment. Even though the majority of patients will recover, 9-25% will have persistent symptoms. In these patients hypoxia in the damage brain tissue plays a major role in the impaired regeneration processes. Recently, we reported that hyperbaric oxygen therapy (HBOT) can induced neuroplasticity in post stroke patients and the aim of this study was to evaluate the effect of HBOT on cognitive impairments and brain metabolism in chronic mTBI patients in a prospective, controlled, randomized, cross-over study.

Methods: The study included 90 patients who suffered from mTBI, 1-6 years prior to inclusion, and had complaints regarding their cognitive function. Patients were randomized into two groups: a treated group and a cross group. The patients in the treated group were evaluated twice: baseline and after HBOT. Patients in the cross group were evaluated three times: baseline, after control period of no treatment, and after HBOT. The HBOT protocol was: 40 sessions, 5 days/week, 90 minutes, 100% oxygen at 1.5ATA.

The primary end points included neuropsychological function, and brain metabolism, evaluated by SPECT. Secondary end point included quality of life evaluation.

Results: Following HBOT a significant improvement in all cognitive measures (memory, executive function, attention and information processing speed) as well as quality of life was observed in both groups after HBOT(pall). No improvement was noticed in the crossed group during the control period.

Concomitantly, a significant improvement in brain metabolism was also demonstrated in the brain SPECT evaluation.

Conclusion: HBOT may induce significant neuroplasticity and improve cognitive function in patients with mTBI even years after the acute injury.

OR08

English: **IDIOPATHIC CHILBLAINS (PERNIOSIS) - EXPERIENCE IN FIELD, TREATMENT STRATEGIES AND AEROMEDICAL ISSUES**

French: **ENGELURES IDIOPATHIQUES (PERNIOSE) - EXPÉRIENCE EN PRATIQUE, STRATÉGIES DE TRAITEMENT, ET QUESTIONS AÉROMÉDICALES**

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Introduction: Cold injuries such as chilblains are common among helicopter aircrew and maintenance personnel, operating at high altitude locations, exposed to extreme winters. As the recommended behavioral preventive measures were not always adequate, a study was undertaken to see the effectiveness of Pharmacological measures against chilblains.

Methodology: 42 healthy males affected with chilblains participated. 6 subjects, who were doing recommended behavior measures only, were taken as controls. Rest 36 subjects were divided into four groups of 9 each with four different pharmacological combinations which were foot parade + Clopidogrel (treatment-I), foot parade + Clopidogrel + Pentoxifylline (treatment-II), foot parade + Clopidogrel + Nifedipine (treatment-III) and foot parade + Clopidogrel + Pentoxifylline + Nifedipine (treatment-IV). Data was analyzed to find the advantage of pharmacological intervention.

Results: Of the total 42 patients, 32(76.2%) were recovered and 10(23.8%) were not recovered during the study observation period of 10 days. Control and treatment-I groups had shown recovery rate of 16.7% and 44.4% respectively. Rest three groups had 100% recovery. When the duration of treatment required for clinical cure was analyzed among different groups, the mean \pm SD in days for control, treatment I, II, III and IV were 9.0 ± 0.0 , 9.3 ± 1.1 , 4.4 ± 0.5 , 4.4 ± 0.7 and 3.2 ± 0.6 days respectively. The control and treatment-I groups were taken significantly longer time for recovery than other three groups (p). Treatment groups II and III were not found to have any significant difference ($p=1.0$) between themselves, while treatment group-IV had shown further advantage ($p=0.047$). The mean \pm SD of pre-treatment and treatment duration in days did not have any significant correlation ($r=-0.05$, $p=0.78$).

Conclusion: Behavioural preventive measures may not be able to effectively cure the chilblains during continued stay in cold climatic conditions.

Pharmacological strategies have shown added advantage both in cure rate and rapidity of recovery.

OR09

English: **A FEW IDEAS ABOUT THE FITNESS MANAGEMENT OF THE FRENCH PREGNANT PILOTS**

French: **REFLEXIONS SUR LA GESTION DE L'APTITUDE DES PILOTES FRANCAISES ENCEINTES**

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Pregnancy is a non pathological condition that may be associated with functional symptoms or progressive complications involving the flight safety. Since 2005, the application of the JAR standards in France has allowed a fit assessment until the 26th week in case of a "normal" pregnancy, with OML restriction and special conditions particularly a monthly aeromedical evaluation. In case of normal flights, the impact on the fetus is negligible, the unpredictable maternal risk is accepted and the adverse effects of aeronautical activities are minimized at best.

The medical files of about fifteen pilots were selected without pretending to make an exhaustive or statistical study.

The issue of the monthly evaluation, the cooperation with obstetricians and occupational practitioners, and the misgivings of other aircrews are discussed. The reasons given to continue then to stop flying, the adjustments of flying activity, and the feeling of pregnant pilots are also analyzed.

This study is a very partial picture of reality, omitting the pilots who stop flying from the diagnosis, or those who hide their pregnancy and fly until they declare this condition at the end of the third month.

The possibility to make pregnancy official leads to an optimization of the potential aeronautical risks of the first quarter. However, no incidents have been experienced since the implementation of this practice.

Some lessons can be learned from this experience:

- To perform a very early ultrasound exam to ensure the absence of an ectopic pregnancy;
- To continue considering "normal" pregnancies only for a fit assessment;
- To think about a proposal for a more simple follow-up than a monthly protocol;
- And to take advantage of this experience for the future management of pregnant cabin crew who will be authorized to fly until the 16th week

OR10

English: **INTEREST OF ENT EXAMINATION FOR AEROMEDICAL FITNESS**

French: **INTÉRÊT DE L'EXAMEN ORL EN EXPERTISE AÉRONAUTIQUE CIVILE**

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Au moment où les nouvelles normes européennes d'aptitude médicale au vol pour les pilotes ou le personnel navigant commercial sont mise en application en France, tant dans leurs contenus que dans leurs fréquences. Il est important de souligner l'utilité de l'examen ORL pour la sécurité du vol comme pour la bonne santé de ces personnels.

Nous rappelons les bases de l'examen clinique et les orientations diagnostic qui peuvent en découler. Nous étudions sur une période de deux ans les pathologies ORL dépistées et nécessitant un avis de l'autorité

OR11

English: **BAROTRAUMATIC OTITIS : ASSESSMENT AFTER 20 YEARS OF PREVENTION TOWARDS SHORT-HAULS CABIN CREWS. MAIN CAUSES, FAVORING FACTORS AND RESULTS.**

French: **OTITES BAROTRAUMATIQUES : BILAN DE 20 ANS DE PRÉVENTION POUR LES HÔTESSES ET STEWARDS COURT-COURRIERS. PRINCIPALES CAUSES, FACTEURS FAVORISANTS ET RÉSULTATS.**

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Les vols court-courriers représentent en théorie le plus grand risque d'otites barotraumatiques puisque c'est dans ce type d'exploitation que le nombre de descentes par temps d'engagement est le plus élevé. Cette étude fait avant tout le bilan de 20 ans de prévention de cette pathologie pour le personnel navigant commercial (stewards et hôtesSES) du réseau domestique d'Air France, court-courrier, avec présentation des principaux moyens employés : formation (forums, brochures, apprentissage des manoeuvres, rappels aux équipages en exploitation...), information directe lors des visites médicales (reprise après arrêt de travail pour otite, consultations pour avis avant vol...).

Des facteurs favorisants à traiter ont été mis en évidence ou recherchés. Cela concerne par exemple les infections, anomalies ou pathologies ORL, dentaires, les allergies, d'éventuels troubles de la déglutition...

L'analyse des résultats montre un recul important du risque d'otite en vol : celui-ci a diminué de plus de 50% entre 1991 et 2012.

OR12

English: **U.S. FAA EXPERIENCE WITH AVIATORS SEEKING SPECIAL ISSUANCE FOR TREATMENT OF DEPRESSION WITH SSRI MEDICATIONS**

French: **L'EXPÉRIENCE DE LA FAA AMÉRICAINNE AVEC LES AVIATEURS QUI DEMANDENT UNE DÉROGATION POUR LE TRAITEMENT DE LA DÉPRESSION AVEC LES IRSS**

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Introduction: Both depressive disorders and selective serotonin reuptake inhibitor (SSRI) medications pose a potential risk to safe flight due to cognitive impairment. In April 2010, the FAA implemented an "SSRI policy" for airmen with mild-to-moderate depressive disorders, who had 12 months of symptom remission on a stable SSRI dose. Among other program requirements, the airman was directed to submit results from a full battery of neuropsychological tests (i.e., the NP-battery) as well as the results from a 1-hour aeromedical neuropsychological screening test (CogScreen-AE). All of the neurocognitive tests are standardized, published tests routinely used in aeromedical neuropsychological assessment. The NP-battery testing requirement proved to be a substantial time/cost burden on airmen and created an administrative burden for the FAA. The objective of this study was to evaluate the utility of CogScreen-AE in screening aeromedically significant neurocognitive deficits in airmen applying for medical certification under the SSRI special issuance program.

Methods: A Medical Appeals database was queried for all SSRI cases from April 2010 through June 2012. Additional data were extracted from the FAA DIWS database and hardcopy records. Data were entered into Microsoft Excel for statistical analysis.

RESULTS: Of 98 cases, CogScreen-AE identified 22 aviators (25.2 % of cases) as potentially impaired. The NP-battery confirmed aeromedically-significant impairment in 11 cases, while the other 11 cases were determined to have performed in the acceptable range on the NP-battery. Overall, 87 (87.4%) of the applicants for special issuance met FAA eligibility requirements for certification, and 11 (12.6%) were disqualified. CogScreen-AE showed 100% sensitivity, 87.4% specificity, 50% positive predictive value, and 100% negative predictive value.

Discussion: CogScreen-AE correctly ruled out impairment in 74.6% of cases. There were no cases identified as impaired on the NP-battery that were not also identified by CogScreen. Half of the cases identified as potentially impaired by CogScreen-AE (n=11) were confirmed by the NP-battery as having aeromedically significant deficits. For the 11 cases where deficits on CogScreen were not confirmed by the NP-battery, the "false-positives" were generally the result of age-related memory and deductive reasoning difficulties seen on CogScreen, but not seen on the conventional tests. Study limitations include limited sample size and the possibility that the "false-positive" cases have an aeromedically significant cognitive deficit that is not detectable with conventional tests. Based on the data analysis described above the FAA policy was modified to allow CogScreen-AE to be used alone for initial assessment and requiring follow-up assessment with the NP-battery for confirmatory testing for those cases with abnormal CogScreen-AE results or for other clinical or aeromedical indications.

OR13

English: **AEROSPACE AND OPERATIONAL MEDICAL SUPPORT: AN IMPERATIVE FOR CHANGE**

French: **SUPPORT MÉDICAL OPÉRATIONNEL ET AÉROSPATIAL: UN BESOIN DE CHANGEMENT**

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In previous eras, operational medical support was focused primarily on aviation and the occupations surrounding the aerospace environment. In an era where wars are being fought in different ways, to include remotely using unoccupied vehicles and multi-node decisions, operational support must evolve. The author will describe how the US Air Force Medical Service is adjusting access, prevention, and care for specialized operational communities, describing early successes and potential challenges, as well as the potential impact on operational medical support.

OR14

English: **ECHOCARDIOGRAPHY EVIDENCE BASED CHANGES IN MEDICAL POLICY AND CRITERIA FOR FLIGHT STATUS**

French: **ECHOCARDIOGRAPHIE: CHANGEMENTS DE POLITIQUE MÉDICALE ET DE CRITÈRES D'ÉLIGIBILITÉ AU VOL À PARTIR DE DONNÉES PROBANTES**

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Background: military aviators are exposed to various kinds of stresses during his training and active duty that can affect cardiovascular function. Examples are hypoxia and acceleration forces. Emphasis is placed on cardiac examinations during routine check-ups which include history, physical examination, electrocardiogram and echocardiography.

Objectives: review of findings in echocardiographic research in the IAF aeromedical unit and their effect on policy changes.

Methods: policy on echocardiogram performance in IAF aviators has changed over the years. We extracted key echocardiographic studies performed in the IAF aeromedical unit over the years and review policy changes in examination performance and medical criteria enacted because of them.

Results: studies that examined the effect of a flying career, and acceleration forces in particular resulted in policy changes. In bicuspid aortic valve cases, no difference was found between flight platforms in regurgitation progression. Therefore it was determined that bicuspid aortic valve is not disqualifying in low performance aircrafts. In cases of mitral valve prolapse we saw an increase in regurgitant flow in high performance platforms but not in low performance. Therefore MVP is not disqualifying for low performance aircrafts. We also found that almost 2% of all candidates for flight academy were disqualified due to abnormal echocardiography.

Conclusions: because of the above mentioned studies it was determined that echocardiography will be performed before entry to the flight academy and not in its end. The number of repeated tests was greatly reduced to once before flight academy and once at the age of 40 in jet fighters. Research in the field of echocardiography has a critical impact on medical fitness policy in aviators and candidates. Further research is required to better guide policy-makers.

OR15

English: **AEROMEDICAL EVACUATION MISSIONS AND RISK TAKING BEHAVIOR OF PILOTS**

French: **MISSIONS AÉRIENNES MÉDICALISÉES ET PRISE DE RISQUE : LA PERCEPTION DES PILOTES**

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Introduction : According to literature data, aeromedical evacuation missions are associated with an increase risk of accident. So, an exploratory cross-sectional survey was conducted to study the consequences, including on safety, of the transmission of information by medical teams to aircrews.

Methods : General data was collected in early 2011, using a self-anonymous questionnaire distributed to 892 professional pilots, civilian or military, belonging to the main French governmental units of helicopters and airplanes conducting aeromedical evacuation missions. 56 % (503) of the questionnaires were duly completed and returned.

Results : The population was predominantly composed of male pilots and the mean age was 37 years old. Over three quarters of pilots were serving in the Defense Ministry and flew rotary wings. In two thirds of cases, the medical team sends to the pilots information about transported patients or casualties. This information relates predominantly the injuries severity and/or circumstances of occurrence (62 %). If this is useful for mission progress (65 %), this also influences the pilots flight management (59 %). In regard to risk taking behavior, over a quarter of pilots admit of having gone beyond their limits during these missions and, even more frequently, having breaking through procedures (47 %). Such behavior is primarily (3 out of 4) triggered by the information provided by the medical team.

Conclusion: From the flying personnel perspective, risk taking behavior is an integral part of aeromedical evacuation missions. Medical teams should be aware of the potential consequences of medical information issued to aircrews. But they must also be aware that the absence of information such as that experienced pilots have involved as much on the safety of this flight type.

OR16

English: **DEVELOPING AERO MEDICAL EVACUATION TO REDUCE THE MORTALITY OF THE WOUNDED AND SICK**

French: **DÉVELOPPEMENT D'UN PROGRAMME D'ÉVACUATION AÉRIENNE POUR RÉDUIRE LA MORTALITÉ DES BLESSÉS ET DES MALADES**

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During the First World War, French army started to use airplane to evacuate the sick and wounded, and established the world's first medical aircraft Group in 1918. During World War II, United States air- evacuate more than 1.4 million wounded, the former Soviet Union air-evacuate more than 0.4 million wounded. Due to the extensive application of aero medical evacuation, the mortality of the sick and wounded during World War II dropped from the First World Wars 8% to 4.5%. During Tangshan earthquake in China, 476 aircraft sorties had been dispatched, and transport the sick and wounded up to 20,784. In Wenchuan earthquake in the May of 2008, the Air Force of China had totally send 766 sorties, and transported the wounded up to 9,767. Aero medical evacuation is quick and timely, safe and comfortable, mobile and flexible, free from the influence of terrain etc. However, it is also limited by air dominance, aircraft number, weather, flight scheduling, and other conditions. The organization of aero medical evacuation includes command institution, flight unit, medical unit and logistics support unit. Each organization is responsible for its own air evacuation work. Usually the aero medical evacuation should firstly establish the air evacuation service scheme, carry out some medical preparation, then organize the sick and wounded to board on the aircraft, carry out medical care in the aircraft, and lastly, organize the sick and wounded to get off the plane and transfer to related organization. The medical care in the aircraft mainly includes continual treatment of the original injury, emergency medical treatment and filled out air evacuation files, general medical care and intensive medical care. With the development of aviation, the application of aero medical evacuation will become more and more widely.

OR17

English: **OUTSIDE AIR QUALITY IN AIRPORT ENVIRONMENT**

French: **QUALITÉ DE L'AIR EN MILIEU EXTÉRIEUR AÉROPORTUAIRE**

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Introduction: Afin d'évaluer la qualité de l'air extérieur que respirent les travailleurs de la zone aéroportuaire, les médecins du travail d'Air France ont procédé dans différentes escales françaises à des campagnes de mesurage successives sur quatre ans des principaux polluants atmosphériques.

Méthodes: Un organisme extérieur accrédité a été choisi afin de vérifier que les normes de santé au travail, qui sont différentes des norms environnementales de la population générale, sont bien respectées vis-à-vis du risque chimique. Des prélèvements individuels au poste de travail, complémentaires aux prélèvements ambiants, ont été réalisés pour les différents groupes homogène d'exposition de travailleurs en piste (tractistes, agents support cabine, mécaniciens avion, mécaniciens engins de piste, agents d'escale) concernant les COV, le benzène, les hydrocarbures C6C12, les HAP, les particules diesel, le monoxyde de carbone, lesaldéhydes, le monoxyde et le dioxyde d'azote. Résultats

Les résultats montrent des expositions très faibles, parfois à la limite de quantification des méthodes utilisées, pour la plupart des polluants mesurés. L'exposition aux particules diesel apparaît comme faible à importante sans toutefois dépasser la valeur limite d'exposition professionnelle.

Conclusion: Une surveillance particulière métrologique et clinique s'impose donc vis-à-vis des particules diesel, qui sont désormais reconnues depuis le 12 juin 2012, comme cancérogènes pour l'homme(groupe 1) par le Centre International de Recherche sur le Cancer (CIRC), ainsi que la mise en place de mesures de prévention adaptées en zone aéroportuaire.

OR18

English: **AEROMEDICAL DECISION MAKING (ADM) IN CEREBROVASCULAR PROBLEMS**

French: **PRISE DE DÉCISION AÉROMÉDICALE CONCERNANT LES PROBLÈMES VASCULAIRES CÉRÉBRAUX**

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With an aging pilot population, cerebrovascular problems are, increasingly, a matter that is raised in medical certification decisions. Over the last few years the research into the aetiology, pathogenesis and diagnosis of stroke and TIA has changed remarkably. A large part of these improvements are as a result of improvements in neuroimaging techniques. The diagnosis of TIA, which was earlier a diagnosis of exclusion, has now become a tissue diagnosis, and there can be reasonable certainty about the diagnosis, and therefore on a future prognosis. The Civil Aviation Safety Authority has had a policy of considering a return to flying a year after the development of a stroke. Recent reviews into accidents have caused CASA to review its policy, and in doing so an extensive literature review has been carried out. The paper presents the evidence linked to recurrence, the effects of interventions and the impact of other co-morbidities on recurrence. This evidence is critically appraised and a policy proposed for aeromedical decision making when dealing with this difficult condition.

OR19

English: **SPECIAL ISSUANCE MEDICAL CERTIFICATION IN THE UNITED STATES: CURRENT CATEGORIES AND POLICY**

French: **DÉLIVRANCE SPÉCIALE DE CERTIFICATION MÉDICALE AUX ÉTATS-UNIS: POLITIQUE ET CATÉGORIES ACTUELLES**

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In the United States, pilots must hold first, second, or third class medical certificates thereby meeting medical standards published in U.S. Title 14 CFR, Part 67. Adherence to these Part 67 medical standards for pilots is one means of ensuring the safety of the U.S. National Airspace System. In a 12 month period 2012/2013, the U.S. Federal Aviation Administration (FAA) received 380,158 applications for medical certificates of all classes. There were 203,545 first class, 72,621 second class, and 103,992 third class applications. The FAA Federal Air Surgeon has the authority to grant Special Issuance of a medical certificate to a pilot who does not meet the medical standards, as long as there is no danger to public safety. In this same 12 months, there were 37,172 Special Issuance medical certificates authorized, an increase of 4,000 over the previous year. There were 16,920 first class, 6,778 second class, and 13,474 third class Special Issuance medical certificates authorized. Final denials of medical certificates accounted for less than 0.9% of total applications received. The major categories of denial were cardiovascular, medication, psychiatric, neurologic, sleep disorders, endocrine, and cancer. The major categories of Special Issuance medical certificates granted were cardiovascular (arrhythmias, valvular disease, coronary artery disease), diabetes, sleep disorders, cancer, and neurologic. The numbers of Special Issuance medical certificates issued in the major categories will be reviewed along with the safety implications. In 2013, the FAA identified 11 Special Issuance conditions that Aviation Medical Examiners, following certain criteria, could issue regular medical certificates. This process will be discussed.

OR20

English: **MEDICAL EVALUATION OF SPACE FLIGHT PARTICIPANTS FOR COMMERCIAL SPACE FLIGHT**

French: **ÉVALUATION MÉDICALE DES PARTICIPANTS À UN VOL SPATIAL COMMERCIAL**

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Several challenges confront aerospace medicine specialists in implementing a medical program to support private commercial human spaceflight. This paper will address an approach to the medical evaluation and clearance of the space flight participants (SFPs) who will soon be embarking on suborbital commercial space vehicles.

Future SFPs are able to reserve a ticket for a commercial suborbital spaceflight without regard to medical conditions or disabilities. The medical evaluation may occur some months or years after the ticket is reserved. It begins with the completion of a medical questionnaire, and may be followed by a request for additional information after review by the operators medical personnel. A physical exam by a qualified aviation medical examiner (AME) is completed approximately six months prior to the anticipated space flight. Findings from the medical questionnaire and physical exam that raise concern for the safety of the SFP are addressed through follow-up medical testing and evaluation. Additionally, evaluation of performance and medical responses in a high-G centrifuge or a micro-gravity airplane flight may be indicated.

A level of medical risk is determined for the SFP at each step of the medical evaluation. The risk assessment determined by review of the medical questionnaire is refined using subsequent information from the physical exam, medical testing, performance testing, and training activities. A final determination of acceptance for space flight is made by mutual agreement of the SFP and the operator once the medical risks are determined. Each party must be willing to accept the known risks in order for the flight to be undertaken.

The medical personnel working for Virgin Galactic have completed the initial review of medical questionnaires from over 300 customers. Approximately 15% of these reviews will result in requests for additional medical information and testing to further assess the level of medical risks imposed by a space flight. The results of the initial reviews and follow up evaluations will be discussed.

OR21

English: **CLASSROOM SIMULATION OF SPACE COLONIZATION MISSIONS**

French: **SIMULATION EN CLASSE DE MISSIONS DE COLONISATION DE L'ESPACE**

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Introduction: During the history of space exploration conflict has sometimes arisen between the disciplines of engineering and aerospace medicine. Therefore, a course was created to familiarize engineers with the principles of aerospace medicine and to promote mutual cooperation and understanding between these disciplines.

Methods: A graduate level course in Space Systems was provided for engineers to achieve a working knowledge of aerospace physiology and medicine required for vehicle and mission design. As part of this course, a classroom simulation in space colonization was conducted at the end of the semester long instruction. Simple descriptive computations were used to summarize data from various mission components to document the classroom decision process. The results are averaged over the past 15 years from each course taught.

Results: The students were found to have the following preferences during the space colonization :

Crew composition: multinational 90%, single nation 10%; mostly male 5%, mostly female 40%, couples or family units 55%

Food source: pure vegetable 20%, mostly vegetable 70%, predominate meat/dairy 10%.

Long term life support: self contained ecological system 80%, chemical industrial process 20%

Medical care specialties preferred: General surgery 60%, Psychiatry 30%, other 10 %.

Power: nuclear 80%, solar 20%

Propulsion: conventional 80%, nuclear 15 %, other 5%. **Discussion/Conclusion:**

The participants consistently chose diversity in crew composition while favoring couple or familial makeup, and demonstrated appropriate knowledge of biological factors in their dietary and life support choices while maintaining their physical sciences orientation in other mission choices. Engineers and their medical counterparts can work together in simulated long term space colonization projects for mutual future benefits to space exploration.

OR22

English: **PHYSIOLOGICAL RESPONSES FROM TOE TO HEAD DURING DISORIENTATION IN THE SPACE-FLIGHT ENVIRONMENT**

French: **RÉPONSES PHYSIOLOGIQUES DES PIEDS À LA TÊTE PENDANT UN ÉPISODE DE DÉSORIENTATION DURANT UN VOL SPATIAL**

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Introduction: John Hunter described torsion movements of the eye in opposition to the tilt of the head in 1786. Ocular counter-rolling serves as a sensitive indicator of otolith activity, with an internal body-vertical reference (Clement G 2007), and even under hypogravic conditions (Kellog 1971) in bipeds. Retinal images are however sensed as objects located in the external world, rather than in internal representations of the brain (Feldman 2009).

State of the Art: Proprioceptive adaptations are attributable to whole-body propulsive foot functions in exposure to weightlessness and the adaptation of motor behavior with tonic vibration reflexes, to the 3D space and microgravity (Roll 1993). Training programs for Flying personnel and Air Traffic Controllers showed the ball of the first toe as a significant site for action-coordination along the spine (Usachiakov 2012). Correction of individual's errors of movement are possible with joint receptors and flexions of the ankle joint, and between joints wherein, feedback loops can be modified by inverting the visual display (Jaeger 1978); loaded indices of muscle activation; tactile sensory proprioception, by leg movement; center of pressure trajectory as significant in the foot (Danna-Dos-Santos 2008); and perceptual-to-motor transformations to kinaesthesia.

Simulation of parabolic flight in microgravity by the Convair 131B, Boeing and A340 with Roll tilt of the head and eyes during the extended Head Alignment Circle tended to align the retina with the visual horizon (Moore 2008) for the "visual capture" and vision-to-event coordination. Weighted helmet Head loading on Earth even when without affecting vestibular stimulation, alters functional kinaesthetic, touch, vestibular and neuromuscular sensory mechanisms induced by the prolonged absence of a normal 1-G gravitational environment (Lackner 1989), including the toe-to-head vertical.

Conclusions: The training for disorientation illusions is dependent on the physiological and stabilizing balance of the vertical Toe to Head for the horizontal, rolling and vertical positions for good accuracy and precision by afferents in limb function.

OR23

English: **TRAINING TEAMS FOR SUCCESSFUL PERFORMANCE IN LONG-DURATION SPACE MISSIONS**

French: **FORMATION DES ÉQUIPES À UN BON RENDEMENT À DES MISSIONS SPATIALES DE LONGUE DURÉE**

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Introduction: Successful long-duration space missions will require crews to respond adaptively and collaboratively to unanticipated problems and to maintain cohesion. The present study examined alternative protocols to train crews for both effective performance and cohesive relationships.

Method: Five-member crews engaged in a computer-simulated search for water on the lunar surface. Dual two-person teams were supported by a base coordinator who assisted with navigation, strategy, refueling and rover resupply.

Time-synchronized audio, video and computer records, and questionnaires were used to assess team processes and outcomes. We compared two training and two control conditions: (1) Interpersonal Relations Training (IRT): 22 hours of team exercises and feedback to build team trust, understanding, and cohesion; (2) 8-hour Team Adaptation and Coordination Training (TACT): information sharing, planning, team monitoring, support and feedback; (3) team familiarity control: 22 hours of live-action role play but no training, and (4) no-training/no-familiarity control. Following team training or control exercises and training on the simulation system, teams engaged in six 75-minute missions, one moderate and one difficult mission per day for 3 days (order counterbalanced).

Results: Team success reflected team training, team self-management strategies, and team social interaction processes. TACT led to significantly better performance than IRT, based on the number of component tasks and missions completed. More successful teams exhibited higher levels of team resource management, reliance on the base coordinator, multitasking, contingency planning, and positive affect. Behavioral indicators of team cohesion included equal member participation, balance between expressive and task-oriented behaviors, and a supportive rather than dominant base coordinator. In contrast, negative social dynamics were associated with lower team performance.

Conclusion: These findings demonstrate that TACT training provided tools to overcome the stresses associated with task difficulty through team self-management, teamwork strategies and positive team dynamics.

OR24

English: **VENTILATORY RESPONSE TO MOON RUNNING WITH A GRAVITY LOADING COUNTERMEASURE SKINSUIT A CASE STUDY**

French: **REPOSE VENTILATOIRE À UNE COURSE LUNAIRE AVEC UN VÊTEMENT À CHARGE GRAVITAIRE EN CONTRE-MESURE - UNE ÉTUDE DE CAS**

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Introduction: The gravity loading countermeasures skinsuit (GLCS, MIT, Massachusetts, USA) is the first known suit to utilize a specialized, tailored material strain to replicate the gravitational loading on the body found on Earth, when used in a hypo- or microgravity environment. By integrating exercise with the GLCS, this could provide greater musculoskeletal stimulus via both passive and active loading. **Objective:** This case study aimed to compare for the first time the oxygen uptake and pulmonary ventilation during a 5 min run with the GLCS, between Moon simulated hypogravity and the Earth (1G).

Methods: A 26 yo, healthy, male subject, wearing the GLCS, performed a 5 min run on a treadmill in a Moon hypogravity simulated environment and at 1G (control) with a 10 min interval between these two conditions. The hypogravity found on the Moon was simulated by using a body suspension device, a counterweight system and a harness. The oxygen uptake (VO₂) and ventilation (VE) were measured breath- by-breath using a gas analyser (VO2000, Inbrasport, Brazil). A matched-pairs Student t and Wilcoxon tests were used to analyze the data, considering a level of significance of 5%.

Results: The mean VO₂ during the 5 min run in the Moon simulation and at 1G were 11.1±1.5 mL/kg/min and 23.1±1.2 mL/kg/min, respectively (p20.2±2.3 L/min and 36.8±2.1 L/min at 1G

Conclusion: Even with the strain generated by the GLCS and the increase of the gravity load, the ventilatory response of running for 5 min at a Moon simulation was significantly lower than on Earth. New studies related to the kinematics and other physiological variables will be needed in order to clarify the differences of walking and running in hypo gravity environments.

OR25

English: **HERMANN VON SCHROETTER (1870-1928) LIFE AND WORK IN THE FIELDS OF AVIATION MEDICINE**

French: **HERMANN VON SCHROETTER (1870-1928) SA VIE ET SON TRAVAIL EN MÉDECINE AÉRONAUTIQUE**

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The Austrian flight surgeon Victor Hermann Anton Schroetter Thomas was born on 5th August 1870 in Vienna, Austria. He dealt with the early physiological effects of air pressure changes and developed in 1905 the concept of a pressure cabin for the stratosphere flight. By 1896 he made his first balloon flight to study the altitude sickness. 1902 von Schroetter participated in the 3rd International Scientific Conference on Aviation in Berlin, where he introduced a freezing-resistant mask for high altitudes for balloonists. At this occasion he took the time on the edge of the congress for several scientific balloon ascents together with Berson, Suering and Zuntz. With altitude physiological questions, he also worked on several expeditions to the Monte Rosa mountain. He also participated in 1910 alongside with Nathan Zuntz, Arnold Durig and Joseph Barcroft on the Tenerife height expedition. Besides bioclimatic studies and works its commitment to tuberculosis he was a medical officer in the Balkans and the Middle East.

Von Schroetter finished his medical habilitation at the University of Vienna in internal medicine in 1925. He died of a pulmonary tuberculosis only three years later. Among his most important works: Knowledge of mountain sickness (1899), Atmospheric pressure conditions (1900), Results of two balloon flights to physiological purposes (with Zuntz, 1902) and Hygiene of Aeronautics and Aviation (1912).

OR26

English: **A VIEW OF THE SPACE PROGRAM'S RELATION TO LIFE ON EARTH**

French: **UN APERÇU DE LA RELATION ENTRE LE PROGRAMME SPATIAL ET LA VIE SUR TERRE**

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In September 1971, I was invited to address the opening session of the 19th ICASM in Tel Aviv, Israel (the first ICASM in Israel). This address enumerated benefits to mankind and planet earth. This address is now a part of ICASM history. At that time we had accomplished 4 landings on the moon and saved the crew of Apollo 13.

An awareness of how small Spaceship Earth was created, for it could be obscured by an astronaut's thumb as viewed from translunar space.

At the invitation of Russian leaders after our initial landing on the Moon I visited the space medical support activities in Russia. I was most impressed by the belief of Russians that this activity would bring the peoples of the earth together. Seeking of a common goal resulted in a kinship feeling of participants and would produce a decrease in earthy conflict.

The developments in science and technology to support our progress into space will create many benefits to us on earth. Communications, medicine, earth scanning etc., have reaped many innovations. Monitoring human function from a distance of 240,000 miles can be translated to medicine at a distance here on earth.

Preventive Medicine is the keystone of our support of man in space. We must redirect more of our earth bound medicine to prevention. Physicians will need to organize teams of paramedical personnel and utilize technology to extend their eyes, arms and hands to meet the future needs and spend more time with the patient.

These and other observations from the 1971 address will be discussed, in relation to the world today.

"It should therefore be obvious to all that I feel man's destiny is the stars and the technology and the scientific base are the thrust to achieve that destiny. We have placed a ladder, and we now ask that those that follow climb it." Will we continue to climb that ladder for the good of all mankind?.

OR27

English: **REAL TIME PILOT HEALTH MONITORING SYSTEM**

French: **SYSTÈME DE SURVEILLANCE DE LA SANTÉ DU PILOTE EN TEMPS RÉEL**

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Introduction: G Loss of Consciousness (GLOC) is a common cause for mishaps in fighters and claims lives yearly around the globe. A significant number of hypoxia incidents have been reported lately resulting in life threatening incidents. No airborne physiological monitoring device is fielded today to warn/recover pilots in any of those events.

Elbit Systems is developing such system to be integrated in its helmet mounted display (HMD) systems. A unique technology developed by LifeBeam is used to monitor physiological signals and to identify hazardous physiological events.

Methods: Two optical sensor technologies were embedded in an HMD, providing continuous, real-time monitoring:

- DLS (Dynamic Light Scattering) a laser based detector monitoring red blood cell flux and velocity, providing a pulse wave from which heart rate and BF are extracted
- Unique reflection PPG Pulse-Oximeter calculating the SpO₂.

Novel signal-processing algorithms implemented to enable extraction of accurate physiological parameters during varying flight conditions, and to overcome artifacts during extreme maneuvers, head movements and rapid changes of ambient light. The system was then integrated with advanced HMD system and tested in a centrifuge (+9G), at hypo-baric chambers and in multiple flight experiments.

Results: Results show that the algorithms extracted correct heart rate 96% of the time (± 4 bpm relative to the gold-standard ECG). Furthermore, during high-G, head BF dropped by 40-60%, and the decreased flow was correlated to G-onset.

Dozens of hypobaric experiments showed that an upcoming hypoxia event can be detected with high significance. SpO₂ calculated values were correct throughout the measurement scale.

Conclusions: Very encouraging test results strongly support the concept that the HMD system (as described) will provide high fidelity pre-hypoxia and G-LOC warnings to pilots, as well as means to identify pilot LOC and to initiate aircraft automatic recovery process, saving pilots lives and expensive equipment.

OR28

English: **USING PORTABLE PHYSIOLOGIC MONITORING DEVICES TO HELP ASSESS EXERTIONAL FATIGUE IN FIGHTER PILOTS**

French: **UTILISATION DE DISPOSITIFS DE SURVEILLANCE PHYSIOLOGIQUES PORTABLES POUR AIDER A ÉVALUER LA FATIGUE A L'EFFORT CHEZ LES PILOTES DE CHASSE**

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Introduction: The cost of performing the Anti-G Strain Maneuver in a fighter aircraft is exertional fatigue and predicting its onset before it impacts performance becomes a key challenge. Percent heart rate reserve (%HRR) has emerged as a strong measure for assessing exercise intensity with a high correlation to oxygen uptake reserve across the intensity spectrum. We examined %HRR using data captured with available technology during sequential high-G maneuvers to help characterize exertional fatigue in support of future countermeasure design.

Methods: An IRB-approved, retrospective review was performed. Over 2100 minutes of physiologic data was obtained during five F-22 flight tests at Edwards AFB, CA between July and September 2011. Time-synchronized, R-R

interval data was captured during sequential G-loading across 25 high-G events (defined as greater than +6Gz) using off-the-shelf monitoring devices with a data acquisition rate of 1Hz. Heart Rate Reserve (HRR) was calculated as the difference between the pilot's resting and maximum predicted heart rate. %HRR was then determined as the percentage of HRR utilized during a specific G- loading event.

Results: During high-G maneuvers, the data drop-out rate for heart rate data captured with a chest harness device was significantly less at 5% as compared to 59% with a finger-mounted oximeter (p during the first four sequential G-loading events was 51% (SD=6), 69% (SD=12), 76% (SD=4), and 76% (SD=4) respectively. The elevation in %HRR during sequential G-loading progressed in a manner similar to interval exercise with gradually increasing set-points. The maximum achieved %HRR with successive G- loading ranged between 79-83%.

Conclusion: With careful device selection, heart rate data was reliably captured during sequential G-loading and analyzed using metrics common to exercise physiology with direct relevance to exertional fatigue. The resulting %HRR for sequential G-loading was consistent with moderate to heavy exercise intensity.

OR29

English: **STATE OF THE ART OF ROBOTICS IN EMERGENCY SITUATIONS**

French: **ETAT DES CONNAISSANCES EN ROBOTIQUE DANS LES SITUATIONS D'URGENCE**

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In this presentation I will review the state of the art of robotics as applied to rescue support in emergency operations. The word Robot implies an autonomous machine that can perform task without interference. How near are we to this vision? How well can robots perform in these extreme situations? What is autonomy in practical terms?

In this presentation I will review, in the context of emergency rescue operations, advances in robotics, operational concepts, autonomy and human integration concepts. I will also review the challenges and existing as well as future solutions.

The presentation will include video from existing and simulated robotic systems.

OR30

English: **VISIBILITY IN SNOW BY RADAR**

French: **VISIBILITÉ DANS LA NEIGE ÉVALUÉE PAR RADAR**

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Introduction: Aviation safety at Canadian airports depend crucially on adequate visibility for landing and take-off. Snow and blizzards are main factor that reduce visibility to less than 1 km which results in unsafe distances. Human observers at airports are costly and thus there is a need to forecast visibility using remote sensors such as weather radar.

Methods: Hourly visibility measurements (V) are plotted versus radar reflectivity (Z) measurements sampled over Edmonton International Airport during snowfall events. For a given Z observation, the probability distribution of V was determined.

Results: The (Z, V) scatter diagrams showed that increasing Z was correlated with decreasing Vis . The interquartile range with $Z > 20$ dBZ was smaller than the IQR with $Z < 20$ DBZ. The scatter was not significant affected by temperature profile or the wet bulb potential temperature. Strong wind speeds (> 15 knots) along with high reflectivity was associated with low V (< 2 km).

Conclusion: Radar reflectivity observations provide valuable information for visibility at Canadian landing strips, yet they are not a safe substitute for human observations.

OR31

English: **OPERATIONAL EVALUATION OF BLUE-ENRICHED WHITE LIGHT AS A FATIGUE COUNTERMEASURE FOR CONTROLLERS ON NIGHT SHIFT**

French: **L'ÉVALUATION OPÉRATIONNELLE DE LA LUMIÈRE BLANCHE ENRICHIE AU BLEU EN TANT QUE CONTRE-MESURE À LA FATIGUE POUR LES CONTRÔLEURS SUR UN QUART DE NUIT**

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Introduction: Daily changes in sleepiness, performance and physiology are regulated by exposure to light. This is thought to occur through its effect on the melanopsin-containing retinal ganglion cells. Through a complex neurochemical pathway, their activation leads to the suppression of melatonin release. As these cells are preferentially activated by blue light, we hypothesised that, compared to ordinary fluorescent white light (FWL), exposure to blue-enriched white light (BEWL) would reduce subjective fatigue among controllers on night shift.

Methods: An operational evaluation was conducted over 8 weeks in a windowless air traffic control center. Night shift controllers (n = 39) were exposed to three 2-week periods of light exposure (FWL-BEWL-FWL), with an intervening week between exposure periods. The correlated color temperature of the BEWL was 8000K. The Sam Perelli Fatigue Scale (SPFS) and our centre's proprietary Subjective Fatigue Scale (SFS) were utilized to assess the end-of-shift fatigue levels of all subjects.

Results: The response rates for the 3 exposure periods were 49%, 46% and 18%, respectively. For end-of-shift SPFS score, there was a statistically significant difference between the BEWL group (mean \pm SD, 2.58 \pm 1.017) and the FWL group (mean \pm SD, 1.78 \pm 1.215), p = 0.036. Cohen's effect size value (d = 0.714) also suggested a moderate to high practical significance. For end-of-shift SFS score, there was a near statistically significant difference between the BEWL group (mean \pm SD, 15.00 \pm 10.386) and the FWL group (mean \pm SD, 22.53 \pm 11.763), p = 0.051. Further, Cohen's effect size value (d = 0.667) suggested that there was a moderate to high practical significance.

Conclusion: Notwithstanding the limitations of an operational evaluation, our results suggest that BEWL is effective in reducing subjective fatigue among night shift controllers. A laboratory-based study has been initiated to address the practical limitations of the operational setting.

OR32

English: **MEDICAL DEVELOPMENTS IN NEUROTECHNOLOGIES**

French: **DÉVELOPPEMENTS MÉDICAUX DANS LES NEUROTECHNOLOGIES**

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Increasing capabilities of digital electronic devices such as the number of transistors on integrated circuits doubling approximately every two years (Moore's Law), decreased RAM cost, increased RAM size, decreased average microprocessor cost, increased microprocessor clock speed, and increased computing processing power, have had a significant impact on accelerated scientific breakthroughs in medical discoveries and technologies, including neuro-technologies, bio-engineering, virtual medical imaging, regenerative medicine, stem cells therapies, cloning, biomedical devices, micro-electro-mechanical systems (MEMS), genomics and gene therapies, nano-medicine, medical robotics, engineered replacement organs, networked health care, etc. The implementation of new advanced medical technologies are rapidly changing the scope and complexity of Aerospace Medicine and its impact on safety in aviation and space operations, including: 1) Clinical aerospace medicine aspects such as health monitoring, prevention, screening, diagnosis, treatment and rehabilitation of aerospace personnel and passengers, 2) Aeromedical implications for emergency and elective transportation of patients by air, 3) Medical certification/licensing implications (fitness for flight) for aerospace personnel, 4) Operational roles and responsibilities of aerospace medical personnel, 5) Aerospace human factors considerations, 6) Human- machines-environment interactions, 7) Post aerospace accident/incident investigation factors and analytical tools, etc.

This presentation will discuss a variety of neuro-technologies including: smart APS, deep brain stimulation, cortical brain stimulation, transcranial magnetic stimulation, transcranial direct current stimulation, peripheral nerve stimulation, neuro- signal acquisition and processing wireless headsets, implantable brain- computer interfaces, brain-controlled prosthetics, brain-controlled robotic limbs, traumatic brain injury detectors, handheld intracranial hematoma detectors, portable intracranial pressure monitor. The new Brain Research Through Advancing Innovative Neurotechnologies or BRAIN initiative was announced on April 2, 2013, to map the entire human brain and will revolutionize our understanding of brain physiology.

OR33

English: **AEROSPACE MEDICINE, TECHNOLOGY AND HUMAN-MACHINE INTERFACE**

French: **MÉDECINE AÉRONAUTIQUE, TECHNOLOGIE ET INTERFACE HOMME-MACHINE**

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Background: Remotely Piloted Aircraft (or Unmanned Aerial Systems) have fundamentally changed the nature of the pilot's relationship to his aircraft. Military aviators can now “telecommute” to combat – coining the terms “telecombat” and “telewarfare.” Human-machine interface is still critical to these operations. Just as the past 2 decades has seen explosive growth in communications, many authors hypothesize that advancement in microprocessor speeds combined with decision software has the world on the cusp of an explosion in autonomous robotics. Robots are already used in warfare, but just as telecommunications enabled “telewarfare,” machine autonomy will fundamentally alter traditional warfare. Additionally, component miniaturization and nano-technology herald brave new vista’s in man-machine interface. Implantable defibrillators, injectors are only the beginning. Cochlear implants, cybernetic retinas and robotic limbs are reality. The combination of these 3 developments will no doubt have truly profound impacts not simply on medicine or warfare, but on what it means to be human.

Methods: Author reviews the current state of robotics and bio-implantable technology. The author presents a unique framework to describe the perspectives and capabilities that make Aerospace Medicine uniquely suited to deal with multidimensional aspects of integrating new technologies into human life, health and operations. He raises many provocative questions for the future of the specialty of Aerospace Medicine, the ethics of medicine and warfare, and human society itself.

Conclusion: Aerospace Medicine is a specialty that deals with health, medicine and human performance in an extreme variety of environmental conditions. As such it is nicely suited to deal with new combinations of biology and technology that will undoubtedly impact all aspects of human performance in the future.

OR34

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

French: **AMÉLIORATION DE LUNETTES DE VISION NOCTURNE PERFORMANCE AVEC INTÉGRATION DES SYSTÈMES HUMAINS DE MATÉRIAUX, LES FACTEURS PERCEPTIFS, COGNITIFS ET DE LA FORMATION**

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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 US 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.

OR35

English: **IN-FLIGHT MEDICAL EVENTS AFFECTING TECHNICAL CREW. A 29 MONTHS REVIEW**

French: **ÉVÉNEMENTS MÉDICAUX EN VOL AFFECTANT DES PILOTES. UNE REVUE DE 29 MOIS**

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Introduction: Accidents related to pilot incapacitation are not frequent. However, these are just worst cases from medical events occurring in-flight. The true incidence and clinical spectrum of in-flight medical events affecting flight deck crew (FD-IFME) is not known. Calls received by a ground based medical support (GBMS) company provide epidemiological aspects of FD-IFMEs.

Methods: The database of MedAire, a US-based GBMS company was researched from the period of Jan 2011 until May 2013. Cases of FD-IFMEs were identified from commercial airlines and corporate aviation. Demographic and operational data were captured in each case.

Results: 89 cases FD-IFMEs were retrieved out of 59,143 total in-flight cases. 86 (95.6%) cases came from a commercial airline. 84 cases (94.4%) affected male and 5 (5.6%) female pilots. Median age was 43 (range: 24-63) years. 50 cases out of 88 (56.2%) where the original flight duration was identified, were of less than 8 hours flight time. Overall 7 cases (7.9%) ended-up in a diversion, 2 out of 39 (5.1%) from flights of more than 8 hours and 5 out of 45 (10.0%) of less than 8 hours. Gastrointestinal (33) and neurological (15) were the most frequent events accounting in combination for more than half (53.3%) of instances. In 50 (60.9%) cases a medication was recommended or taken before contacting GBMS. Loss of consciousness occurred in 10 cases (8 syncope and 2 seizures).

Conclusion: The advent of GBMS and its increasing utilization allowed for a detailed perspective in observing cases of pilot medical impairment and incapacitation while in-flight. GBMS plays an important role in this scenario by directly proactively influencing the related decisions which can have a direct impact upon flight safety.

OR36

English: **DERMOSCOPY - A USEFUL TOOL FOR THE DETECTION OF MELANOMA AND NON-MELANOMA SKIN CANCERS AMONG AIRCREW.**

French: **DERMOSCOPIE - UN TECHNIQUE UTILE POUR LA DÉTECTION DES CANCERS DE LA PEAU (MÉLANOMES ET NON-MÉLANOMES) CHEZ LES MEMBRES D'ÉQUIPAGE.**

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Introduction: Skin cancer is the most common form of cancer in the world. Several epidemiological studies have demonstrated an increase in the expected incidence of melanoma and non-melanoma skin cancers among airline crew internationally. The increased incidence has been attributed to aircrew lifestyle, a greater opportunity to spend time outdoors than the general population, and perhaps exposure to cosmic radiation or circadian disruption. The recent medical literature concerning the epidemiology of skin cancer among airline pilots and crew will be briefly reviewed.

Methods: Dermoscopy is an optical technique used for the identification of skin lesions by enabling visualization of anatomic structures below the epidermis, thereby serving as a bridge between clinical observation and histopathology. Introduced in the 1990s, it is now used by more than 50% of dermatologists and has become known as the "dermatologist's stethoscope," yet is still rarely used by non-dermatologists.

Results: This presentation will demonstrate how dermoscopy is performed with a dermatoscope, and briefly review the two-step dermoscopy algorithm, which differentiates non-melanocytic from melanocytic skin lesions, in addition to other simple algorithms that can help the clinician distinguish between benign and suspicious or malignant melanocytic lesions. These algorithms include the three-point checklist, the ABCD rule of dermoscopy, and the CASH algorithm. Pattern analysis and more complex algorithms including the 7-point checklist and the Menzies method, are more often used by dermatologists.

Conclusion: Aviation medical practitioners should learn more about dermoscopy and consider employing the technique in their practices.

OR37

English: **NEAR WORK AND MYOPIA IN YOUNG PILOTS**

French: **TRAVAIL RAPPROCHÉ ET MYOPIE CHEZ LES JEUNES PILOTES**

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PURPOSE: The connection between reading and myopia development remains controversial. This study aims to assess whether 12 months of university academic study caused myopia in young pilots.

METHOD: This retrospective consecutive database study compared baseline and 6-year refractions in a cohort of young pilots. Refractions were non-cycloplegic, retinoscopic and subjective at a distance of 6 m, using the best visual acuity and minimum minus technique. Maximum baseline myopia and hyperopia (cycloplegic) were -1.75 and 2.00 D, respectively. Baseline refractions were performed close to the onset of the pilot training course, and repeated yearly under consistent conditions. The cohort was analyzed as two groups depending on the completion of 12 months of university study during the pilot training course.

RESULTS: We studied 432 right eyes of 432 male pilots, 180 completed 12 months of academic study and 252 did not. Range of baseline manifest refraction for the entire cohort was 0.50 D (2 eyes) to -1.87 D. Median baseline age was 17.8 years (range, 17.0–21.9) in both groups. Prevalence of refraction < 0.50 D at baseline was 9.5 and 16.7% in the nonacademic and academic groups, respectively. Over the 6-year study period, 13.1 and 13.9% of eyes developed 0.50 D or more of myopia, and 2.4 and 5.0% had a myopic change of 1 D or more, in the nonacademic and academic groups, respectively. Eyes with baseline myopia of 0.50 D or more developed more myopia than emmetropic eyes at baseline.

CONCLUSIONS: Twelve months of university academic study was not a significant stimulus for myopia development and progression. Myopic eyes have a greater tendency to progress than emmetropic eyes.

OR38English: **CONCORD OR CONCORDANCE**French: **ENTENTE OU CONFORMITÉ**M. Drane, P.D. Navathe

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The risk of complications for many medical conditions may be controlled by the judicious use of medications. In some cases those complications may be catastrophic causing acute incapacitation. From a regulatory perspective, the mitigation of elevated incapacitation risk may depend on such medical intervention.

There is much data now available which demonstrates the disconnect between what a clinician prescribes and what a patient actually takes. However, there is little evidence of this disparity being considered in aeromedical assessments. Taking a few specific examples, this presentation raises questions about inconsistencies in aeromedical decision-making, which arise from patient non-compliance and lack of concordance in managing potentially hazardous medical conditions. Some possible remedies are proposed.

OR39

English: **MRA STUDY ON VARIATION OF WILLIS CIRCLE IN HEALTHY CHINESE PILOTS**

French: **ÉTUDE MRA SUR LA VARIATION DU CERCLE DE WILLIS CHEZ DES PILOTES CHINOIS EN BONNE SANTÉ**

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Introduction: Willis circle (WC) is an important intracranial collateral circulation system that maintains adequate blood flow, and decreasing damage of the lesion for patients with cerebrovascular diseases. The traditional studies have some limitations for its based on autopsy, patient or the sample was not large thus it couldn't reflect the real physiological status of WC

Materials and methods: To determine the developmental situation and the integrity of WC by undertaking a retrospective analysis of cerebral MRA of 2,246 healthy subjects with normal MRI and MRA.

Results: The incidence rate of WC integrity, partial integrity and non-integrity are 12.24% (275/2246), 70.17% (1576/2246), 17.59% (395/2246). The integrity rate of anterior circulation is 78.58% (1765/2246), it is higher in those with ACA-

A1 variation than those with balanced A1 segments (P0.01). The variation rate of ACA-A1 is 28.23% (634/2246), and the right side is higher than the left side when comes to the ACA-A1 (P0.01). The non-integrity rate of posterior circulation is 83.93%(1885/2246). FTPs formed at 530 laterals in 438 subjects. The formation of FTPs is correlated to the type, sides and variation degree. The FTPs formed on those with ACA-A1 variations and on the variation sides of those with A1 variations are obviously more than that on those with balanced ACA-A1 and on the normal side of those with ACA-A1 variations (P0.01), and the formation rate of FTP on those with variations and on the variation side increases as the ACA-A1 variation degree exacerbated (II-IV) (P0.01).

Conclusion: The WC variation is a common phenomenon among the healthy subjects. MRA can reflect the morphology of WC in physiological situation, providing some reference for the treatment and prognosis of clinical cerebrovascular diseases and some information for the selected pilot.

OR40

English: **AEROMEDICAL IMPLICATIONS OF PARKINSON'S DISEASE**

French: **IMPLICATIONS AÉROMÉDICALES DE LA MALADIE DE PARKINSON**

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Introduction: Parkinsons disease is a progressive neurodegenerative condition which typically presents in the sixth and seventh decades. Clinical features include bradykinesia, resting tremor, rigidity and cognitive deficit; all of which have implications on a pilots fitness to fly. This study examined the United Kingdom Civil Aviation Authority (UK CAA) experience of Parkinsons disease. The aeromedical implications of the condition will be discussed and the UK CAA policy for the certificatory assessment of pilots with Parkinsons disease will be described.

Methods: A search of the UK CAA medical records database from 1990 to 2013 revealed 35 pilots with a diagnosis of Parkinsons disease. Data was extracted for age at diagnosis, age at loss of medical certification and the reasons for loss of medical certification.

Results: The mean age at diagnosis was 58 years (range 36 to 72 years). The mean time from diagnosis to loss of medical certification was 27 months (range 0 to 93 months). The reasons for loss of certification will be discussed.

Conclusion: In the UK, pilots diagnosed with Parkinsons disease may be granted medical certification depending on functional ability and the nature of the treatment. The aeromedical implications of Parkinsons disease and the UK CAA policy for the certification of pilots with this diagnosis will be discussed.

OR41

English: **FREQUENSES OF ARTERIAL HYPERTENSION CASES WITH ELDERLY (AGING, SENIOR AGE GROUP) PILOTS**

French: **FRÉQUENCE DE CAS D'HYPERTENSION ARTÉRIELLE CHEZ LES PILOTES VIEILLISSANTS**

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Arterial hypertension (AH) is one of the most spread chronic diseases in modern society, incidents of arterial hypertension which is growing with age. The greatest difficulty is to see if the pilot of this age group is fit to fly.

Purpose: To estimate the frequency of arterial hypertension with civil aviation pilots of elderly age group.

Research group: Examined 1189 pilots age 54-68 yrs during 2009-2010 years in the department of medical examination and rehabilitation treatment at Central Civil Aviation Hospital, Moscow (cross-sectional study). The pilots who had no complaints were examined at regular bases.

End results. At the first medical examination the average systolic blood pressure (SBP) was 124,71 mm Hg; diastolic blood pressure (DBP) – 81,25 mm Hg; pulse blood pressure (PBP) - 43,88 mm Hg. The Hauss curve of SBP, DBP, PBP in test was different from the normal one ($p < 0,0001$). Optimal BP ($< 120/80$ mm Hg) was registered with 49,7% of pilots ($n=591$), normal BP (120-129/80-84 mm Hg) – 30,9% ($n=367$), aloud high BP (130-139/85-89 mm Hg) – 30,9% ($n=181$). Therefore, the BP with the most of pilot (84,8%) was not higher than normal level. Number of pilots with BP higher than 140/90 mm Hg was 15,2% ($n=181$). Among them arterial hypertension 1 degree was in 14,7% ($n=175$), 2 degree – 0,5% ($n=6$) and 3 degree was not registered at all.

The diagnosis was clarified considering additional medical examination (monitoring of BP, ECG, EchoCG, triplex ultrasonography detection of the extracranial arteries, dynamic exercise) AH was registered in 26,7% of pilots ($n=318$). Damaged organs and associated of clinical conditions were not registered (revealed) in 13% ($n=155$); damaged organs were registered in 6,3% cases ($n=74$) mainly as atherosclerosis of extracranial arteries. Associated clinical conditions were revealed in 4 pilots.

Medical treatment was prescribed to 219 pilots out of 1189 (18,3%). Monotherapy was used in 56,6% cases; 2-medicines-therapy – 33,3%; 3-medicines-therapy – 4,1%. Medical examination was suspended in 6% cases ($n=11$).

Conclusions: Therefore, the arterial hypertension frequency among pilots 54-68 yrs in cases of first examination is 15,2% and at through medical examination – 26,7%. Medical prognosis depends on BP level and conditions of damaged organs. Pilots with AH received treatment and undergo regularly medical supervision by air company medical doctors.

OR42

English: **PREVALENCE AND CLINICAL FEATURES OF METABOLIC SYNDROME AMONG THE AVIATION PERSONNEL OF RUSSIAN CIVIL AVIATION**

French: **REPÈRES VIBROTACTILES DURANT DES VOLS D'HÉLICOPTÈRES DE LONGUE DURÉE SIMULÉS - UNE ÉTUDE PRÉLIMINAIRE**

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Metabolic syndrome is widely spread in today's society and according to the forecast up to 2025 more than half a billion people on the planet will have its manifestations. Taking into account the importance of the issue the study of its prevalence among the aviation personnel of Russian civil aviation (flight crews and air traffic controllers) was conducted. The verification of the metabolic syndrome was based on the criteria accepted in the Russian Federation similar to those of the International Diabetes Federation (2005). On the whole the data on the 155 cases of the metabolic syndrome among the aviation personnel recorded in 2012 were obtained. Of these in 128 cases accounting for 83% the metabolic syndrome was recorded among the flight crew members; in 27 cases (17%) – among the air traffic controllers. In regard to the ages of the patients having the metabolic syndrome persons ranging from 50 to 60 years old dominated.

Among the main clinical manifestations of the metabolic syndrome the most common are arterial hypertension (144 persons, or 92% of all cases of the metabolic syndrome) and obesity (137 persons, or 88%); the rest had overweight. 83 patients had dyslipidemia, 10 – type 2 diabetes, in 4 cases – impaired glucose tolerance.

In our opinion, the importance of obesity as a risk factor for cardiovascular disease and diabetes is often underestimated. Nevertheless in 2012 the frequency of obesity cases in the group of the flight crew having some diseases has reached 14,5%, and 2,6% persons had overweight. Among air traffic controllers the same indices were 15,1% and 3,2%.

Attention is drawn to the high frequency of prognostically adverse associations of metabolic risk factors. So the combination of hypertension, obesity and dyslipidemia was observed in 36% of cases, and the combination of the first two factors and diabetes or impaired glucose tolerance – in 9% of cases.

The above facts demonstrate the urgency of the problem of the metabolic syndrome among the aviation personnel of civil aviation, the solution of which requires the development of special therapeutic programmes.

OR43

English: **AVIATION SAFETY ISSUES OF MANDIBULAR PROGNATHISM IN A COMBAT PILOT. A CASE REPORT**

French: **QUESTIONS DE SÉCURITÉ AÉRIENNE RELIÉES AU PROGNATHISME MANDIBULAIRE CHEZ UN PILOTE DE CHASSE: UN RAPPORT DE CAS**

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Mandibular prognathism is a term coined in case of the mandible over-riding the maxilla with a cross bite of the dental occlusion element also termed as Skeletal Class III relation and Dental Class III Malocclusion. A 25 year old serving apparently healthy Air force combat pilot in A1G1 medical fitness reported to Dental Clinic with chief complaints of difficulty in chewing and abnormally protruding lower jaw leading to unsightly aesthetics, difficulty in mastication, altered speech and low morale. Clinical, radiological and cephalometric evaluation aided in the diagnosis of the subject as a case of Mandibular Prognathism. Aeromedical issues in the management revolved around altered concave facial profile with accentuated negative nasion menton angle compromising face mask fit as also speech alteration for effective communication, recovery post surgery, convalescence period and subsequently fitness for flying. As per norms for ideal dental fitness for armed forces, he was unfit since none of his anterior teeth came to approximation and posterior teeth were in complete cross bite. After obtaining written consent, he was operated under general anaesthesia for bilateral intra oral sagittal split osteotomy and posterior setback with rigid internal fixation. Post operative profile improved drastically, phonation improved especially the linguo- palatal sounds and the total mandibular Class III cross bite was corrected to normalcy with Class I harmonious occlusal scheme both dental and skeletal. The subject was placed out of flying category for three months for satisfactory healing of surgical bony wound subsequent to which he was evaluated and since bone healing was adequate, masticatory and phonetic functions had improved he was reverted back to his flying category.

KEY WORDS: Mandibular prognathism, Bilateral sagittal split osteotomy

OR44

English: **RETROGRADE INTRARENAL FLEXIBLE URETEROSCOPY FOR CALYCEAL CALCULI IN AVIATION PILOTS (REPORT OF 6 CASES)**

French: **URÉTÉROSCOPIE FLEXIBLE INTRARÉNALE RÉTROGRADE POUR LES CALCULS CALICIELS CHEZ LES PILOTES D'AVIATION (UN RAPPORT DE 6 CAS)**

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Introduction: Calyceal calculi in aviation pilots are an important problem with unique public safety implications. We assess the safety and efficacy of flexible ureteroscopy in the treatment of calyceal calculi for aviation pilots.

Methods: The records of 6 aviation pilots with calyceal calculi treated with retrograde flexible ureteroscopy in May 2013 were reviewed. Four cases of application of NGage" Nitinol stone extractor taken directly out little stones. Two cases of application of basket removal after 200µm fiber,0.8-1.2J/5-10Hz power holmium laser lithotripsy. The results were evaluated with computed tomography (CT).CT scan was performed 14 days after double-J stent removal to identify absence of stones. We defined a stone-free status as the absence of fragments in the kidney or fragments of

Results: Six aviation pilots were identified for a total of 21 calyceal calculi with size range 215mm, 18 of them were detected (85.7%). The success rate of stone fragmentation after one session was 100% (18/18). The operation time ranged from 30 to 95 min (mean 66.7min). No intraoperative bleeding. The patients were discharged from hospital in 3-4 days (mean 3.7 days) after the operation. No major intraoperative or postoperative complications occurred.

Three positive stones (3/21) in CT scan images could not be found in flexible ureteroscopy which were considered as calculus in concealed calyceal. No residual stones in CT scan images after operation 4 weeks, except three calculi in concealed calyceal, and no ureter stricture and vesicoureteral reflux occurred.

Conclusions: Flexible ureteroscopy is a safe and effective treatment for calyceal calculi, especially for aviation pilots with unfavorable anatomic factors related to ESWL and those with minor stones and without significant hydronephrosis. Through retrograde intrarenal flexible ureteroscopy can clear whether there is calculus in calyceal and the diagnosis of calculus in concealed calyceal, providing direct evidence for the aeromedical certification

OR45

English: **A CASE REPORT OF SURGERY FOR CERVICAL ECTOPIC THYMIC CYST IN CHINESE PILOT**

French: **RAPPORT D'UN CAS DE CHIRURGIE DE KYSTE THYMIQUE ECTOPIQUE CERVICAL CHEZ UN PILOTE CHINOIS**

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Objective: To improve the knowledge of cervical ectopic thymic cyst.

Methods: Our department received one case of cervical ectopic thymic cyst in November of 2008, male, pilot, 39 years old. He was received because of "shortness of breath about two months". Examination after admission: Tumor located at the lower pole of the right lobe of the thyroid, approximately 4.0cm smooth palpable mass, CT: the mass was on the right lower pole of the thyroid with surrounding clear boundary. It was diagnosed of nodular goiter with cystic change before operation.

Results: The surgery was taken on after general anesthesia on November 21,2008, Among operation we found the tumor located behind the lower pole of the right lobe of the thyroid, with clear boundary. The recurrent laryngeal nerve was jacked by the tumor in the right tracheoesophageal groove the nerve located in the tumor surface and was closed to the reserve side of strap muscles. separated the recurrent laryngeal nerve along the tumor carefully, resected the tumor completely. The patient felt shortness of breath eased significantly when he was awake after anesthesia. The pathological examination: The censorship matter was thymic cyst. The patient discharged from hospital on the third day after operation. He was permitted flight 3 months after surgery. There was no recurrence in the follow-up.

Conclusions: The tumor was misdiagnosed, mainly because the tumor was at the lower pole of thyroid gland, whose boundaries with thyroid tissue was not clear. Then cervical ectopic thymic cysts is so rare in clinical work that we lacked the relevant experience. The location of the recurrent laryngeal nerve in patients was variable because it was raised by the cysts. We protected the recurrent laryngeal nerve during operation . We dissected carefully and protected the recurrent laryngeal nerve during operation .The recurrent laryngeal nerve was intact to ensure his normal flight.

OR46

English: **HEARING LOSS IN AVIATORS NATURAL HISTORY AND RISK FACTORS**

French: **PERTE AUDITIVE CHEZ LES AVIATEURS: HISTOIRE NATURELLE ET FACTEURS DE RISQUE**

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Background: aviators are exposed to considerable ambient noise during their career. Previous research has shown hearing loss in Israeli aviators.

Objective: to describe the natural history of hearing loss in Israeli aviators and to examine potential risk factors.

Methods: Aviators in the IAF go through yearly audiometry. We randomly selected medical records of aviators from four flight platforms: fighter-jets, transport, utility- and attack-helicopters, who were at least forty years old at time of the study, and had a normal audiometry at entry to the flight academy. We examined the audiometry at age 30 and the last audiometry performed for hearing loss. We defined hearing loss as a pure-tone threshold of 30 DB and above at any frequency and severe hearing loss as a pure tone threshold of 40 DB and above. We determined if the hearing loss was typical of phonal trauma (3-6 KHz) or if it affected the speech-frequencies (0.5-2 KHz).. The analysis was descriptive for hearing loss, and linear regression was used to determine the odds ratio for the risk factors (hours of flying, age, platform, ear-plug use).

Results: the study included 163 aviators, all males. 54 were fighter-pilots, 30 were transport pilots, 26 were attack-helicopter pilots, 53 were utility- helicopter pilots. We found that at age of 30 9% presented mild hearing loss. No one presented with severe hearing loss. At the last examination 39% had hearing loss, 12% severe. Helicopter pilots (attack and utility) and jet fighters had similar degrees of hearing loss (38%, 39%, 42% respectively), while transport pilots had lower rates (33%) at the last examination. The rate of severe hearing loss was highest in attack helicopter pilots (19%).

Conclusions: a substantial percent of aviators in the IAF develop some degree of hearing loss during service. It appears that transport personnel have the lowest risk.

OR47**English: G-TOLERANCE WITH AN ELECTRICAL MUSCLE STIMULATION SUIT****French: LA TOLÉRANCE À LA FORCE G ASSISTÉE PAR UNE COMBINAISON QUI STIMULE ÉLECTRIQUEMENT LES MUSCLES**U. Balldin, J. Gibbons

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Electrical muscle stimulation (EMS) has been shown to increase the systemic blood pressure similarly to a standard G-suit or voluntary lower body muscle straining at +1 Gz. It was hypothesized that EMS also could be applied for improving G-protection at increased G levels. METHODS: An EMS suit was developed with electrodes located over the calves, thighs, gluteal and abdominal muscles. Nine male subjects (of fifteen planned) were tested in a human-rated centrifuge up to + 9Gz. The optimal EMS suit stimulation of each muscle group was tested before the data collection. The stimulators were automatically activated above + 4 G. G-tolerance with the EMS suit was compared to a standard 5-bladder G-suit (std) during different days. RESULTS: Preliminary statistical analyzes of data with 9 subjects clearly showed inferior G-protection with the EMS suit. Therefore, the study was stopped to avoid further risk exposures to the subjects. Final data analyzes showed that the maximal G-level during relaxed Gradual Onset Runs (GOR) was 1.1 G higher, during relaxed Rapid Onset Runs (ROR) 1.5 G higher and during straining ROR 2.0 G higher with std compared to EMS suit. The Simulated Aerial Combat Maneuver (SACM) G-exposure duration was 46 s longer with std compared to EMS suits. At relaxed GOR the average heart rate was 9 bpm lower and at SACM 23 bpm lower with std compared to EMS suits. The effort level was 1.5 units lower during SACM, the discomfort level 1.2 units lower during relaxed ROR and the peripheral light loss during relaxed ROR was less with std compared to EMS suit. All these differences were statistically significant. There were 4 G- LOCs with the EMS and none with std suit. CONCLUSION: The EMS suit showed an inferior G-protection compared to a standard G-suit in all the tested G-exposures.

OR48

English: **VIBROTACTILE CUES IN LONG-DURATION SIMULATED HELICOPTER FLIGHT - A PRELIMINARY STUDY**

French: **REPÈRES VIBROTACTILES DURANT DES VOLS D'HÉLICOPTÈRES SIMULÉS DE LONGUE DURÉE - UNE ÉTUDE PRÉLIMINAIRE**

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Introduction: Research has shown that tactile cues, as provided by the tactile situation awareness system (TSAS), improve flight performance in degraded visual environments and safely maintain fatigued helicopter pilot performance during hover over moving targets. Performance of aviators using TSAS over a prolonged mission has not been previously studied; it is possible that, over an extended period, users could adapt and habituate to tactile stimuli. Further, pilots' physiological response (e.g., perspiration) to hot-weather operations may interfere with their accurate perception of vibrotactile stimuli. The purpose of this investigation was to determine if aircrew performance with TSAS would be affected by prolonged mission duration or peri-tactor moisture.

Methods: Four male UH-60 aviators participated in this preliminary study. Participants completed four consecutive iterations of a 3-hour flight profile consisting of 10 maneuvers in the USAARL UH-60 Black Hawk research flight simulator. Subjects performed a total of 12 hours of continuous flight while wearing the TSAS-Lite system, consisting of a vibrotactile belt, shoulder harness, and seat cushion. Flight performance, tactor information, responses to a discomfort questionnaire, and ratings of fatigue symptoms were recorded.

Results: The independent variable in all analyses was session (four levels). Independent-samples Kruskal-Wallis tests showed that performance per maneuver and proportion of stimulus cues (measure of response to cues) per maneuver were consistent across sessions ($p < 0.05$).

Conclusion: The findings of this preliminary assessment support the use of tactile displays in long-duration helicopter flight and in hot-weather conditions. Vibrotactile displays remain a viable solution to aircrew orientation and safety while flying in a degraded visual environment.

OR49

English: **BAROREFLEX FUNCTIONS DURING EXPOSURE TO NON-HYPOXIC HYPOBARIA**
French: **FONCTIONS DES BARORÉFLEXES PENDANT UNE EXPOSITION HYPOBARE NON-HYPOXIQUE**

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Introduction- Certain operational constraints prohibit pressurisation in a few military aircraft below 15,000. To prevent hypoxia, during such exposures, aircrew breathe appropriate air-oxygen mixture. Such exposures to non-hypoxic hypobaria increase parasympathetic influences and attenuate pressor responses to isometric muscle tensing. The present study examined baroreflex functions in humans during exposure to non-hypoxic hypobaria for 5 hours.

Methodology- Baroreflex sensitivity was measured as peak-trough amplitude (in R-R interval tachogram) and power around 0.1 Hz in the heart rate variability (HRV) power spectra, derived from 2 min of ECG recordings, during engagement of 15 male subjects in a controlled breathing protocol in normoxic normobaria (breathing air at 3,159 AMSL; 0.92 ATA) and after 25 min & 5 hours of exposure to non-hypoxic hypobaria (breathing ~40% oxygen at 15,000 equivalent; 0.56 ATA).

Results- Controlled breathing at 0.1 Hz concentrated most of the power (~70% of total) in HRV spectra in a narrow confine of 0.084-0.108 Hz. Peak-trough amplitude and power around 0.1 Hz exhibited a transient increase at 25 minutes of exposure to non-hypoxic hypobaria ($p=0.003$ and $p=0.020$, respectively). After normalization to mean R-R, only changes in peak-trough amplitude remained significant ($p=0.027$). The values at 5 hours of exposure were not different from those in normoxic normobaria ($p=0.111$ and $p=0.733$, respectively). It was despite a persistent increase in cardiac vagal activity evident from increase in pNN50 ($p=0.004$) and tonic modulation of R-R intervals ($p=8.40E-0.4$). Peak-Trough amplitude and Power around 0.1 Hz correlated significantly with pNN50 ($r=0.915-0.935$ and $r=0.842-0.915$).

Conclusions- Baroreflex sensitivity, measured through above protocol, increases transiently during exposure to non-hypoxic hypobaria. The effect was independent of PAO₂ and cardiac vagal status.

Keywords- Non-hypoxic Hypobaria, Baroreflex Sensitivity

OR50

English: **THE INFLUENCE OF HYPOXIA ON COGNITIVE FUNCTIONS AND ELECTRICAL ACTIVITY OF THE BRAIN**

French: **L'INFLUENCE DE L'HYPOXIE SUR LES FONCTIONS COGNITIVES ET L'ACTIVITÉ ÉLECTRIQUE DU CERVEAU**

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Introduction: We have investigated the immediate effects of hypoxia in several experiments both in hypobaric and normobaric conditions. We have measured performance and event related brain potentials (ERP) associated with various cognitive reaction time (RT) tasks and regional cerebral blood flow (rCBF) in one experiment.

Methods: Hypobaric experiments (1 and 3) were performed during chamber flights to 5500m. In normobaric studies (2 and 4) 80% O₂ saturation was maintained by breathing nitrox mixture. In Experiments 1 and 2 subjects had to respond to infrequent visual target stimuli and ignore the frequent standard stimuli slightly different from the targets as well as the infrequent variable novel stimuli. ERP was measured simultaneously. In Experiment-3 subjects listened to mans and womans names pronounced by various male and female speakers. They had to indicate either the gender of the voice or that of the name. In experiment-4 rCBF was measured with positron emission tomography (PET) while subjects performed a cognitive RT task.

Results: Hypoxia resulted in marked decrease of the P3a ERP component evoked by novel stimuli in the oddball tasks. Incompatible stimuli (e.g. mans name on a female voice) resulted in increased reaction times (and errors). This effect of incongruence was enhanced in hypoxia. Areas of decreased perfusion in hypoxia were found in the medial prefrontal cortex as well as in a visual area, the lingual gyrus.

Conclusion: All of the above results could be attributed to particular vulnerability of prefrontal brain areas responsible for the executive control of behavior. These findings might have operational implications in aviation and mountaineering and provide insights to the neuro-behavioral consequences of obstructive sleep apnea and COPD. Comparison with similar findings in sleep deprivation, fatigue or aging opens a window to the possibly common mechanism behind the cognitive consequences of these challenges.

OR51

English: **THE EFFECT OF EXERCISE ON ALTITUDE-INDUCED HYPOXAEMIA AND THE IMPLICATIONS FOR SUPPLEMENTAL OXYGEN SYSTEM TESTING AND USE.**

French: **L'EFFET DE L'EXERCICE SUR L'HYPOXÉMIE INDUITE EN ALTITUDE ET IES INCIDENCES SUR L'EXAMEN ET L'UTILISATION DU SYSTÈME D'OXYGÈNE D'APPOINT**

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Introduction: Exercise exaggerates physiological markers of hypoxaemia at pressure altitudes (PAs) as low as 6700ft. However, exercise is not typically a feature of PA limits for flight without supplemental oxygen in unpressurised aircraft. Physiological markers of hypoxaemia are also used as outcome measures in the assessment of protection provided by oxygen delivery systems at altitude. The study aim was to assess the effect of different exercise levels on physiological markers of hypoxaemia at PAs relevant to UK aircrew.

Methods: Nine healthy volunteers (8 male, 1 female) provided written informed consent and completed hypobaric chamber exposures at three altitudes to simulate upper limits of: i) pressurized cabins (8000ft PA); ii) flight crew in unpressurised cabins without supplemental oxygen (10000ft PA); and iii) cargo despatchers or parachutists in unpressurised cabins without supplemental oxygen (12000ft PA). Physiological parameters (including peripheral arterial oxygen saturation [SpO₂] and end-tidal gases) were measured at rest and, to simulate flying and rearcrew workloads, during 30 W and 150 W exercise on a cycle ergometer, respectively. The Ministry of Defense Research Ethics Committee approved the study.

Results: During rest, 30 W and 150 W exercise SpO₂ was 91.0±2.2 (88-96), 89.1±4.3 (84-93), and 85.1±4.3 (79-91) % at 8000ft PA; 87.7±3.7 (84-92), 84.2±3.2 (79-89) and 81.8±4.9 (71-89) % at 10000ft PA; and 82.4±4.8 (74-88), 75.6±3.8 (70-82), and 73.9±7.4 (62-84) % at 12000ft PA respectively. Data are mean ±S.D. (range).

Discussion: SpO₂ decreased with altitude and exercise, providing further evidence that exercise should be considered in altitude threshold guidelines for supplemental oxygen use in aviation. Further studies are required to investigate if these physiological changes affect flight safety relevant performance. During oxygen system testing the effect of exercise on physiological outcome measures should be assessed while breathing air at the control altitude.

OR52

English: **RESTRAINT USE: SIMULATING GY**

French: **UTILISATION DE SYSTÈME DE RETENUE : SIMULATION EN 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.

OR53

English: **SUDDEN LOSS OF CONSCIOUSNESS AND CONVULSIONS DURING ALTITUDE CHAMBER TRAINING**

French: **PERTE DE CONSCIENCE SUBITE ET CONVULSIONS DURANT UNE FORMATION EN CHAMBRE HYPOBARE**

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Background: reports on sudden loss of consciousness and convulsions during sudden decompression training in altitude chambers are scarce. An evidence- based treatment protocol is lacking.

Case report: a 23 year old female fighter-jet navigator went through a routine altitude chamber training. History was non-significant, and medical flight permit was up-to-date. The first protocol of hypoxia (elevation of 5000 feet per minute up to 25000 feet) after denitrogenation was unremarkable. During sudden-decompression protocol (from 8000 feet to 22500 feet almost instantly) she lost consciousness and began convulsing. Oxygen was administered, the chamber was crashed to the ground level and medical treatment begun. Subcutaneous emphysema was remarkable. Convulsion stopped spontaneously after 7 minutes, and she returned to full consciousness with no postictal state. An emergency ground transport was done to the closest hospital with hyper-baric chamber present. The patient was fully conscious and with no neurological residua. An MRI and MRA of the brain were conducted with no significant findings. Pneumothorax, pneumomediastinum and pneumopericard were diagnosed. The patient was admitted in the ICU and treated with oxygen. After 2 days she was discharged with a diagnosis of pulmonary barotrauma. In the follow up tests (lung function, metacholine challenge, computed tomography and EEG) no significant findings were detected. After 6 months the aviator was returned to full flying status.

Summary: there is a differential diagnosis to sudden loss of consciousness and convulsions even in the presence of pulmonary baro-trauma. A treatment protocol needs to be established for future events.

OR54

English: **LYME DISEASE COMPLICATED BY CARDITIS IN A 51 YEAR OLD PILOT - AEROMEDICAL CONCERNS**

French: **MALADIE DE LYME COMPLIQUÉE PAR UN CARDITE CHEZ UN PILOTE DE 51 ANS - IMPLICATIONS AÉROMÉDICALES**

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The case of a 51 year old airline pilot who contracted Lyme disease is described. He presented with rapidly decreasing exercise tolerance, having noted an erythematous eruption on his abdomen one month before.

Echocardiography appeared normal and he completed an exercise test without any ECG changes, but became hypotensive at peak exercise with persistent sinus tachycardia. A 3 week course of IV ceftriaxone was started for a presumptive diagnosis of Lyme disease complicated by carditis. Serology was subsequently positive for Lyme disease and his symptoms improved during treatment, only to partially relapse on discontinuing the antibiotic. Further assessment with echocardiography and a CT angiogram was satisfactory. It was decided to maintain him on oral doxycycline for 6 months. Over this period his symptoms of general fatigue, exercise intolerance and poor concentration showed a fluctuating but improving pattern.

Three months after discontinuing all therapy, he was symptom free and a full cardiac assessment was satisfactory. His exercise capacity was excellent with no symptoms or ECG changes and he was returned to flying status with a multicrew restriction. Cardiology review after 1 year was unremarkable and the multicrew restriction was removed. Unfortunately he was grounded 6 months later with a recurrence of symptoms, which he was concerned represented a relapse of his original disease. His doctor recommenced oral doxycycline and his fatigue and concentration slowly improved over 3 months. On subsequent aeromedical review all routine investigations were normal, except that his previous incomplete RBBB pattern on ECG was now complete. He was returned to flying with a requirement for annual review.

Cardiac complications in Lyme disease occur in 5-10% of cases, the commonest being transient atrioventricular conduction abnormalities. Arrhythmias, impaired ventricular contractility and pericarditis are less common. Cardiac complications of Lyme disease and their potential impact on aeromedical fitness are discussed, and the more contentious issue of chronic Lyme disease and the pilot is explored.

OR55

English: **BRUGADA ELECTROCARDIOGRAMS IN AIRCREW - AEROMEDICAL RISK?**

French: **BRUGADA À L'ÉLECTROCARDIOGRAMME D'UN NAVIGANT - RISQUE AÉROMÉDICAL?**

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Introduction: Cardiac arrhythmias are an aviation medicine problem impacting the flying career of aircrew. Discovery of a Brugada electrocardiogram (ECG) on entry and in trained aircrew requires completion of an extensive cardiovascular (CV) workup. Recent advances in diagnostic workup have improved the return to flight duty of trained aircrew. The Military Flight Surgeon or the Aviation Medicine Examiner (AME) must determine the risk of the cardiac arrhythmias, available treatment options, and ultimately fitness for flying duty. Recent reviews have identified a low risk (asymptomatic individuals). This review was conducted to determine the incidence of Brugada pattern ECG and the prognosis for return to flight status. The data was extracted from the US Army Aeromedical Epidemiology Data Register (AEDR) maintained at Fort Rucker, Alabama, USA.

Methods: The USA Aeromedical Epidemiology Data Register (AEDR) was established in 1984 and contains approximately 685,000 FDME records for approximately 145,000 aircrew. It was searched for the ICD-9 code of 746.89 for Brugada. In the AEDR data base, this is coded as other specified anomalies of the heart. Any associated diagnoses at the time of the most recent Flying Duty Medical Examination (FDME) were also reviewed. The final disposition was evaluated to identify aircrew with the diagnosis of Brugada permanently disqualified.

Results: During the period 1998-2012, thirteen (13) cases were identified that were listed as Brugada or considered as a suspected Brugada like ECG (0.009%). Of these cases, only one (1) case was confirmed as meeting the criteria of Brugada on ECG. Review of the cardiovascular evaluation, and follow-up of these cases will be presented. Evaluation required by the FAA, EASA, ICAO, and US military regulations will be discussed.

Conclusions: Entry level aviators would be disqualified. Trained aircrew subsequently identified as having the ECG diagnosis of Brugada, require extensive evaluation to determine risk of arrhythmia/sudden death. Those aircrew without arrhythmias after challenge could be considered for waiver.

OR56

English: **ECHOCARDIOGRAPHIC FINDINGS IN YOUNG HEALTHY SUBJECTS BEFORE AND AFTER INTENSE PHYSICAL TRAINING**

French: **CONSTATS ÉCHOCARDIOGRAPHIQUES CHEZ DES JEUNES SUJETS EN SANTÉ AVANT ET APRÈS EXERCICE PHYSIQUE INTENSE**

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Objective: To determine normal M mode echocardiographic values in healthy young adults and to evaluate whether an intense period of physical activity influences these values.

Methods: A cross-sectional study evaluating a cohort of young healthy air force academy applicants of the Israeli air force (IAF) in the years 1994-2010. Only studies interpreted as normal were included. These were divided into those performed routinely and those performed because of findings on history, physical examination or electrocardiography and echocardiographic findings were compared between the two groups. Routine echocardiographic studies were performed following completion of a non-medical selection process, during which applicants performed intense physical activity. Values are expressed as mean and standard deviation

Results: Echocardiography was performed routinely in 3,525 applicants and because of a clinical indication in 3,517 applicants. Those in whom echocardiography was performed routinely had slightly higher left ventricular

end systolic volume (31.2 ± 3.3 mm vs. 30.7 ± 3.4 mm; pdiameter (28.5 ± 2.1 vs. 27.9 ± 2.2 mm) and slightly lower pulmonary artery systolic pressure (25.2 ± 4.4 mmHg vs. 27.5 ± 4.4 mmHg) and left ventricular mass index (108.8 ± 15.8 vs. 109.9 ± 16.5). No differences were noted between the two groups in left atrial diameter (33.3 ± 3.3 mm vs. 33.4 ± 3.8 mm), left ventricular end diastolic volume (50.7 ± 3.4 vs. 50.8 ± 3.3 mm), posterior wall thickness (8.6 ± 0.9 vs. 8.6 ± 1 mm) and interventricular septum thickness (9 ± 0.8 vs. 9 ± 1 mm).

Conclusions: Normal M mode values in healthy young adults may be different than those reported for the general population. Several months of intensive physical activity result in mild changes in echocardiographic findings in young healthy individuals.

OR57

English: **PULMONARY ARTERY PRESSURE IN YOUNG HEALTHY SUBJECTS.**

French: **PRESSION ARTÉRIELLE PULMONAIRE CHEZ DES SUJETS JEUNES EN SANTÉ**

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Background: Pulmonary artery systolic pressure (PASP) is frequently measured noninvasively using transthoracic echocardiography. Normal values of PASP are based on studies performed in heterogeneous populations. The normal values of PASP in young healthy subjects are poorly defined. The aim of this study was to describe the distribution and clinical and morphologic correlates of PASP values in young healthy subjects.

Methods: Echocardiography is routinely performed for aircrew candidates for the Israeli Air Force. All echocardiographic examinations performed between 1994 and 2010 in which tricuspid regurgitation was present, a prerequisite for echocardiographic PASP measurement, were collected. Subjects with morphologic abnormalities were excluded. PASP was calculated using the simplified Bernoulli equation, with right atrial pressure assumed to be 5 mm Hg. The associations between PASP and clinical and echocardiographic characteristics were studied.

Results: Subjects were healthy young adults aged 17 to 29 years. Evidence of tricuspid regurgitation was found in 1,900 of 6,598 subjects. The estimated mean PASP value was 31.2 ± 4.5 mm Hg, and the upper 95th percentile was 34 mm Hg. In univariate analysis, PASP was correlated with left ventricular end-diastolic and end-systolic diameters. A multivariate linear regression model including age; diastolic blood pressure; echocardiographic measurements of aortic root, left atrial, and left ventricular end-diastolic diameters; and left ventricular mass explained only 7% of the variability in PASP.

Conclusions: PASP in young, physically fit subjects may be higher than previously reported in the general population and is poorly explained by age, blood pressure, and other echocardiographic parameters

OR58

English: **PRE-PARTICIPATION ECG SCREENING IN MILITARY RECRUITS**

French: **DÉPISTAGE ÉLECTROCARDIOGRAPHIQUE EN PRÉ-PARTICIPATION CHEZ LES RECRUS MILITAIRES**

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Objectives: To evaluate the rate of abnormal findings on pre-participation electrocardiography (ECG) in young adults and the additional evaluations required based on these findings

Design: Retrospective-cohort study

Settings: The Israeli air force (IAF) aero medical center screening center for flight academy and elite units candidates

Patients: Flight academy and elite units candidates undergo pre-participation ECG prior to their enlistment to the Israeli Defense Forces (IDF). Since 2010 all ECGs are performed at the IAF aero medical center. All ECGs performed since January 2010 were analyzed by one of three cardiologists and all those in which significant findings were identified were referred to further evaluation based on the cardiologist's request. Causes of referral for further evaluation, the evaluations performed and the results of these evaluations are reported for the study population.

Main outcome measures: Rate of abnormal ECGs in study population, further examinations requested and results of these evaluations

Results: 1455 ECGs were performed in the years 2010-2011. Of these, 1388 (95.39%) were interpreted as normal. 67 subjects were referred to further evaluation based on ECG findings. The most common findings leading to further evaluation were T wave changes (16 cases, 23.88%), pre-excitation pattern (14, 20.89%) and voltage criteria for left ventricular hypertrophy (11, 16.41%). Only 7 subjects (10.44%) had abnormal findings which were considered clinically significant at the end of the medical evaluation.

Conclusions: The rate of significant findings leading to disqualification from military activity is extremely low and referral to continued investigations based on 12-lead ECG findings should be judicious.

OR59

English: **SEDENTARY LONG-DURATION HEAD-DOWN BED REST INCREASES REPOLARIZATION HETEROGENEITY**

French: **ALITEMENT SÉDENTAIRE TÊTE EN BAS DE LONGUE DURÉE AUGMENTE L'HÉTÉROGÉNÉITÉ DE LA REPOLARISATION**

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Introduction: We studied the effects of 90 days of 6° head-down bed rest (HDBR) on cardiac autonomic and advanced electrocardiographic (ECG) function, especially on repolarization heterogeneity as assessed by beat-to-beat QT interval variability (QTV), T-wave complexity (TWC) and 3-dimensional ECG. Based on prior observations of lengthening of the QTc interval during long- duration space flight, we hypothesized that abnormalities in ECG repolarization would occur during long-duration HDBR.

Methods: Five-minute supine high-fidelity 12-lead ECGs were obtained from 20 healthy subjects (14 men and 6 women) during controlled breathing, together with measurements of plasma volume and electrolytes at five points in time: within 10 days before, 28-30, 60 and 90 days into, and 3-5 days after HDBR. **Results:** By repeated measures ANOVA, 90 days of sedentary HDBR significantly increased beat-to-beat QTV, TWC and the spatial QRS-T angle and decreased the spatial ventricular gradient. These changes resolved in part by 3-5 days after resumption of ambulation but unlike concomitant changes in the QTc interval itself and in heart rate variability, they did not significantly relate to changes in electrolytes or plasma volume.

Conclusions: Sedentary, long-duration HDBR reversibly increases ECG repolarization heterogeneity and potentially arrhythmic risk.

OR60

English: **MENTAL HEALTH ENDPOINTS IN USAF REMOTELY PILOTED AIRCRAFT PILOTS**
French: **CRITÈRES D'ÉVALUATION EN SANTÉ MENTALE CHEZ LES PILOTES D'AVIONS**
CONTRÔLÉS À DISTANCE

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Background: The lay press has often headlined "PTSD in drone pilots". For over a decade, the US Air Force (USAF) has performed multiple evaluations and surveys on Remotely Piloted Aircraft (RPA) operations and this specific population. While they do report high levels of stress and fatigue, mental health (MH) diagnoses have not been found to be a significant problem. However, the perception persists.

Methods: The Armed Forces Health Surveillance Center compiled electronic health and demographic data on USAF personnel, including manned pilots and RPA pilots from 2003 to 2011. Using 12 specific MH diagnoses (including Post-Traumatic Stress Disorder or PTSD, depressive disorders and anxiety disorders), various incidence rates for USAF personnel were calculated. Using service code data, rates for differing USAF jobs were also calculated. Using deployment data, rates for subgroups were further evaluated. Rates from USAF manned pilots deployed to Iraq or Afghanistan were compared to those of non-deployed RPA pilots.

Results: Overall rates in USAF pilots were very low compared to overall USAF rates. The unadjusted incidence rate of all MH outcomes in RPA pilots (n=709) was 25.0 per 1000 person-years. Rate for manned aircraft pilots (n=5256) was 15.9 per 1000 person-years. The rate ratio was 1.1 with 95% confidence interval from 0.9 1.5. Adjustments in the data for age, deployment status and time in service showed that no differences existed in RPA and manned pilots. Pilot rates were also found to be much lower than overall USAF rates and than rates for specific job series.

Conclusion: There was no difference in the rates of MH outcomes between RPA and manned aviators.

Additionally, the MH incident rates in pilots were much lower than those in the rest of the USAF.

OR61

English: **HUMAN FACTORS IN UAV OPS - AN INDIAN PERSPECTIVE**

French: **LES FACTEURS HUMAINS DANS LES 'UAV OPS' - UNE PERSPECTIVE INDIENNE**

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Introduction: Reconnoiter unmanned aerial vehicle (UAV) have been in operational use in the Indian Air Force for more than a decade. Two human factors and ergonomics (HF/E) surveys among UAV Operators were undertaken: first at the time of UAV induction and another about five years later. During that period, UAV had baptism with fire during a prolonged conflict on the Western borders in 2001-02. A few UAV related incidents and accidents had also occurred. This paper takes a critical re-look at existing Human Factors issues in UAV operations to define the roadmap for optimal utilization of UAV, in view of likely induction of combat UAV.

Methods: Review of studies related to human factors in UAV operations in the Indian Air Force was undertaken. This was to evaluate outstanding HF/E issues, in line with relevant current human factors literature.

Results: Results are presented in narrative style based on the review of existing but small body of work in India. The two HF/E surveys highlighted healthy motivation, positive interaction among operating crew and satisfaction with the state of the art UAV system. Salient negative findings were long working hours, absence of shift work and fatigue. NASA Task Load Index (NASA TLX), as a workload assessment tool, showed significant difference between routine squadron activities and UAV operations. Early incidents/accidents had elements of human error, in particular signifying the need for improved coordination among operators, both within the system and with the conventional aviation activities.

Discussion: A critical review of the HF/E analysis of UAV operations in India is presented. At individual level the task outcome needs to be balanced with an understanding about circadian rhythm and defined work rest schedule to prevent occupational health risks. At the organisational level, crew resource management training is advocated for enhanced team cognition and improved coordination. This is particularly relevant for safe integration of UAV operations with conventional military aviation.

OR62English: **TOOLS FOR MANNING AND ASSESSMENT OF UAS OPERATORS**French: **OUTILS POUR L'EMBAUCHE ET L'ÉVALUATION DES OPÉRATEURS UAS**N. Samuel, T. Silberring

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The UAS world is constantly growing and evolving, demanding high performance of its Operators at highly diverse missions. Many of today's most pressing UAS issues relate to Human Factors aspects of mission performance. Much focus is brought to the challenge of manning the Operator position, with ongoing disputes over setting the standard criteria for this demanding role. Correct placement of individuals in this position can lower drop-out rate, decrease certification costs, and deliver better operational results. In this presentation, common criteria and screening methods available today shall be discussed, and present several approaches to the Operator screening challenge from the Human Factors perspective. Finally, the importance of assessing Operators' performance on the job shall be elaborated.

OR63

English: **HUMAN IMPACT ON SAFETY ASPECTS IN UAS OPERATION**

French: **L'IMPACT HUMAIN SUR LES ASPECTS DE SÉCURITÉ DANS L'OPÉRATION D'UAS**

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The methodology, the mission requirements, the unique environment, the long missions, and the quiet environment all make quite a difference between a Pilot and a UAS Operator. Our human senses are used differently in manned aviation in comparison to unmanned; it may be easier sometimes but could also be much harder to a large extent (From 3D to 2D, from an individual activity to a group activity, etc) The medical condition and the Skills of the operator need to be evaluated in a different manner in comparison to a Pilot.

Some countries use certified Pilots for UAS operation while others do not, special attention needs to be given to the whole process of how to avoid accidents and use these systems effectively and safe.

The lecture will present the dilemmas, examples of accidents, operator performance and the way IAI is handling them to analyze and improve the human factor and the human interface to the System.

OR64

English: **COGNITIVE EFFECTS DURING AND AFTER PREGNANCY IN A PILOT**

French: **EFFETS COGNITIFS SUR UNE PILOTE PENDANT ET APRÈS LA GROSSESSE**

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Introduction: Discordant findings have been reported about the change in pregnant women cognitive test performance. Visuo-spatial abilities, which are crucial in terrestrial/flight navigation, could be influenced by hormonal variations. Case report: A 32-year-old Italian Air Force pilot underwent a 2-D Mental Rotation Task (MRT) and hormonal assessment in the second trimester of pregnancy and one year after delivery. Her performance was compared with that of two non-pregnant groups of women: one with flying experience and the other without. Estradiol and progesterone were significantly higher in pregnancy compared with postpartum, while testosterone resulted almost unchanged. During pregnancy, we observed a significant difference in the subjects response time compared with pilots (she was slower) and non-pilots (she was faster). One year after delivery, her performance was still better than the non-pilot group and was almost the same as the pilot group. Discussion: Our data are consistent with an effect of pregnancy on visuo-spatial ability that can last for some times after delivery even with the early recovery of the hormonal levels. MRT smoothly changed in our subject supporting previous findings that women who are experts in flight navigation are less sensitive to hormonal fluctuations. Conclusion: This case seems to suggest that visuo-spatial ability requiring effortful processing undergoes variations during pregnancy and postpartum.

OR65**English: CIRCADIAN CHANGES OF COGNITIVE EXECUTIVE FUNCTION IN PILOT CADETS****French: CHANGEMENTS CIRCADIENS DE LA FONCTION EXÉCUTIVE COGNITIVE CHEZ LES PILOTES CADETS**D. Todder, S. Gordona, N. Getter, D. Garbi

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The circadian rhythms of humans include two distinct periods of maximal somnolence. The first is between 02:00-05:00, and the second is between 15:00- 17:00. It is well known that sleep deprivation affects cognitive function as a whole but particularly the executive function. Recent studies proved that circadian rhythms also affect the executive function. Less is known about the influence of the circadian rhythms in a very high function population such as pilots. Since executive function is crucial for pilot's function, it is of major importance to examine the influence of circadian rhythms on executive function in this population.

We recruited 3 groups of pilot cadets who took the same executive function test battery twice on two consecutive days: on the first day, one group took the test at 09:00, the second group took the test at 15:00 and the third group at 19:00. On the following day, each group was divided into three subgroups. Three subgroups, one from each initial group took the test again at 09:00. Three other subgroups, one from each initial group, took the test again at 15:00 and the three remaining subgroups took the test again at 19:00. This design allowed us to control for the test-retest effect while the circadian rhythm remained the major variable.

The following cognitive tests were used: Mental rotation as an integrative executive function task, switching abilities using the CRS paradigm and the anti saccade for inhibition assessment.

In the conference the results of this study will be presented.

OR66

English: **MENTAL FATIGUE DURING FLIGHT SIMULATION IMPAIRED PRE-ATTENTIVE CHANGE DETECTION: EVIDENCE FROM VISUAL MISMATCH NEGATIVITY**

French: **LA FATIGUE MENTALE PENDANT UN VOL SIMULÉ DIMINUE LE DÉTECTION DE CHANGEMENT PRÉ-ATTENTIF: EVIDENCE OBTENUE PAR 'VISUAL MISMATCH NEGATIVITY'**

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Introduction: Mental fatigue during flight has not been well conducted. We investigated the effect of mental fatigue during flight on brain cognition by recording the mismatch negativity (MMN) of event-related potentials (ERPs). MMN can be elicited by infrequent deviant stimuli inserted randomly in a sequence of frequent standard stimuli presented outside of the focus of attention, reflecting the memory-comparison-based automatic processing as an important cognitive function for human survival.

Methods: 20 participants performed a flight simulation task for 4 hours. Before and after flight simulation, the subjective fatigue symptom questionnaire and VAS were employed to evaluate the participants state of mental fatigue. And then, a novel multi-feature vMMN paradigm was conducted for each participant, in which the black cross in the center of screen became bigger or smaller unpredictably (mean frequency: 15/min; 22/block) and the participants were requested to ignore the peripheral stimuli and press the left or the right button as quickly and accurately as possible when the size of the cross changed. Five types of deviant visual stimuli were presented with the solid red rectangles as standard stimuli. Electroencephalogram (EEG) was continuously recorded (band pass 0.05-100 Hz, sampling rate 500 Hz) using an electrode cap with 32 Ag/AgCl electrodes mounted according to the extended international 10-20 system.

Results: After 4 h flight simulation, the subjective evaluation showed obvious mental fatigue and the scale grade was significantly increased. The negative emotion was also modulated by flight fatigue with the increase of anxious as well as the decrease of alert, Energetic, and feel confident. Compared to before fatigue, the amplitudes of vMMNs reduced significantly, regardless of MMN types (orientation, duration, color, size, shape).

Conclusion: Mental fatigue due to long-term simulated flight impaired the pre-attentive processing. The visual MMN could be valuable index of assessing the flight fatigue.

OR67

English: **MULTI-DIMENSIONAL PSYCHOLOGICAL INTERVENTION DURING THE ROMANIAN CRISIS IN JULY 2010**

French: **L'INTERVENTION PSYCOLOGIQUE MULTI DIMENSIONNELLE PENDANT LA CRISE DE JUILLET 2010 EN ROUMANIE**

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Background: Aircraft accidents are considered to be a stressful event to the aircrew members directly involved in the situation as well as to bystanders in the squadron, other units in the base, and the affected families. Even psychological staff involved in the crisis, are exposed to stress and its ramifications. Research reveals that psychological intervention mainly focused on prevention has the potential to prevent the aggravation of legitimate symptoms, shorten their duration, and improve the rehabilitation process.

Intervention Theory: Secondary Inoculation - (Luria, O. 2005) Salomon principles (Thomas w. Salomon ,1927) Proximity, Immediacy, Expectation of a return to routine.

Critical Incident Stress Debriefing (Mitchell, 1983) Continuity theory - (Omer, H. & Alon, N. 1994) Method

Treatment principles: To map sub-populations, secondary prevention, commanders as agents of psychological treatment, and to preserve the psychological team. Population Military people in the area, military people in Israel, family residence, therapists.

Preserving the therapists

Population - 14 therapists: A clinical psychologist and social workers. Standing army and reserve duty.

Stress factors - multiple missions, exposure to traumatic sights, and conflicting issues.

Results: Return to routine professional life. Small number of people needed treatment for a short time.

Discussion and conclusions: Following the event, recommendations were established in order to improve and focus intervention in case of a severe aircraft accident. Structured process has the potential to be more relevant and effective for all sub populations involved, including those who come to help them.