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Oral Presentation Abstracts

O-01

EXPERIENCES IN THE MEASUREMENT OF VISUAL WORKING ABILITY WITHIN THE HUNGARIAN AIR FORCE

EXPERIENCES DANS LA MESURE DE LA CAPACITE DE TRAVAIL VISUEL DES PILOTES DE L'ARMEE DE L'AIR HONGROISE

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In the 1970s, in the field of aeronautics and space medicine, the defensive approach was replaced by the functional diagnostic approach. The essence of this is that besides the clinical methods accepted in practice so far, measurements have been used in complex environment closer to realistic flight conditions, which help us to determine more precisely certain components of the pilot's working ability.

In parallel with the selection of the first Hungarian astronaut, the "Balaton" device was developed and used to quantify more than 50 psychophysiological data from responses to visual and auditory stimuli. The device was successfully used by several international staff of the Salyut-6 Space Station, including the first Hungarian astronaut, Bertalan Farkas.

Since the 1990s, Hungarian military pilots have been using the Visual Performance Test developed at the Kecskemét Institute of Aeronautics to determine factors such as visual acuity, simple and complex reaction time, decision time, monotonous visual performance, and visual information processing capability.

Starting in the early 2000s, we have been applying the elements of the Shufried Vienna Test System (VTS), which complement traditional ophthalmic clinical examinations with tasks that are heavily used by the pilot's visual system, thereby providing a more sophisticated view of the visual performance of pilot candidates and the visual skills of the already trained staff.

The presentation will introduce the method of ophthalmic aptitude testing for pilot candidates and for already trained pilots with new tools and patterns. It became possible to define the visual work ability in a complex way. Thus, it can be more precisely defined which one of two pilots with – according to the ophthalmic methods used in clinical practice – good visual parameters is more suitable for being an astronaut.

Rather than the traditional defensive approach to visual standards in aviation medicine, our method facilitates a more accurate and higher level of aeromedical evaluation regarding the visual system.

O-02

HARMONIZING ALCOHOL AND DRUG TESTING PRACTICES GLOBALLY COULD PROMOTE AVIATION SAFETY AND CAREER LONGEVITY (ICAO PANEL)

L'HARMONISATION DES PRATIQUES DE DÉPISTAGE DE L'ALCOOL ET DES DROGUES À L'ÉCHELLE MONDIALE POURRAIT PROMOUVOIR LA SÉCURITÉ DE L'AVIATION ET LA LONGÉVITÉ DES CARRIÈRES (PANEL DE L'OACI)

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Introduction: The use of alcohol and/ or drugs can be a contributory factor in aircraft accidents or incidents, which in some cases could result in fatalities. It could also lead to a medical certificate or ultimately licence being withdrawn.

Background: Globally, States (countries) have implemented different approaches with regard to regulatory testing of their licence holders nationally. In fact, some States have also implemented requirements for foreign operators flying into their territory. Not only do circumstances under which testing is required differ, but a number of different testing methodologies exist, each with its own advantages and disadvantages. Furthermore, all tests require procedures in terms of quality control and interpretation of the test results. The difficulty in implementing alcohol and drug testing is not only technical in nature. Testing itself could and in some cases have been interpreted as a violation of basic human rights. Sharing of test results (medical confidential information) has also been identified as a major problem in reporting licence holders with alcohol or drug use to national authorities.

A positive test result could have far-reaching effects for the individual ranging from being referred to obtain assistance to return to work safely; to losing employment or in extreme cases being at risk of criminal proceedings in a court of law. However, it is not only the individual who is affected. Any future ICAO Standards and Recommended Practices (SARPs), as well as guidance material should be based on evidence.

Conclusion: Harmonizing alcohol and drug testing practices globally, together with the implementation of a standardized reporting system, will promote aviation safety; while at the same time providing guidance for health promotion and career longevity of licence holders. Challenges relating to the implementation of harmonized approaches to drug and alcohol testing and a standardized reporting system will be discussed.

O-03

AN ANTIPODEAN VIEW OF SUBSTANCE USE AMONG AVIATION PERSONNEL (ICAO PANEL)

*UNE VUE DES ANTIPODES DE L'USAGE DE SUBSTANCES CHEZ LE PERSONNEL DE L'AVIATION
(PANEL DE L'OACI)*

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Introduction: Prevalence of substance use disorder in Australia is about 5%, with alcohol, cannabis, cocaine, ecstasy and meth/amphetamine being the most commonly used substances in descending order. Anecdotally a similar trend is evident among aviation medical certificate holders in terms of substance use, with likely impact on their fitness for aviation duties. Australia has adapted a two-pronged regulatory approach towards problematic use of substance – medical examination and random screening – to ensure aviation safety. This paper, as part of a panel on substance use among aviation personnel globally, presents the approach adapted by the Civil Aviation Safety Authority. The existing regulatory policies and experiences pertaining to their implementation are proposed to be discussed.

Background: ICAO defined 'problematic use of substance' is not a diagnosis in the *Diagnosics and Statistical Manual of Mental Disorders (DSM)*. Hence establishing the pattern of substance use being problematic is the key determinant for refusal of a medical certificate. Those who do not have problematic use require long term surveillance to ensure their ongoing fitness for aviation duties. Random testing of personnel involved in safety sensitive aviation activities is useful as a deterrent.

Summary: Diagnosis of 'problematic use of substance' and return to work of aviation medical certificate holders in Australia is discussed to help understand the regulatory approach to those found to have history or diagnosis of substance use. Endeavour towards increasing awareness among aviation medical examiners (AME), safety sensitive aviation activities personnel and the larger aviation industry is also discussed. More importantly, need for focusing on individual pilots and controllers who may need help to identify their substance use problem and collaboratively working with their treating doctor/AME and airline with an intent to their return to work is highlighted.

O-04

INDIAN PERSPECTIVE – ARE WE READY? (ICAO PANEL)

PERSPECTIVE INDIENNE - SOMMES-NOUS PRÊTS? (PANEL DE L'OACI)

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Introduction: Alcohol is the commonest psychoactive substance used by Indians and the DGCA has a well-established requirement for testing all crew for alcohol consumption. As per provision of Rule 24 Aircraft Rules, DGCA, like many other national aviation authorities does not permit use of other psychoactive substances in any operating crew before or while on flying duty. It however, does not have a mandatory requirement for testing (and reporting).

Background: Major scheduled operators in India carry out screening for illicit drugs for cockpit and cabin crew. In addition, on-suspicion and post-accident testing for alcohol and drugs of abuse is carried out for employees in safety sensitive aviation activities (SSAA). Random testing of crew and other SSAA employees however remains a challenge, both at regulatory and airline level. Some of these challenges in establishing its requirements and implementation will be discussed.

Historically, any new policy either at a national level or industry level takes its incubation period, until problems are assessed and solutions are accepted. Legal framework of the country, required experience and specialists, accessible and standardised facilities for screening, confirmatory and split sample tests, Medical Review Officer services, comprehensive assessment methods, disclosure concerns, substance abuse professional back up, rehabilitation and return to duty policies need to be in place for the resistant aviation community to be willing to consider the need for regulation in the interest of safety.

Summary: While many aviation authorities have established mandatory psychoactive substances management programs which can be adopted and practiced by countries like India, there remain inherent challenges in the system and the need to overcome them. These will be discussed.

O-05

ALCOHOL AND DRUG TESTING REQUIREMENTS IN EUROPE AND THE CHALLENGES RELATED TO IMPLEMENTATION (ICAO PANEL)

LES EXIGENCES EN MATIÈRE DE DÉPISTAGE DE L'ALCOOL ET DES DROGUES EN EUROPE ET LES DÉFIS LIÉS À LA MISE EN OEUVRE (PANEL DE L'OACI)

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Introduction: Following the accident of 9525 in 2015, the Germanwings Task Force led by the EASA issued six recommendations to mitigate safety risks identified. They recommended mandating drugs and alcohol testing as part of a random programme of testing by the operator and at initial Class 1 medical assessment or when employed by an airline, post-incident/accident, with due cause, and as part of follow-up after a positive test result. This required amendments to the rules on aircrew medical certification which were implemented in the 28 Member States and the 4 ECAA States on the 29/01/2019.

Methods: Observational reports from States that implemented the revised regulation were reviewed from the MEG (EASA) and the, EAMAC (formerly the CMO Forum) meeting minutes along with personal experience of the rule change impact.

Results: Areas highlighted included:

- Rationalising the European Regulation with existing National Regulation
- Differences in Personal Rights in States
- National enforcement officers' roles
- Test Threshold Standardisation
- Standardisation of Policies and Procedures
- The role of OPS and SAFA inspectors
- Randomised screening at renewal/revalidation
- Annual Statistical data reporting
- Data on medium-term alcohol misuse
- Psychoactive substance testing
- Assessment and referral decisions

Conclusions: The implementation of Drug and Alcohol testing regulation has proven to be as difficult and controversial as anticipated with significant variability across the implementing States in Europe. Ongoing oversight of the rule will help to refine the regulation to evolve in keeping with the philosophy of performance-based regulation.

O-06

ALCOHOL AND DRUG TESTING PROGRAMS – U.S. FAA PERSPECTIVE (ICAO PANEL)

PROGRAMMES DE DÉPISTAGE DE L'ALCOOL ET DES DROGUES - PERSPECTIVE DE LA FAA DES ÉTATS-UNIS (PANEL DE L'OACI)

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Introduction: After several drug and alcohol related transportation accidents/incidents between 1987 and 1990 in the United States, a Federal Statute authorized the Federal Aviation Administration (FAA) to develop and implement regulations to mandate testing of the aviation industry in the United States.

Background: In 1988, the FAA published the drug testing requirements, and the alcohol requirements were published in 1995. Included in 14 Code of Federal Regulations (CFR), part 120. The Department of Transportation (DOT) established the procedural regulation, 49 CFR, part 40, which governs the collection, testing and treatment requirements for all transportation testing. The DOT/FAA testing regulations are specifically designed to deter and detect covered employees from using drugs illicitly or misusing alcohol while performing safety or security-related duties. The FAA program, covering approximately 7,000 employers and 400,000 safety-sensitive employees that operate within the United States and its territories, has prohibited thousands of safety-sensitive employees from performing while under the influence of drugs and alcohol. Since the implementation of testing, there are no known aviation accidents associated with a covered employer (air carrier or sightseeing operator) attributed to drug use or alcohol misuse.

Summary: This presentation will present the specifics of the testing process, as well as the lessons learned from over 40 years of experience from such testing. It will also discuss the interface of the testing program with that of airman medical certification.

O-07

AOD TESTING: DETECTING OR DISGUIISING SUBSTANCE ABUSE IN AVIATION? (ICAO PANEL)

TEST AOD: DÉTECTER OU DÉGUIISER UNE TOXICOMANIE EN AVIATION? (PANEL DE L'OACI)

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Introduction: Testing for alcohol and other drugs (AOD) in commercial aviation is increasing worldwide. The rationale for implementing testing is to increase safety by detecting and removing airline crew members from duty who test positive for the presence of AOD when reporting for duty. These policies seek to reassure the public and lawmakers that proactive steps are implemented to protect aviation safety. To avoid undermining these goals, medical treatment and recertification opportunities using a Just Culture philosophy are essential.

Background: The Human Intervention and Motivation Study (HIMS) Program is an airline based occupational substance abuse treatment program in effect since 1974. HIMS is specific to commercial pilots and coordinates identification, treatment and return to the cockpit for impaired aviators. It is an industry-wide effort in which companies, pilot unions and FAA work together to preserve careers and further air safety. Prior to the institution of AOD testing, over 1200 pilots with alcohol dependence were successfully treated and returned to flight duty in the HIMS program. Approximately 10% of pilots self-referred for assistance while 70% were peer-referred. Currently, approximately 7,000 pilots with substance abuse have been certified through the HIMS program. Since 2011, only 10% are identified through AOD testing while 30+% each enter by self-referral or review of driving records for alcohol related actions. Therefore, testing alone is an inadequate method for detection, discovering only those in late stages of disease with complete loss of control. Without a Just Culture type program for an individual pilot or peer to refer for treatment and medical re-certification, pilots will deny or hide their disease and continue to fly while mentally and physically compromised due to the acute and chronic effects of addictive substances.

Summary: AOD testing in the absence of peer pilot support programs coupled with employer and regulator cooperation lead to concealment of addictive diseases and compromise aviation safety. Treatment programs in a Just Culture environment encourage self and peer referral resulting in improved aviation safety.

O-08

PANEL DISCUSSION AND Q&A: IMPLEMENTING TESTING PRACTICES AND EFFECTIVE PEER ASSISTANCE PROGRAMMES FOR SUBSTANCE ABUSE PROBLEMS IN AIRCREW

TABLE RONDE Q&A: MISE EN OEUVRE DE PRATIQUES DE TESTS ET DE PROGRAMMES EFFICACES D'ASSISTANCE PAR LES PAIRS POUR LES PROBLEMES DE TOXICOMANIE CHEZ LES MEMBRES D'EQUIPAGE

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Introduction: Following the lead of the preceding thought-provoking Ernsting Panel presentations, an internet-enabled guided question, answer, and discussion session will explore the issues related to the detection and management of substance abuse problems in commercial aviation.

Background: While the hazards of substance abuse in aviators are indisputable, the methods of detecting that abuse, treating it, and returning aircrew to flying duties are less clear. Best practices may vary among countries, due to national laws, customs, available technology, and agreements with aircrew organizations. For similar reasons, once a substance abuse problem is identified, the requirements by governing bodies to return aircrew to flying duties may also vary. There are clear benefits to standardization of these policies across industries and governments, but there are also significant concerns limiting adoption of standardized guidelines.

Summary: This discussion will highlight the operational issues and problems surrounding implementation of substance abuse policies. Questions and topics for further discussion will be solicited from the audience via the internet, enabling real-time discussion of practical and sometimes controversial related topics.

O-09

SPECIAL LECTURE ON THE OCCASION OF THE 500TH ANNIVERSARY OF THE DEATH OF LEONARDO DA VINCI: HIS ANATOMICAL STUDIES AND VISION OF MAN IN FLIGHT

CONFÉRENCE SPÉCIALE À L'OCCASION DU 500E ANNIVERSAIRE DE LA MORT DE LEONARDO DA VINCI: SES ÉTUDES ANATOMIQUES ET VISION DE L'HOMME EN VOL

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Introduction: Leonardo da Vinci was a renowned artist and a scientist, often ahead of his time with the scientific discoveries he made and the theories he formulated. Leonardo's scientific method consisted of a mix of observation of the world around him and the physical experimentation with, and construction of, new inventions, aided by preliminary sketches.

Background: Though his hunger for all types of new knowledge and discovery planted him firmly at the heart of what many consider to be Renaissance values, in another way Da Vinci was something of an unconventional scientist. This is because, despite the fact that university culture was flourishing in Italy during his life time, he never attended a university (and thus had no formal education in mathematics, despite being a great mathematician). This lack of a formal structure to his education is precisely what enabled Da Vinci to be such a free thinker and such a good scientist.

There is no doubt that Da Vinci's in depth knowledge of the human anatomy beneath the skin enabled him to create such dynamic and realistic portraits of human beings in his paintings. Nevertheless Da Vinci's scientific interests, inventions and experiments spread out vastly into numerous different areas of science. Not only was he interested in chemistry and geology but also in astronomy, pyrotechnics, biology (or zoology), human and animal anatomy and mechanical engineering.

When Leonardo carried out his first corpse dissections, his goal was to understand and verify the centuries-old views of the Greek anatomist and physician; however, his meticulous autopsies brought him increasingly into conflict with this handed-down knowledge. The contradictions he encountered spurred him on to create his own illustrated work that could record his observations and that was ultimately intended to convey no less than a new understanding of the human body.

As a natural scientist, he penetrated the surface of the body, delving into the interior while dissecting it. As an artist, through the medium of diagrams, he again returned to the body as a whole, which he pieced together anew from the information he considered important. Leonardo is driven by the ambition to demonstrate the close analogy between machine and human body in which the nature laws govern mechanical instruments as animal motion; "Nature- Leonardo says-cannot give motion to animals without mechanical instruments."

Summary: Da Vinci's scientific endeavours were so ahead of his time that he has anticipated many devices that we consider to be 'modern.' Some of these endeavours, particularly those related to the flight environment are described.

O-10

DESIGN OF AN AERIAL REFUELING TANKER STEREOSCOPIC REMOTE VISION SYSTEM BASED ON HUMAN VISUAL PERFORMANCE RESEARCH

CONCEPTION D'UN SYSTÈME DE VISION STÉRÉOSCOPIQUE STÉRÉOSCOPIQUE DE RÉSERVOIR DE RAVITAILLEMENT AÉRIEN BASÉ SUR LA RECHERCHE SUR LA PERFORMANCE VISUELLE HUMAINE

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Introduction: The U.S. Air Force Operational Based Vision Assessment Laboratory (OBVA) has been tasked by the Secretary of the USAF, Acquisition, to properly fix the new air refueling tanker indirect, three-dimensional, remote viewing system (RVS) stereo display that "flies" the boom to the refueling aircraft. Current and future military aircraft utilizing RVS technology include Boeing KC-46 (USAF), Airbus KC-30 (RAAF, RSAF, UK, etc.), Boeing KDC-10 (RNLAf), KC-767 (JASDF, Italian AF) and Israeli IDF KC-707. The level of stereo acuity and oculomotor capabilities required to maintain fusion and avoid asthenopia with human vision limits was not addressed in the design and development of the RVS by any of the aircraft manufacturers.

Methods: OBVA completed eight separate 3D remote vision system research projects using two \$750K RVS full panoramic training simulation systems including VITAL six-channel image generator from Flight Safety International and surveys to investigate aspects of vision and RVS configuration that affect aerial refueling operator performance. The visual aspects of all participants were fully characterized with existing commercially available vision tests and OBVA developed computer-based vision tests (AVT). 28 subjects completed a two-hour fighter drag refueling comparing test correlation to performance, and differences between young vs presbyopic subjects. The performance of 13 normal and stereo-deficient subjects was compared on systems providing varying stereo cues ranging from monovision to hyperstereo. Over 70 subjects were studied to assess the role of dipvergence, depth distortion geometric distortions, keystone distortion and depth plane curvature on multiple air refueling tasks.

Results: Correlation between vision tests, aerial refueling performance on the eight research projects and post refueling questionnaires identified optimal design 3D remote viewing system design features required for human limitations and performance. The detailed results will be provided in the presentation.

Conclusion: Best industry practices that aircraft manufacturers should utilize to avoid human factors limits in all the current 3D RVS systems today will be discussed. No commercial RVS system currently available has taken human factors into account, limiting the boom operator pool that can utilize the system while avoiding fatigue, visual illusions and mishaps.

O-11

THE DEVELOPMENT AND EVALUATION OF A NEW ALGORITHM FOR THE ASSESSMENT OF SYNCOPE IN PILOTS AND AIR TRAFFIC CONTROLLERS

LE DÉVELOPPEMENT ET ÉVALUATION D'UN NOUVEL ALGORITHME D'ÉVALUATION DU SYNCOPE CHEZ LES PILOTES ET LES CONTRÔLEURS DE LA CIRCULATION AÉRIENNE

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Introduction: Syncope presents a significant challenge in the aeromedical assessment of pilots and air traffic controllers. With many potential causes of transient loss of consciousness, it is important to establish clear and reasoned guidance for the assessment and investigation of syncope. The aeromedical assessment of aircrew considers the acceptable incapacitation risk of an individual in both the single pilot and multi-crew environment, per year. Before 2018, UK Civil Aviation Authority investigation guidance only considered recurrent syncope and did not specifically address isolated episodes. Given that even one episode can be an incapacitating event, the guidance material was reviewed and a new algorithm was developed.

Any new aeromedical guidance material must acknowledge the acceptable level of risk in aircrew and should be comprehensive enough to capture most if not all eventualities. It should however, also refrain from imposing an unnecessary burden of medical investigation without due cause. Therefore, an evaluation and validation of the new algorithm was needed.

Methods: The UK CAA medical record database was searched for cases of syncope in commercial pilots and air traffic controllers over a five-year period leading up to the introduction of the new algorithm. A retrospective review of these records takes into consideration the certificatory outcome.

Discussion: The data show whether applying the new algorithm would lead to an increased referral and investigation rate and possibly a different certificatory outcome. Implications for aviation safety or overburdensome investigation will be considered. Additionally, by looking at variables such as heart rate, blood pressure, age and BMI, any potential patterns or predictors of syncope in aircrew will be discussed. The conclusions of the study will be presented at the conference and should generate discussion about the investigation and management of syncope in aircrew by other states.

O-12

COMPARISON OF HEALTH PROFILES BETWEEN PROFESSIONAL AND LEISURE AVIATION

AVIATION COMPARAISON DES PROFILS DE SANTÉ ENTRE AVIATION PROFESSIONNELLE ET DE LOISIR

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Introduction: The main objective of this study is to compare health profiles between professional pilots (class 1 of European regulations) and leisure pilots (class 2).

Method: The authors carried out a multicenter observational descriptive study, by anonymous standardized questionnaire from January to May 2017. The distribution and the collection of the questionnaires were: a) for professional pilots, during their visit of expertise within one of the five French aeromedical centers (Bordeaux, Clamart, Roissy, Toulon and Toulouse); and b) for leisure pilots, either during their expert visit with a selection of 3 aeromedical examiner, or at the annual general meetings of ten major flying clubs and one association. Each center interviewed 100 class 1 pilots (total: 500 pilots) and 500 class 2 pilots were also surveyed. The questionnaire makes it possible to compare sports practices, the general state of health, aeronautical fatigue correlated with flying hours and work amplitudes and a series of five markers that attest to the diversity of aeronautical practices.

Results: There were 910 total usable questionnaires analysed, 480 from professional pilots and 430 from leisure pilots (respective participation: 91%, 96% and 86%). Leisure pilots, overall older than professionals, have statistically more cardiovascular risk factors. Nevertheless, the two populations report a relatively good lifestyle and comparable with notably a tobacco use much lower than the French general population.

Conclusion: Complementarity and entanglement characterize the two pilot populations. The data collected encourage us to propose an intensification of the medical examination of leisure pilots, thus getting closer to the professional tracking model. The prescription of systematic blood tests is also a major axis of prevention and screening for cardiovascular risk factors. The particular requirements of administrative, legal and operational organization appear to condition aircraft safety levels and flight behavior. Finally, although flight safety appears infinitely superior in professional aviation, it could suffer tomorrow from crew fatigue.

O-13

A PORTRAIT OF VARIOUS RISK FACTORS FOR PREHYPERTENSION AMONG INDONESIAN CIVILIAN PILOTS

*UN IMAGE DE DIVERS FACTEURS DE RISQUE POUR PRÉHYPERTENSION CHEZ LES PILOTES
CIVILS EN INDONÉSIE*

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Introduction: This study aimed to describe various conditions which are risk factors for prehypertension among civilian pilots in Indonesia as well as to get an overview of the implementation of the laws and regulations related to the health and safety that can lead into prehypertension among civilian pilots.

Methods: This was a qualitative study design, through in-depth interview with key informants of one national airline company, consisting of pilots, first officers, and relevant stakeholders, such as flight operations manager at the airline company, manager at the airline's catering company, doctor and operational director of a civil aviation medical center. A study on the existing documents on laws and regulations governing aviation health and safety in the national and international level was also conducted.

Results: The existing aviation laws and regulations related to health and safety did not specifically address practice that could prevent prehypertension. The identified risk factors were high workload (inconvenient flight schedule with maximum working hours and minimum resting hours, as well as lack of route variations), high working stressor, and lifestyle (high smoking habit, high alcohol consumption, frequent visit to nightclubs, and lack of awareness, time, and motivation to do physical activities). There were no clear regulations about diet menu and ingredients for civilian pilots during duties, which led them to have a free and uncontrolled diet. The facilities provided by the airline (accommodation during duties, transportation and sports facilities) were considered sufficient, yet the utilization was still inadequate for the prevention of prehypertension among civilian pilots.

Conclusion: Although implementation of laws and regulation in Indonesian aviation was good enough, yet it was not adequate to address risk factors for prehypertension among civilian pilots. The airline company should develop their own health program to reduce prehypertension and other non-communicable diseases among their pilots.

O-14

CORONARY ARTERY DISEASE IN THE TUNISIAN PILOT, REHABILITATION AND FIT DECISION

LA MALADIE CORONAIRE CHEZ LE PILOTE TUNISIEN, RÉHABILITATION ET DÉCISION D'APTITUDE

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Introduction: The sudden and incapacitating traits of coronary artery damage make her the most dreaded condition in aviation, and especially in the pilot. However the evolution of medical technology, with regard the management of coronary disease, is currently allowing us to review the possibilities for rehabilitation of certain coronary pilots, particularly in civil aviation.

Methods: Our work focused on the records of civilian Tunisian pilots, followed by the Aeronautical Medicine Center of TUNISIA during the period of 1995 to 2018.

Results: The cumulative prevalence of ischemic heart disease in our population was about 1.2%. All 21 patients were male, the average age was over 45 years, and the youngest was 34 years-old. The incidence of a coronary incident is significantly higher in the civilian environment. The risk factors are dominated by smoking, type II diabetes, high blood pressure and dyslipidemia. The myocardial infarction indicated coronary disease in two of our patients; the routine electrocardiogram allowed the detection of the disease in 28% of cases, and the stress test allowed for the detection of coronary disease for 70% of cases. In other cases, angina arose between two periodic visits. Coronary angioplasty with stent placement has been carried out in most cases; coronary bypass surgery was needed once.

Discussion: Pilots who are victims of myocardial infarction are declared definitively unfit. Those who have benefited from coronary angioplasty can recover their ability under certain reserves. One patient was not seen after his heart attack and three pilots are in a convalescent period.

Conclusions: Cardiovascular risk factors are constantly accentuated in our country; as a result, coronary artery disease is gaining a lot of ground on other pathologies, even in the circles hitherto protected by selection and medical surveillance. The Tunisian aeronautical legislator, steeped in the evolution of surgical therapeutics of coronary disease, has allowed pilots meeting the rehabilitation criteria to continue their dreams and passion.

O-15

RISK ASSESSMENT IN AVIATION MEDICINE, BASED ON PERFORMANCE OPTIMIZING METHODS IN EXERCISE PHYSIOLOGY

ÉVALUATION DES RISQUES EN MÉDECINE AÉRONAUTIQUE, MÉTHODES D'ÉVALUATION DE LA PERFORMANCE BASÉ EN PHYSIOLOGIE DE L'EXERCICE

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Introduction: The explosive growth of aviation and aeronautic industry creates a growing need for aviation personnel. More and more tasks are performed by fewer and older staff. The change is very demanding on aviation co-workers, creating a great amount of stress. Therefore, we shifted our research focus to stress, fatigue and loadability.

Methods: Subjects were asked not to do any physical activity on days of measurements. The assessment room was separate, quiet, and temperature controlled (maintained around 24 °C). The subjects had rested quietly in supine position for 15 minutes. The following measurements were made:

- Anthropometry: the correct amount of viscera, bone, muscle, and body fat, measured in both relative (percentile) and absolute (kilogram) value
- Sleep efficiency: special sleep sensors provide data about sleeping pulse, breath rate (possible snoring), times away from bed, deep sleep and awoken time.
- Arteriography: qualifying the blood pressure, coronary flow, endothelial function and condition
- Heart rate variability: mechanic state of the heart as well as information about the state of the autonomous nervous system
- Relaxing capacities of the brain: mini EEG device, monitoring the electrical activity, hemisphere dominance and autogenic status
- Cognitive function test: standardized neuropsychological cognitive test, for registration of quick changes in concentrating ability

Results: We performed our resting evaluations on 118 air traffic control students, 8 helicopter pilot students, and 7 pilots with years of experience. The data is matched to our database of 150 firefighters, around fourteen thousand military personnel and law enforcement personnel.

Discussion: To correctly and objectively measure loadability, mental and physiological status, small and lightweight sensors are needed. These sensors should be convenient during physical and mental tasks, easily handled, not inhibiting the activity in any way. The data obtained should be analyzed individually, with automatic alerts on critical values. Our goal is to help workers in the highest professional requirements like aviation ground control, aircrew, and other experts to reach and maintain optimal physical and mental condition and to handle unexpected events professionally.

O-16

RETURNING HUMANS TO SPACE FROM U.S. SOIL

RETOUR DES HUMAS DANS L'ESPACE DEPUIS LE SOL AMÉRICAIN

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Introduction: Seven and a half years elapsed between the last launch of the Space Shuttle from the Kennedy Space Center and the first flight into space by Virgin Galactic's SpaceShipTwo. This hiatus in the ability to launch humans to space from U.S. soil was much longer than was originally thought when the Space Shuttle was retired after flight STS 135, landing on July 21, 2011. Since that time NASA, as well as private companies such as SpaceX, Boeing, Blue Origin, and Virgin Galactic, have been working toward returning astronauts to space from U.S. launch sites. This presentation will address some of the key steps and the difficulties along the way that occurred during the nearly 7 ½ years before Virgin Galactic sent two pilots to space on December 13, 2018 aboard SpaceShipTwo.

Background: Designing, building, and testing space vehicles for human flight is significantly more challenging than a cargo-only vehicle. The environmental control and life-support system (ECLSS) must account for cabin pressurization redundancy and temperature control. Seat and restraint system design, emergency oxygen systems, vibration control, and many other factors must all be thoroughly addressed before putting humans at risk in a space vehicle. Integrating the human and machine into a smoothly working system requires expertise from human factors engineers, medical personnel, and vehicle and equipment design engineers. The need for redundancy to eliminate single point failures is critical to ensuring a safe environment for humans.

Summary: Challenges in all these areas have also been impacted by vehicle failures that have occurred along the way. SpaceX, Orbital ATK, and Scaled Composites all experienced catastrophic failures since the last flight of the Space Shuttle. The lessons learned from these incidents enhance the eventual increases in safety for human occupants, but the impacts of failures along the way can be severe.

O-17

PLANETARY PROTECTION FOR MARS EXPLORATION MISSIONS

PROTECTION PLANÉTAIRE POUR UNE MISSION D'EXPLORATION DE MARS

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Introduction: Planetary Protection is generally thought of as the process of preventing microbial contamination of the world being explored as well as contamination of earth (from returned samples or astronauts). This can also be expanded to include the consideration of all toxicological exchanges. Protection of the earth from an asteroid impact event is another concern usually addressed in a separate category, but also briefly discussed here.

NASA/ESA Planetary protection officers have reached out to the research community to formulate guidelines and techniques to be used in the establishment of planetary protection programs. This lecture will attempt to detail the science behind those guidelines, explain the derivation of probabilities leading to those formulated guidelines, and how to apply these recommendations.

Background: The Drake equation suggests the number of planets with communicative extraterrestrial life in our galaxy at:

$$N = R \times f_p \times n_e \times f_l \times f_i \times f_c \times L$$

which is 100 million planets in our galaxy. However the number of worlds with primordial life forms and micro-organisms is expected to be much greater.

The current evidence for life on Mars (from recent Mars rovers) shows findings of seasonal methane variances, as well as complex carbon molecules often associated with life forms, but a precise estimate of this probability is not possible from the currently available objective evidence.

The probability of a microbiological impact from both forward and backward (return) (if life exists on Mars) missions is determined by the summarized equation:

$$P = \sum P_j + q(J + 1)$$

The current data, based upon previous planetary protection efforts, indicates that the risk of a microbial contamination of clinically/ecologically significant impact can be reduced to 1 in 10,000 with these programs.

Conclusions: A planetary protection program reasonably limiting both forward and backward microbial and toxicological contaminations can be accomplished with minimal impact on the exploration. Further study is required to determine the details required for sample return and astronaut quarantine.

O-18

LIFE BEYOND...

LA VIE AU-DELÀ

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Introduction: Life beyond NASA may bring known and unknown health issues related to the occupation of space exploration. Astronauts have survived training and mission related risks, but as years go by, health issues may emerge. Recent policies permit better care and health tracking.

Background: Human "life" beyond Low Earth Orbit (LEO) consists of a brief span from 1968-1972, with only 24 individuals traveling beyond LEO. This region of space will soon be visited by humans again, with NASA's intent to have an extended presence on and around the Moon. Life beyond LEO brings risks to astronauts, some of which may not be totally understood.

This presentation will discuss recent changes in NASA's ability to monitor, evaluate, and treat astronaut health once they separate or retire from NASA. It will also describe NASA's plans for exploration to the Moon and beyond and its health challenges.

With the passage of the TREAT Astronauts Act, NASA expanded monitoring the health of astronauts through the Lifetime Surveillance of Astronaut Health, as well as treating conditions associated with spaceflight. This authority grants NASA the ability to better care for astronauts throughout their lifetime and give it better insight into the impact of spaceflight on the body as it ages. This is important as NASA moves to explore beyond LEO. NASA has worked in LEO for nearly 20 years on the ISS. However, not since the Apollo missions to the moon has mankind ventured beyond this point. NASA now seeks to return a man and, for the first time, a woman to the Moon by 2024.

Summary: With every step, NASA will learn more about how to safely transport humans to each of these locations, to protect them whether they are in a spacecraft or on a planetary surface, and to safely return them to Earth.

O-19

A DIFFERENT VESSEL/HABITAT HYPOBARIC BREATHING ATMOSPHERE FOR EXTRATERRESTRIAL USE

UNE ATMOSPHÈRE DE RESPIRATION HYPOBARE DIFFÉRENTE POUR LES NAVIRES ET LES HABITATS POUR UNE UTILISATION EXTRATERRESTRE

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Introduction: The planned breathing environment for NASA's Orion spacecraft flights to the Moon and Mars will contain a hypobaric atmosphere of approximately 34% Oxygen and 64% Nitrogen. With that mixture of gases, the Orion's pressurization would be maintained at approximately 15,301 ft (4663 m), equivalent to Earth's atmosphere at about 3,500 ft (1067 m). During exit from Orion or a habitat for maintenance or other activities, oxygen would be vented to the exterior and is not recoverable. The loss results in need for extra storage of oxygen which is more weight and expense. That could be reduced if the venting were to the vessel/habitat interior.

Background: In the Apollo era, it was calculated that added equipment and power for atmosphere recovery would typically pay off if the mission involves six or more extra-vehicular/habitat activities (EVAs). The Orion's atmosphere provides a very low risk of decompression sickness (DCS) following decompression to the extravehicular activity suit pressure of 4.3 psia.

That risk could be reduced more with use of a Trimix atmosphere of 33 % Helium, 33 % Oxygen, and 33 % Nitrogen inside a vessel at 18,000 ft (5486 m). The Trimix would provide the same level of oxygen available on earth at approximately 6,500 ft, equivalent to an altitude lower than Mexico City, Mexico, and near that of Colorado Springs, CO. Trimix could save weight, maintain fire safety and, at a lower EVA suit pressure, improve mobility and safety while requiring no prebreathe for EVA.

Summary: This presentation is based on the extensive United States Air Force Manned Orbiting Laboratory (MOL) research in the 1960s at Brooks AFB, TX. They investigated the use of Oxygen:Helium hypobaric MOL capsule atmospheres and, if the program had not been cancelled in June 1969, such an atmosphere with Helium would have been selected for the MOL capsule. The appropriate altitude chamber research is recommended.

O-20

DISTANT MONITORING OF EMOTIONAL STATUS OF CREWS OF TERRESTRIAL SPACE ANALOGS: CONTENT ANALYSIS OF DIARIES OF ANTARCTIC WINTEROVERERS

SURVEILLANCE À DISTANCE DU STATUT ÉMOTIONNEL DES ÉQUIPAGES D'ANALOGUES D'ESPACE TERRESTRIAUX: ANALYSE DE CONTENU DES JOURNÉES DES ANTARCTIQUES WINTEROVERERS

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Introduction: In our days, space psychologists agree that research on crews living and working in terrestrial space analogs (scientific outposts in the Antarctica, the Moscow Mars-500 simulation, etc.) may provide valuable information for future manned missions into the deep space. As with space missions, these ground facilities are also referred to as ICE-environments (=Isolated, Confined and Extreme). The pathology of ICE-groups may include somatic symptoms (disturbed sleep, chronic fatigue, gastrointestinal complaints, etc.), impaired cognition, depressed mood, anger and irritability, anxiety, as well as interpersonal conflicts. These issues are traditionally monitored by psychological tests. Most recently, however, the rapid progress of language technology has opened the way to the use of computerized psychological content analysis of textual outputs (electronic communication, diaries and anecdotal reports) generated by ICE-groups. The basic assumption of psychological content analysis is that psychological states and processes are encoded in verbal behavior, and appropriate methodology is able to yield results that are comparable to traditional psychometric methods.

The first aim was to use word-based content analysis for exploring and comparing the effect of time on overall and fine-grained patterns of emotionality in two different winter-overing settings in the Antarctica. The second aim was to detect the presence or lack of the third-quarter emotional dysphoria among the crews of the two research stations.

Methods: The venues of the two settings were the ESA-coordinated French-Italian Concordia and the British Halley VI stations, respectively. Video diaries were collected from 24 crewmembers. A total of 617 diaries were subject to word-frequency based content analysis by the LIWC 2015 software. The results were processed by Repeated Measures ANOVA.

Results: Concordia and the Halley VI samples showed very different emotionality patterns. The French and the Italian diarists showed the third-quarter phenomena; the fine-grained analysis of the diaries revealed that the main negative emotion was Anger, rather than Anxiety or Sadness. The British diarists showed no significant changes in emotionality as broken down according to four quartiles of winter-overing.

Conclusions: Word-based content analysis was able to provide an articulated picture of emotional valence and negative emotions. The differences found in the two samples suggest that cultural differences and the degree of isolation of settings may be explanatory for the inconsistency of the third-quarter phenomenon reported in literature.

O-21

COMMERCIAL SPACE VEHICLE MISHAP SURVIVAL FACTORS

FACTEURS DE SURVIE D'ACCIDENT DE VEHICULE SPATIAL COMMERCIAL

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Introduction: Human commercial space transportation is generating unique human factors issues that must be effectively managed in order to protect the safety of flight crews and spaceflight participants in space flights. Commercial space vehicle designers, manufacturers and operators must be prepared to meet their obligations and responsibilities in support of human commercial spaceflight safety.

Background: Mishaps can occur during any phase during the operation of a commercial space vehicle including pre-launch, launch, inflight (suborbital/orbital), atmospheric entry, pre-landing and landing/ditching (nominal, non-nominal and contingency). Post-landing/post-crash environments can also produce significant hazards. This presentation will focus on those hazards and survival factors associated with potential mishaps during the dynamic phases in the operation of a space vehicle including acceleration, vibration, temperature, inflight decompression, weather, wildlife, fire, vehicle crashworthiness and occupant restraints. Reliable environmental control & life support systems (ECLSS) as well as personal protective equipment are very important operational safety considerations to effectively manage hazards, prevent mishaps and promote survivability. Several examples of mishaps will be discussed. Furthermore, pre-existing medical conditions could be aggravated or exacerbated by exposure to the environmental and operational risk factors encountered during launch, inflight and landing that could have an adverse impact on occupant survival.

Summary: The ultimate success of the emerging commercial human space flight industry will depend (to a great extent) upon organizational actions by commercial space vehicle designers, manufacturers and operators to demonstrate a firm commitment to prevent the occurrence of adverse occupant safety outcomes.

O-22

ASSESSMENT OF PHYSIOLOGICAL RESPONSE TO REPEATED EXPOSURES OF -GZ TO +GZ ACCELERATIONS IN TRAINING AND SUBORBITAL SPACEFLIGHT

*ÉVALUATION DE LA RÉPONSE PHYSIOLOGIQUE À DES EXPOSITIONS RÉPÉTÉES
D'ACCÉLÉRATIONS DE -GZ À + GZ DANS LES ENTRAÎNEMENTS DE FORMATION ET DE VOL
SPATIAL SUBORBITAL*

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Introduction: Commercial suborbital spaceflight profiles will expose pilots to sustained +Gx (some in combination with +Gz) during the vertical/launch phase of flight as well as a period of microgravity followed by high +Gz acceleration during re-entry portion of the flight. Pilots must maintain the ability to actively pilot the spacecraft throughout the flight. To train for suborbital spaceflight, pilots undergo centrifuge-simulated suborbital flights along with frequent aerobic flights with profiles which include transitions from -Gz to high +Gz acceleration. Previous studies with U.S. Navy Blue Angels indicate that training can improve tolerance to push-pull profiles with reduced heart rate variability and less bradycardia with -Gz flight. This study compares heart rate responses in experienced pilots and inexperienced non-pilots during the acceleration environment of aerobic flights, centrifuge training, and two suborbital spaceflights.

Methods: Heart rate and triaxial accelerometry were measured in five experienced pilots and five inexperienced non-pilots by a Zephyr Bioharness3 worn device. Measurements were made during repeated aerobic flight profiles (5 pilots), one-time aerobic flights (5 non-pilots), centrifuge simulated suborbital spaceflight profiles (5 pilots), and two suborbital spaceflights (4 pilots, 1 non-pilot). Each pilot served as his/her own control for heart rate response and variability between training and actual suborbital flights. Non-pilot responses were aggregated and compared to those of the pilots to evaluate a training effect.

Results: Aerobic training resulted in attenuated heart rate decreases in trained pilots during -Gz exposures and increased heart rate response to +Gz transitions after -Gz exposures. Limited data from this study show steady decline in heart rate throughout the microgravity period of suborbital spaceflight but adequate response with return of +Gz during the entry profile for trained pilots.

O-23

IMPLEMENTATION AND OVERSIGHT OF SAFETY MANAGEMENT FOR AERO-MEDICAL CENTRES (AEMC) (ESAM PANEL)

MISE EN OEUVRE ET SUPERVISION DE LA GESTION DE LA SÉCURITÉ POUR LES CENTRES AÉROMÉDICAUX

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Introduction: Over the last 30 years there has been a great evolution in the regulations for medical certification in Europe from ICAO, JAR-FCL and national requirements, we have gone to a pan-European medical certification system. As a result, the level of safety has increased. In this presentation, we will give an idea how EASA propose, harmonize, control and implement the content of the actual regulations in regard to implementation and oversight of Safety management in non-complex organisations with a particular focus on aeromedical centres (AeMCs).

Background: Monitoring and management of performance and safety are not new in medicine. In one way or another it is performed since medical institutions have been in place. Since 8 April 2014, AeMCs are required to adapt their management system, training programmes, procedures and manuals to be compliant with Annex VII of the Regulation (EU) 1178/2011. Aeromedical Centres are seen as non-complex organisations and for this reason their safety management system (SMS) should be in line with their size and complexity. Nevertheless, the main functions of the SMS should be properly implemented in order to ensure continuous improvement of the safety level.

The presentation aims to provide an explanation regarding the items that need to be in place rendering the SMS fit for purpose, as well as the oversight layers over the activity of the AeMC, namely the external oversight by the NAA, national health authorities, etc. and internal assessment via the compliance monitoring system. EASA, during their standardisation inspections and Medical Expert Group (MEG) meetings provided guidance for the Heads of AeMCs and medical assessors of the competent authorities in regard to the implementation and oversight of SMS in order to help them to ensure effectiveness of their SMS.

Conclusion: The harmonization of medical certification of Aircrew members and ATCO's, including a standardised approach on the Safety Management System is a major step forward in the European civil aviation aeromedical requirements.

O-24

AESA OVERSIGHT: CURRENT PROCEDURES & PROTOCOLS (ESAM PANEL)

AESA INSPECTION: PROCEDIMENT ACTUEL ET PROTOCOLS

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Introduction: EASA establishes standardization inspections, annual or multiannual, in order to take into account emerging risks stemming from its continuous monitoring activities. National Authorities must maintain and update the information collected from the comprehensive and focus inspections for the purpose of adequate monitoring, provide corrective actions and evidence of implementation of the agreed corrective actions. This approach entails four major components: collect information, analyse and prioritise, act as appropriate and follow-up and closure of findings stemming from these inspections. EASA Member States must plan in advance the oversight of the Aeromedical Centers scattered in each Member State of EASA. A comprehensive approach to one of the roles of National Authorities (NA), the oversight of the AeMC's, is described and analyzed on behalf of a standardized procedure, a necessary tool to accomplish the objectives of the oversight including the SMS requirements for AeMC's.

Background: AESA since 2017 has elaborated a comprehensive procedure and guidance material in order to develop a common approach to the establishment of a safety management system in Aeromedical Centers (AeMC's), according to Regulation ORA GEN 200. In relation to AeMC's, we have ensued two policy systems to assure all authorized AeMC's, following what it is established in EASA 1178/2011 Regulation: 1) Guidance material to be followed by authority and 2) Proform Manual to be provided to AeMc's in order to follow and accomplish what it is established in ORA GEN 200 & AMC1 ORA GEN 200 (a).

Summary: Oversight of 7 of 14 authorized AeMC's, has been processed according to AESA published methodology, by reviewing 1) General description of the AeMC: functional and organic structure, functions, scope, personnel, facilities, subcontracted activities, clinical and IT technical means; 2) Safety programme: responsibilities, safety policy, risk & hazards management and evaluation, instruction of personnel and proposals for improvement of safety, 3) Quality assurance: oversight control, instruction and audit, 4) Procedures: candidate appointment.

O-25

EUROPEAN OVERSIGHT: POLICY, SAFETY MANAGEMENT, PROCEDURES & AME PEER SUPPORT: PERSPECTIVE FROM AN AEMC (ESAM PANEL)

REGARDE EUROPÉENNE: POLICIE, MANAGEMENT DE SECURETÉE, PROCEDEMENTS ET SUPPORT AUX AMES: PERSPECTIVE D'UN AEMC

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Introduction: Medical evaluation for pilots, crewmembers and air traffic controllers require special assessment by qualified professionals with experience in aerospace medicine and familiar with the aerospace environment.

Background: The Centro de Instrucción de Medicina Aeroespacial (C.I.M.A.) is an institute with more than 70 years of accumulated experience devoted to aerospace medicine. Medical exams of flight personnel (military and civilian), physiological training, teaching and research are the main areas in which this institute is involved. Over 7.000 medical exams are performed every year in the Center. The whole medical is done within one morning.

Summary: Organization of the Center with the different departments and procedures which are followed are presented as well as the relation with the Authority (AESA), AMEs and other AeMCs.

O-26

PEER SUPPORT FOR AME'S/AEMC'S: CONCEPTS & APPLICATIONS (ESAM PANEL)

SUPPORT PAR LES PAIRS POUR LES TEA/AEMC: CONCEPTS ET APPLICATIONS

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Introduction: Following the accident of 9525 in 2015, the Germanwings Task Force led by the EASA issued six recommendations to mitigate safety risks identified. They recommended developing Peer Support Networks for Aeromedical Examiners (AME), amended rules on aircrew medical certification and implemented in the 28 Member States and the 4 ECAA States on the 29/01/2019.

The majority of AME's working in Europe spend only a very small proportion of their professional lives in Aviation Medicine. They practice in very similar ways to rural single-handed physicians.

Methods: Peer Support Groups were established in Member States according to their national practices and in accordance with the Regulation as early as 2017. Groups of 10 to 14 AME's with a facilitator as "lead" were formed, usually on a geographic basis. They meet regularly or inter alia when a need is identified. The meetings usually last about two hours, are noted and recognised as part of the AME Oversight Programme of the Competent Authority.

Findings: Main benefits include:

- Networking
- Education
- Case working
- Discussion and Debate
- Continuing Professional Support

Difficulties identified:

- Geographical
- Personality
- Commercial
- Scope of Practice

Conclusions: In General Practice Medicine, the benefit of Peer Support Networks has been known for many decades. It is expected that the practice of AME's will benefit from this similar process. Ongoing oversight of the Peer Support Networks will help to develop the process and may be extended to include other isolated/time-limited practitioners.

O-27

AEROMEDICAL DECISION MAKING IN COMMERCIAL PILOT WITH POLYDIPSIA

LA PRISE DE DECISION AEROMEDIQUE EN PILOTE COMMERCIAL AVEC LA POLYDIPSIE

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Introduction: The etiology and prognosis of polydipsia is not well defined. Different theories include a dysfunction in the thirst mechanism, involvement of the hippocampus, stress-reducing behavior, and lesion occurrences in specific areas of the brain. The current case study is about a male commercial pilot was diagnosed Diabetes Insipidus. With limited evidence in the literature regarding polydipsia in pilots, it was challenging to care for the pilot with polydipsia to ensure flying safety.

Case Report: A 28-yr-old male pilot presented with polydipsia and polyuria gradually increasing for 10 years. He drank 9- 10 liters of water daily. His symptoms included urination every 2 hours during daytime and nocturia 2-3 times per night; his urine was dilute and odorless. He denied history of head injury. On physical examination, there was no visual field defect, no muscle weakness, otherwise no significant findings. In order to confirm the diagnosis, a multidisciplinary approach was used: water deprivation test, Insulin-Like Growth Factor 1, serum cortisol, serum prolactin—all were negative. He was further evaluated with a brain MRI, which revealed a well-defined delayed-enhancing lesion at inferior aspect of anterior pituitary gland. Partial central DI and nephrogenic DI was the initial diagnosis.

Discussion: Our patient was an active commercial pilot; he frequently needed to get up to urinate during the night, which interrupted sleeping. His need to void urine frequently during daytime and drink large amounts of fluid would obviously be a disadvantage in an operational situation. There is also a risk of hyponatraemia and its complications, and the primary cause of polydipsia could include neoplasms of the hypothalamus; infections, e.g., meningitis and encephalitis; granulomatous disease such as sarcoid and histiocytosis; etc. In case of primary polydipsia, considering the potential progression of polydipsia by repeated exposure to aviation stresses, our patient's medical certificate for commercial pilot was renewed with OML limitation

O-28

ALPHA THALASSEMIA IN ROTARY AIRCREW: FITNESS TO FLY A CONSIDERED DECISION

THALASSÉMIE ALPHA EN AÉROSOL ROTATIF: APTITUDE À VOLER UNE DÉCISION CONSIDÉRÉE

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Introduction: The disease / disability Alpha-Thalassemia, is a rare genetic disorder wherein there is reduced production of haemoglobin. Alpha thalassemia is an autosomal recessive inherited trait. Defects on one or more of the 4 alpha globin genes (aa/aa), lead to reduced or absent production of the alpha-globin polypeptide chains. The alpha-globin gene mutations could be either the more common deletion (partial (a+) deletions or total (a0) deletions) or non-deletional types. The most common alpha-thalassemia mutations in the world are the 3.7 single-gene deletions. While a+-thalassemia is caused by single-gene deletions (such as 3.7 and 4.2), a0-thalassemia is caused by double-gene deletions. This aircrew presented with complaints of easy fatigability and anaemia. The paper discusses the aeromedical disposal dilemma in the first and only case of Alpha Thalassemia documented in the military flying across the globe.

Case Report: This is a case of Indian Air Force (IAF) rotary wing aircrew who presented with complaints of easy fatigability. He was detected to have anaemia with haemoglobin as 11.1 gm/dl. High Performance Liquid Chromatography revealed low HbA2 with thalassemic indices on haemogram. He was diagnosed as a case of Alpha-thalassemia. He was extensively evaluated including exposure to various aeromedical stresses and was awarded fitness for flying under waiver after due consideration.

Discussion: No reported case of an aircrew with Alpha-thalassemia and military flying has been reported, and none could be found on an extensive internet search of various aviation-related journals, including the Aerospace Medicine and Human Performance (AMHP) journal, formerly known as Aviation, Space, and Environmental Medicine journal (ASEM). However, based on the observation on ground, simulated aviation stressors, Hb and Hct values and international best practices, the aircrew was awarded a flying category under waiver. The aircrew has been asymptomatic and is currently flying without compromising aerospace safety.

O-29

AVIATION PODIATRY - IS THERE A NEED?

PODIATRIE AVIATION - Y A-T-IL BESOIN?

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Introduction: What place does podiatry have in aviation medicine? Problems associated with poor foot mechanics often present as symptoms in the lower back, hips, knees, ankles, feet and connective tissues in these areas.

Background: Screening of 250 ab-initio cabin crew over a 12 month period revealed many to have abnormal foot mechanics. Whilst many were asymptomatic and/or compensating for such abnormalities at this early point in their career, it was noted that many crew started to develop symptoms after they started to fly. In 2012 – ab-initio cabin crew were assessed over a 12m period. Over that time, 34% of crew were found to have a podiatric issue with 30% requiring orthoses. Of the 34%, 30% of this group had footwear issues. It was considered that the occupational role of cabin crew along with the wearing of a corporate style shoe, fatigue and physiological changes over 10,000ft altitude were largely responsible for the apparent rise in symptoms following the commencement of a flying career. Differences in the number of crew presenting with issues amongst cultural and gender groups also existed. The screening of crew also served to highlight common biomechanical problems. Each person was screened once using an electronic pressure plate scanner and a hands on assessment to check the range and type of motion in the lower limbs. Six common conditions were noted amongst the group: Hypermobility; Over-pronation with/without secondary issues including plantar fasciitis; Forefoot Equinus; Morton's Neuroma / Intermetatarsal Bursitis; Plantarflexed 1st Ray – with (functional) hallux limitus; Achilles Tendonitis.

Summary: Observations at a leading airline in the Middle East found that many of the industrial injuries occurring amongst its cabin crew, were frequently related to the lower limbs. Resource management meant that it was necessary, initially to focus on rehabilitating those crew who were symptomatic as opposed to taking a preventative approach

O-30

ASYMPTOMATIC WPW IN A PARACHUTIST – IS RADIOFREQUENCY ABLATION INDICATED?

WPW ASYMPTOMATIQUE CHEZ UN PARACHUTISTE - L'ABLATION PAR RADIOFRÉQUENCE EST-ELLE INDIQUÉE?

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Background: Wolff-Parkinson-White (WPW) is the well-known abnormal cardiac conduction pattern defined by an accessory electrical pathway that bypasses the atrioventricular node. WPW syndrome requires the presence of a tachydysrhythmia for appropriate diagnosis. The prevalence of WPW pattern in military aviators is about 1 – 1.5/1,000. The clinical and aeromedical concerns regarding preexcitation are risks of sudden cardiac death (SCD) and sustained supraventricular tachycardia (SVT). Noninvasive tests have a poor overall positive value to detect individuals at risk for SCD. Ablation or invasive risk stratification via electrophysiologic testing (EPT) may be considered overly aggressive for an asymptomatic subject with only the WPW ECG pattern.

Case Report: The studied subject was a 35-yr-old Romanian parachutist. He was evaluated at N.I.A.S.M, Bucharest, in order to participate to a foreign military mission implying a high operational stress. The subject can perform intense physical training, had no significant pathology in his medical history, and had no relative with known significant disease or sudden death. He is known with permanent WPW pattern in the last 7 years. He was evaluated periodically at Central Clinical Military Hospital, including electrophysiologic testing in 2012, and the result was that he did not need medication and could perform his duty. A new EPT was recommended and the result revealed a high vital risk. Radiofrequency ablation was successfully performed, and his ECG returned to normal. One month post-ablation the parachutist is asymptomatic and ECG is normal. He was scheduled for re-evaluation after 2 months.

Discussion: In this case, sudden cardiac death is the most compelling concern; however, this risk is low. The greater aeromedical concern is the risk for SVT, because it occurs more frequently, occurs suddenly and unexpectedly, and certainly could affect an aviator's safe performance of flight duties. We will discuss all aeromedical concerns, including risk stratification and (aeromedical/ clinical) indications for radiofrequency ablation and post-ablation monitoring of patients with WPW pattern.

O-31

HYPERKALAEMIC PERIODIC PARALYSIS - A CASE REPORT

PARALYSIE PÉRIODIQUE HYPERKALIÉMIQUE - UN RAPPORT DE CAS

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Background: Hyperkalaemic Periodic Paralysis is an autosomal dominant condition that results in episodic muscle weakness. Attacks may be precipitated by cold exposure, rest after exercise and fasting and can be focal, affecting only one limb, or generalised with hypotonia. Cranial and respiratory muscles are usually not affected. There are several measures that can be used to prevent or treat attacks.

Case Report: A medical examination for the initial issue of a Part-MED Class 1 medical certificate to a 40 year old applicant with Hyperkalaemic Periodic Paralysis was referred to the UK Civil Aviation Authority. The applicant had previously been issued a Class 2 medical certificate following secondary review, having initially been assessed as unfit. He had subsequently obtained a PPL(H). He had experienced major attacks in childhood affecting all four limbs, had been taking medication for around 20 years, including acetazolamide for the last 10 years and had experienced no major attacks since starting medication. At the time of assessment he was experiencing 4-6 episodes of mild focal muscle weakness per annum. Following a secondary review, the applicant was issued an EU Class 1 medical certificate with Operational Multi-pilot Limitation (OML). This decision was upheld following an appeal to have the OML removed.

Discussion: The aeromedical assessment should take account of the type of Periodic Paralysis, the muscles affected (including potential cardiac involvement) and the situations that might precipitate attacks. The effectiveness and side-effect profile of medication used to control symptoms are an important consideration. Taking account of the very low risk of a major attack and the rate of onset of an attack, the risk to flight safety can be further mitigated with a second pilot. The UK CAA has published an exemption from the requirement that only holders of a commercial licence may be issued with a Part-MED Class 1 medical certificate with an OML endorsement.

O-32

MDC SPLATTER-RELATED INTRAOCULAR LEAD FOREIGN BODY INJURY FOLLOWING EJECTION FROM HAWK TRAINER JET

BLESSURE INTRAOCULAIRE SUITE À UNE ÉJECTION À PARTIR DE HAWK TRAINER JET LIEES A L'EXPLOSION D'UNE CANOPIE DE COCKPIT

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Background: Facial protection with visors has reduced but not entirely eliminated intraocular injuries following ejection. We report a rare case of intraocular lead foreign body in a Hawk pilot following ejection.

Case Report: A 40-year-old male pilot sustained facial injuries after ejection from a Hawk aircraft following partial midair collision with another jet during aerobatic display. Initial examination revealed multiple foreign bodies in the skin around the jaw, multiple corneal foreign bodies, corneal oedema with self-sealed entry wound, one intralenticular foreign body with clear lens and self-sealed lenticular entry and exit wounds and two intravitreal foreign bodies in his left eye. Posterior segment was normal and vision was 6/18. Right eye was normal. The foreign bodies were 0.5 to 1.2 mm in size with CT scan reflectivity of 270 Hounsfield's units suggestive of plastic. Spectroscopic and electron microscopic analysis of fragments removed from the cornea showed high lead content. Analysis of canopy material and Miniature Detonator Cord (MDC) confirmed MDC as the source of lead. Electroretinogram (ERG) showed reduced scotopic response and mild diminished photopic response in the affected eye. He underwent removal of intravitreal foreign bodies successfully by pars plana vitrectomy, leaving the lens untouched as the intralenticular foreign body was lodged in the periphery, well encapsulated in a clear lens. He recovered 6/6 vision with improved ERG 6 weeks post-surgery.

Discussion: The case is unique as direct retinal toxicity by intravitreal lead foreign body is unreported. It raises aeromedical concerns about the hazards of MDC splatter even with intact visors as the pilot reportedly had his visor down.

Conclusion: MDC splatter during ejection is a potential source of lead foreign body injury which is toxic to the retina. Visors need to be designed to prevent penetration.

O-33

ELECTROMYOGRAPHIC ASSESSMENT OF MUSCLES PARTICIPATING IN PERFORMANCE OF AGSM

EVALUATION ELECTROMYOGRAPHIQUE DE MUSCLES PARTICIPANT A LA PERFORMANCE DE L'AGSM

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Introduction: The effectiveness of the EMG technique is used in assessing the participation of muscle groups in performance of Anti-G Straining Manoeuvre (AGSM). AGSM is the most effective physiological method, available with the aircrew, to increase his or her +Gz tolerance. However, there is a requirement to learn and practise the correct technique of performing AGSM to obtain optimal benefit.

Methods: 25 male aircrew from fighter stream (healthy volunteers) between the age group of 21 to 30 years (ab initio aircrew) participated in the study. The protocol was explained and consent was taken. Relaxed and straining G tolerances of the aircrew were recorded in the High Performance Human Centrifuge (HPHC) and EMG assessment of the four muscle groups involved in performance of AGSM was carried out on the AGSM Practise and Test rig using surface EMG (SEMG) technique. Subjects were indoctrinated with the correct technique of performing the AGSM (L1 manoeuvre). EMG recordings and the G tolerances were repeated and the values compared at pre and post training stages. The obtained data was evaluated using Student's T test and Pearson correlation study.

Results: The normalized RMS EMG values of all the four groups of muscles showed significant increase in the post-training stage. The post-training EMG values of all the four groups of muscles were compared and correlated with the post-training straining G tolerance values. The thigh muscles showed the highest positive correlation with the straining G tolerances ($r=0.343$) followed by calf muscles ($r=0.212$).

Conclusion: The EMG data from various groups of muscles revealed that the lower limb muscles, i.e., thigh muscles, followed by calf muscles, are the most active muscles. Although abdominal musculature has been considered an important contributor in the performance of AGSM, it is not the only important muscle group.

O-34

DYNAMIC FLIGHT SIMULATION FOR CENTRIFUGE TRAINING

SIMULATION DE VOL DYNAMIQUE POUR L'ENTRAÎNEMENT CENTRIFUGE

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Introduction: For many years, centrifuge training around the world employ closed loop profiles to train fighter pilots in combating high gravitational (G) forces. While closed loop profiles are useful for ab initio fighter pilots seeking qualification on their platform, they do not appeal to operational fighter pilots who undergo centrifuge training for currency requirements.

Method: In the Republic of Singapore Air Force (RSAF), Dynamic Flight Simulation (DFS) centrifuge training has been implemented for all operational fighter aircrew since April 2019. To our understanding, the implementation of DFS on such a large scale is the first in the world. The DFS consists of an open loop profile which combines realistic flight simulation with centrifuge training, and has been refined over several years to achieve good fidelity. Gamification is also introduced through the tasking of a realistic mission set.

Results: Feedback on the acceptability and efficacy of DFS centrifuge training have been collected from operational fighter pilots through the conduct of post-training surveys. Preliminary data on the post-training surveys will be presented. Videos showing how DFS was conducted will also be shown.

Discussion: DFS centrifuge training not only increases the training realism for operational fighter pilots and hence their acceptability of centrifuge training, it allows them to better understand their physical limits in a dynamic fashion, specifically their G performance and endurance in relation to the G forces that they pull. With DFS, a pilot's AGSM technique can be fully assessed in the centrifuge rather than in the air, providing a safer and more accurate method of assessment.

Conclusion: DFS centrifuge training heralds a new form of centrifuge training which should be adopted for the training of operational fighter pilots.

O-35

THE IMPORTANCE OF USING FLIGHT SIMULATION TO PREVENT PILOT'S SPATIAL DISORIENTATION

L'IMPORTANCE D'UTILISER LA SIMULATION DE VOL POUR EMPÊCHER LA DÉSORIENTATION SPATIALE DE PILOT

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Introduction: The inherent feature of flight is that pilots sometimes lose their spatial orientation as a result of various external influences and internal processes.

Background: During my presentation, I analyze the factors that inevitably lead to a loss of an orientation, such as imbalances and pilotage errors. Recognizing the reasons, I prove that "The lack of reference points, lines in the surrounding space, or the loss of them during the flight can lead to a fatal outcome!" Then, I will clarify the know-how to prevent this negative physiological effect, and discuss the effects that can be achieved by utilizing pilot swings and simulators.

Summary: Concentrating on the use of flight simulators, I present the current possibilities of the Hungarian Defense Forces and the means of the future.

O-36

UNPOWERED FLIGHT ABOVE THE ARMSTRONG LINE – THE PERLAN II PROJECT

VOL NON ALIMENTÉ AU-DESSUS DE LA LIGNE ARMSTRONG - PROJET PERLAN II:

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Introduction: On 2 Sep 2018 James M. Payne and Timothy Gardner again set the absolute altitude record for gliders at 22657meters (74,334 feet). Previously, the world's altitude record at 50,772" (15,475m) was achieved by the original Perlan Project in a modified DG505 sailplane by Steve Fossett and Einar Enevoldson. In that aircraft, aircrew physiological protection was effected by conventional pressure suits. The Perlan 2 Project attempts to soar as high as 27,432m (90,000 feet) in a uniquely designed sailplane, with a closed, pressurized cabin.

Background: The cabin was designed to maintain an equivalent altitude of 15,000' (4,572m) with compressed air supplied from bottles. This was increased to 16,500' (5029m) after calculating no increased risk of DCS. The 2-person crew breathe 100% oxygen via continuously worn masks supplied by an adapted, closed loop, Self-Contained Breathing Apparatus, using gaseous oxygen bottles. Exhaled CO₂ will be adsorbed in a calcium carbonate bed. Excess cabin moisture from ambient air and exuded sweat will be adsorbed on a zeolite bed. No heating or cooling equipment is installed.

Perlan flies in the polar vortex wave in southern Argentina, in mid-spring, cold weather. Missions require 4-8h duration and will operate above atmospheric tropopause, and above the "Armstrong Line" of approximately 63,000' (19,202m), in temperatures as low as -70C. Decompression Sickness risk is minimized by the closed, 100% oxygen system and relatively low rate of climb allowing long pre-breathe time. However, ebullism would occur if a cabin pressure failure occurred above the Armstrong Line. Rapid descent is available with an installed drogue chute, and a separate, ballistically deployed, whole-aircraft parachute. In the event of crew incapacitation, locating the unguided glider after impact and rescuing the crew would be difficult.

Summary: The engineering solutions that were selected present unique aeromedical problems. Thus far, the design has proved safe. Protection against DCS and ebullism will be shown.

O-37

USE OF VIRTUAL REALITY TECHNOLOGY IN SIMULATED AEROMEDICAL STRESS SITUATION IN LOW PRESSURE CHAMBER

UTILISATION DE LA TECHNOLOGIE DE RÉALITÉ VIRTUELLE DANS UNE SITUATION DE STRESS AÉROMÉDICAL SIMULÉ DANS UNE CHAMBRE À BASSE PRESSION

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Introduction: All Air Forces are challenged to fully understand Physiological Events (PEs) and mitigate their risk possibly caused by OBOGS (On-Board Oxygen Generating System) abnormalities. Virtual Reality (VR) technology in ground based safe situation can create new possibilities for aeromedical approach: We can perform virtual flight scenarios, combined with aeromedical monitoring system, in ground-based physiological stress situation in barochamber.

Methods: 8 male and 2 female applicants volunteered after hypoxia awareness training to perform different virtual flight profiles in a low pressure chamber. During the simulated flight, we could provide the altitude changes provoking hypoxia insidiously and the possible emergency situation as well. Monitoring the cerebral regional oxygen saturation by NIRS (cerebral pulse oximetry), pCO₂ level by capnometry and pulse variance HRV (Heart Rate Variability), we can characterize the real oxygen utilization in brain and the possible accompanying vegetative dystonia.

Results: In younger applicants there is a tendency for higher fall in regional cerebral oxygen saturation, parallel to increased washout of CO₂, even after restoring the oxygenation or returning to ground level. The response seems to be highly individual, possibly depending on sympathetic activity of the central nervous system.

Conclusions: Using VR, we can provoke the flight stress caused by hypoxia in a more realistic way. Configuration and integration of technical computerized tools in the pilot's helmet and aeromedical monitoring system is a possible way ahead for training and better understanding of PEs.

O-38

ASSESSMENT OF PHYSICAL ACTIVITY PATTERN AMONG INDIAN CIVIL AIRCREW AND ITS CORRELATION WITH METABOLIC SYNDROME

ÉVALUATION DU PROFIL D'ACTIVITÉ PHYSIQUE CHEZ LES CIVILS INDIENS ET DE SA CORRÉLATION AVEC LE SYNDROME MÉTABOLIQUE

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Introduction: Growing urbanization, mechanization, economic growth and dietary westernization has led to the risk of sedentary lifestyle. Physical inactivity is documented as a predictor of cardiovascular events and mortality. Metabolic Syndrome (MetS) is also known to be associated with a sedentary lifestyle. Aircrew, being part of urban population, are no exception to the risk of sedentary lifestyle. This study was done to assess the physical activity pattern among Indian Civil Aircrew and correlate with MetS.

Methods: The validated long form of International Physical Activity Questionnaire (IPAQ) was issued to aircrew who participated in the MetS prevalence study. The responses were analyzed using the validated scoring protocol and physical activity pattern categorized. The association between physical activity pattern and MetS was further studied.

Results: 260 out of 421 aircrew returned the completed questionnaire. Of these, 81.2% (n=211) felt that they were physically highly active whereas the remaining 18.8% (n=49) felt that they were moderately active. Not a single aircrew considered themselves to be low on physical activity. The prevalence of MetS noted in this study was 6.7%. No statistically significant association ($p=0.774$) was observed between physical activity pattern and MetS in this study.

Conclusion: The requirement of periodic aeromedical evaluation to maintain higher health fitness could be attributed to the lower prevalence of MetS in aircrew compared to general population. This could be further substantiated by the high and moderate physical activity pattern among the aircrew as assessed through IPAQ. Few aircrew expressed that some activities noted in IPAQ were not appropriate for the Indian population and might be more relevant to western population. No significant association between MetS and physical activity pattern might have been due to socially acceptable answers given and few culturally unrelated activities list in IPAQ. This study adds impetus for the development of physical activity assessment questionnaire suitable for Indian aircrew population so as to study the association of physical activity pattern and MetS.

O-40

THE ROLE OF ANTIHISTAMINES IN FLIGHT SAFETY: MEDICAL RESEARCH AND OPINION

LE RÔLE DES ANTIHISTAMINES DANS LA SÉCURITÉ DES VOLS: RECHERCHE MÉDICALE ET AVIS

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Introduction: Antihistamines are easily accessible and cover the vast majority of the medical therapy of allergic rhinitis. However, their systemic administration may more frequently associate with their well-known side-effect, sedation, which is a serious problem in persons in safety-critical jobs such as aviation. We have a poor understanding whether a non-sedative antihistamine has an impact on vigilance when hypobaric hypoxia occurs during flight.

Methods: In this randomized, placebo-controlled, double-blind, cross-over study, the effect of 20mg bilastine was compared to 10mg cetirizine and to placebo (20mg pyridoxine) in 33 individuals at ground level and at 4000 m altitude simulated in hypobaric chamber. Level of vigilance, ultrashort memory, combined distributive attention, monotony tolerance and peripheral blood oxygen saturation (SpO₂) were assessed.

Results: Bilastine did not impair tested abilities in comparison with the control groups under hypobaric hypoxia at the simulated altitude of 4000 meters. As to cetirizine, only one parameter, the increase of the number of errors pointed to a weaker performance at ground level, however, at the simulated altitude already demonstrated impaired results with regards to the distributive attention test.

Conclusions: Among the two examined antihistamines, bilastine should be the preferred medication for individuals who require constant attention and are exposed to hypobaric hypoxia.

O-41

IMPROVING THE QUALITY OF PILOT CLINICAL EXAMINATIONS. AN OBSERVATIONAL STUDY OF UK AEROMEDICAL EXAMINERS PRACTICE

L'AMELIORATION DE LA QUALITE DES EXAMENS CLINIQUES PILOTES. UNE ETUDE D'OBSERVATION DE LA PRATIQUE DES EXAMINATEURS AEROMEDICAUX BRITANNIQUES.

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Introduction: The aircrew medical is performed to detect medical causes of inflight incapacitation and provide assurance that the human component of an aviation system is fit for flight. Other opportunities for health promotion and detection of asymptomatic disease exist but how good are we at this? This study has drawn on 4 years of oversight findings where AMEs were observed by medical auditors in their history taking, examination and management of civilian commercial aircrew.

Methods: We retrospectively reviewed the findings from over 400 site audits between 2015 and 2019. At each of these audits, history taking, examination and the clinical management of pilots were assessed.

Results: Preliminary results have identified common themes. Few AMEs are perfect and for most there are areas where some improvement could be made. The identification of these areas coupled with a justification for change and signposting of resources to affect this has been well received. Common findings have included inadequate auscultation for murmurs or bruits, poor respiratory examination, inadequate management of BMI, inadequate mental health examination, poor history taking and finally, missing the opportunity to carry out health promotion activity (particularly testicular and breast self-examination).

The results from our audits will be presented in full along with data to support why the aspects of examination highlighted are important and where AMEs can access resources to improve their skills.

Conclusion: Poor performance usually reflected skill fade, inexperience or a lack of awareness. Examination of asymptomatic patients presents a challenge to doctors who are more used to patient directed examination and investigations. Knowing where to look and why this is important is essential knowledge for AMEs. Mental health, cardiovascular examination and health promotion activity were identified as areas for improvement.

Discussion: Detection of asymptomatic disease is challenging and the prospect of false positives worrying but knowing what to look for and where to focus attention is vital. Increasing work load, a young fit population and over familiarity can lead to complacency.

O-42

FAA AUTHORIZATION FOR SPECIAL ISSUANCE MEDICAL CERTIFICATION - 2018

AUTORISATION DE LA FAA POUR L'ÉMISSION SPÉCIALE DU CERTIFICAT MÉDICAL - 2018

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Introduction: In contrast to other national civil aviation authorities, the Federal Aviation Administration (FAA) in the U.S. does not determine risk in medical certification decisions by use of the 1% Rule.

Background: In cases where the individual pilot does not meet the medical standards as stated in 14 CFR Part 67, the only means to medical certification is through the Special Issuance process. The regulatory framework of the FAA requires that each such case be evaluated on an individual basis. The FAA decision must be able to withstand the legal challenge of being considered capricious and arbitrary. The FAA conducts an operational risk management assessment of a pilot's medical condition. This assessment is done utilizing the expertise of FAA Aerospace Medicine subject matter experts, in addition to Federal Air Surgeon consultants in specific medical specialty areas all relying on currently available medical and scientific information. It is evidence based, risk assessment decision making. In contrast to other national regulatory authorities, the FAA does not issue first class medical certificates with operational restrictions such as "with or as a co-pilot" – each pilot in a multi-pilot crew must be fully, independently medically qualified.

Summary: In 2018, the FAA received 387,341 applications for medical certificates, and of these granted 33,811 Special Issuance certificates. Specific case examples of this risk based decision process, and diagnoses receiving Special Issuance will be presented as well as a new FAA protocol for evaluating pilots with insulin treated diabetes mellitus desiring a first or second class FAA medical certificate. FAA statistics for 2018 show 5,270 Special Issuance certificates for Diabetes Mellitus for all classes were issued, and of these 448 are insulin treated, all of which are third class airmen.

O-43

REVIEW OF MOST COMMON CAUSES OF MEDICAL DISQUALIFICATION FOR UNMANNED AIRCRAFT SYSTEM OPERATORS

EXAMEN DES CAUSES LES PLUS COMMUNES DE DISQUALIFICATION MÉDICALE POUR DES EXPLOITANTS DE VÉHICULE AÉRIEN SANS PILOTE

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Introduction: The US Army utilizes several different Unmanned Aircraft Systems (UAS) whose operators fall under Army Class 4 aeromedical standards. This review will discuss the causes of aeromedical disqualification for operators and the most commonly waived conditions.

Methods: We reviewed the Aviation Epidemiology Data Registry (AEDR) within the Aeromedical Epidemiology Resource Office (AERO) electronic, physical exam system for fiscal years 2013-2018 to determine the total number and causes of medical disqualification for UAS operators. The data was also reviewed to determine the most common medical conditions that received waivers. Like conditions were grouped together by body systems; we did not include data from incomplete physicals.

Results: Of 6,607 UAS operators medically evaluated during the study period there were a total of 17,372 unique patient encounters. Of the unique encounters, 614 (3.53%) were disqualified; of these, 125 (20.36%) received waivers. The most common causes of disqualification were psychological conditions (203), vision deficiencies (134), and attention-deficit disorders (64). The most common medical conditions that received waivers were psychological conditions (35), vision deficiencies (19), and spinal musculoskeletal disorders (18). The disqualification statistics are not additive as some patients receive disqualifications for multiple conditions.

Discussion and Conclusions: The results indicate a potential lack of screening criteria for attention-deficit disorders as well as psychological conditions and vision deficiencies. Misapplied or absent standards are alarmingly common and failure to understand the unique characteristics of these personnel and their operational environment has the potential for catastrophic life and materiel loss. Categorizing and enumerating these data has applicability to both the US civilian and international aviation communities. Revisions to US Army Aeromedical Policy are currently planned to more thoroughly delineate aeromedical waiver requirements which will aid in normalizing application of standards and facilitate more homogeneous future inter-service policy updates. Further study is needed to compare the causes of disqualification for UAS with manned aviation counterparts to assess the completeness of current aeromedical standards.

O-45

AFTER 2015 – CHANGES AND CONSEQUENCES IN AVIATION PSYCHOLOGICAL TESTING METHODS

*APRÈS 2015 - MODIFICATIONS ET CONSÉQUENCES DES MÉTHODES DE CONTRÔLE
PSYCHOLOGIQUE EN AVIATION*

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Introduction: In the last few years, aviation psychology came into focus more than ever. After some tragic events, mental health of air crews is a core issue among aviation medical professionals. New regulations, protocols and basic data analysis formed this interdisciplinary work. The presentation tries to collect the consequences of initial pilot examinations, based on the work of a mainly Hungarian sample.

Background: First, the summary of personality and clinical psychological test results is taken into account to give an aspect of the average initial pilot applicant in the age group of 18 to 40. Second, instrumental aptitude testing was used, like attention, tendency of failures, etc. This is compared to personal observations of examiners, using observed data collections. In the third chapter we want to focus on differences and common parts between clinical personality and aptitude testing methods, their exact role and necessity regarding the new, actual situation of air traffic safety, including the importance of hidden, secondary information, and their predictive validity.

Summary: According to preliminary summary, much more aviation accidents and incidents are caused by soft-skill problems, or even organisational anomalies, flight training, than mental disorders. What a medical assessor or an instructor pilot observe about mental status is still a question. We use reports from flight instructors, including class-2 and class-1 cases, to reveal what practical failures they meet repeatedly and what they can observe from the personality of the pilot sitting next to them. By evaluating these data this presentation is intended to be a keynote paper, keeping the future of practical aviation psychology in aspect.

O-46

FLYING 65 AND BEYOND – A POSSIBLE ANSWER TO THE GROWING DEMAND FOR AIRCREW

VOLER À PARTIR DE 65 ANS - UNE RÉPONSE POSSIBLE À LA DEMANDE CROISSANTE DE PERSONNEL NAVIGANT

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Introduction: The number of air travelers has increased dramatically over the last few years, and will hit 7.2 billion by 2035. This has led to a growing demand for pilots. The training itself cannot keep up with this worldwide shortage of pilots, so the attention turns to age limitation.

Method: For a thorough assessment of a pilot over 65, we assembled an examination plan with special tests. During a 6 min interval, we evaluate the pilot's physiological state in a resting position. We use HRV (heart rate variability), which gives information about the autonomic nervous system, the electrical and the mechanical state of the heart, and possible inflammation. Arteriography demonstrates the characteristics of large arteries and endothelial function, revealing several parameters: augmentation index (AIX, optimal range <-30%) traces the degree of pulse wave reflection, state of peripheral circulation, and is related to cardiovascular mortality. Pulse wave velocity (PWV, optimal range <7 m/s) represents the speed of the pressure wave on the aorta generated by the heart's contraction, which is crucially affected by the elasticity of the aorta. PWVao is a solid, independent, proven risk factor of cardiovascular mortality. Diastolic area index (DAI, 50-60% among healthy individuals) represents the diastolic proportion of the cardiac cycle, and gives information on the pressure properties of the left coronary artery. With dry electrode EEG, we monitor the well-known brain wave range combinations. We compared the findings of 3 pilots above 65 (average 65.6 y/o) to 8 younger pilots (average 33.75 y/o).

Results: Our measurements show that the physiological parameters of older pilots are in the normal range, compared to younger pilots who are in the optimal range (Aix: -41.3 to -61,4; PWV 8.2 to 6.32; DAI 50.35 to 53.41).

Conclusion: The actual physiological state and the ability of a certain pilot should define fitness. Further evaluations need to be done, even during flight, and repeated measurements to verify that the limitation should not depend only on age.

O-47

EFFECTS OF ACUTE AND CHRONIC HYPOBARIA UPON THE BRAIN

EFFETS DES HYPOBAIRES AIGÜES ET CHRONIQUES SUR LE CERVEAU

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Introduction: Non-hypoxic hypobaric exposure is associated with increased subcortical white matter hyperintensity burden. U-2 pilots have significantly lower MicroCog scores in multiple domains compared to other USAF pilots. Pathophysiological mechanisms may involve a neuroinflammatory response or perturbations in cerebral blood flow (CBF).

Methods: U-2 pilots (U2, n=103), altitude chamber inside observer personnel (AOP, n=83), and health-matched personnel with doctorate degrees (DOC, n=162) were imaged using a high angular resolution diffusion imaging sequence. Whole brain and white matter (WM) tract fractional anisotropy (FA) values were generated from the ENIGMA-DTI pipeline. Aircrew undergoing standard altitude chamber training (AFC, n=117) were compared to controls who were not exposed to hypobaria (NOR, n=67). MRI arterial spin labeling imaging was performed to quantify CBF at baseline (- 24 h), and at 24 and 72 h post chamber training. CBF was quantified in mL/g/min using the ASLtbx with SPM8.

Results: Group differences demonstrated a significant effect for the body, fornix, internal/external capsules, corona radiata, and (superior) fronto-occipital tracts, all with U2 group having significantly higher FA values, except in the fornix, where U2 FA was significantly lower. No significant tract differences were found between DOC and AOP groups. Chamber trainees had increased WM CBF 24 h after experiencing hypoxic hypobaria (AFC: 7.65 +/- 1.61 mL/g/min, NOR: 7.13 +/- 1.64 mL/g/min, p=0.04). At 72 h, chamber trainee WM CBF was higher than controls (AFC: 7.72 +/- 1.61 mL/g/min, NOR: 7.25 +/- 1.50 mL/g/min, p=0.06). No differences between groups were found for gray matter CBF.

Conclusion: Non-hypoxic hypobaric exposure of U-2 pilots, but not chamber inside observers, is associated with significantly lower FA values in the fornix, which plays an important role in memory. A single hypoxic hypobaric exposure may provide a model to study alterations in CBF associated with hypobaric exposure.

O-48

EFFECTIVENESS OF MASK-ON VERSUS MASK-OFF HYPOBARIC HYPOXIA TRAINING

EFFICACITÉ DE L'ENTRAÎNEMENT HYPOBARIQUE HYPOBARIQUE PAR MASK-ON VERSUS MASK-OFF

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Introduction: Hypoxia awareness training for aircrew in the Republic of Singapore Air Force (RSAF) has traditionally been accomplished through mask-off hypoxia in a hypobaric chamber. With the aim of improving training realism and to better hone aircrew's ability to respond to in-flight situations of insidious cabin depressurisation or on-board oxygen generation system (OBOGS) failure, mask-on hypobaric hypoxia training was introduced in 2019 following the operationalisation of a Breathing Quality Air (BQA)-compatible hypobaric chamber in 2018.

Methods: This study aims to (1) assess the subjective effectiveness of mask-on hypobaric hypoxia training in meeting the training objective of self-recognition of one's hypoxia signature, (2) compare the subjective effectiveness of mask-on versus mask-off hypobaric hypoxia training pedagogies, and (3) obtain descriptive data on the type(s) of hypoxia symptoms experienced and the time to onset of hypoxia symptoms. The study is designed as a consecutive case crossover study involving aircrew undergoing mandatory mask-on hypobaric hypoxia training who had previously undergone mask-off hypobaric hypoxia training.

Results: Based on preliminary trials, 83.3% (25/30) of aircrew undergoing mask-on hypobaric hypoxia training experienced hypoxic symptoms and executed corrective action appropriately, 16.7% (5/30) were false positive. 46.7% (14/30) of aircrew executed corrective action within 3 minutes of hypoxia exposure, while 33.3% (10/30) of aircrew took more than 4.5 minutes.

Based on subjective survey results, 92.9% (13/14) participants felt that the mask-on hypoxia training enabled their experience of mask-on hypoxia, 78.6% (11/14) preferred the mask-on training compared to mask-off, and 92.9% (13/14) felt that it was an improvement from the mask-off training. Subjective feedback highlighted increased realism and task-oriented training as reasons for the improvement.

Conclusions: Being able to reproduce aircrews' hypoxia signature in mask-on hypobaric hypoxia training, and to train aircrew to confidently detect their hypoxia signature early whilst instituting corrective action are two important training objectives of the RSAF's new mask-on hypobaric hypoxia training.

O-49

THE IMPACT OF HIGH OXYGEN LEVELS ON CEREBRAL PERFUSION & COGNITIVE PERFORMANCE

IMPACT DES NIVEAUX D'OXYGÈNE ÉLEVÉS SUR LA PERFUSION CÉRÉBRALE ET LES PERFORMANCES COGNITIVES

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Introduction: High oxygen levels are an omnipresent exposure in tactical aviation. High performance aircraft typically deliver an aggressive oxygen schedule to pilots to protect against the threat of hypoxia. However, the physiologic and cognitive implications of hyperoxic exposures in this environment are not well-understood; this study seeks to fill that gap.

Methods: This effort utilized 30 military and civilian subjects under room air (21% fraction of inspired oxygen [FiO₂]) and a sustained hyperoxic exposure (100% FiO₂) to determine cerebral perfusion (cerebral blood flow [CBF]) and associated physiologic sequelae. Subjects experienced both levels of oxygen while undergoing magnetic resonance (MR) imaging assessment; electroencephalogram, arterial blood gases, cognitive testing, and ventilation were contemporaneously measured. CBF was measured by MR pulsed arterial spin labeling. MR scans were processed to provide measures of brain gray matter, white matter, ventricular volumes, as well as total volume of 105 specific brain regions.

Results: Exposure to 100% FiO₂ within our MR scanner led to a rapid, significant, and sustained reduction in CBF. Compared to CBF during room air, CBF under 100% FiO₂ decreased dramatically, quickly, and continuously. After approximately 30 min of 100% oxygen, CBF values fell to 63% of the baseline values. Whole brain DaO₂ was significantly reduced by 22% ($p=0.001$) during 100% FiO₂. At 21% FiO₂, the majority of study subjects scored within the range of "average" cognitive performance in each of the nine cognitive domains. At 100% FiO₂, significant improvements (P7 of 9 domains measured by MicroCog). During cognitive testing at 100% FiO₂, alpha and beta spectral power showed increases in several brain regions.

Discussion: This is the most comprehensive study of CBF under hyperoxia performed to date; previous studies have had small sample sizes and have been limited to male subjects. The implications for tactical aviation physiology are clear and concerning; CBF decreased dramatically within a very short time frame and continued to decrease throughout the exposure.

O-50

THE IMPACT OF LACK OF PHYSICAL ACTIVITY IN AIR TRAFFIC CONTROLLERS

IMPACT DU MANQUE D'ACTIVITE PHYSIQUE CHEZ LES REGULATEURS DE LA CIRCULATION AÉR

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Introduction: An Air Traffic Controller is handling high-stake risks on a day-to-day basis. Six to eight hours sitting, many overweight, lack of physical activity, suffering back or neck pain and reduced mobility from conditions like arthritis, increase risks of injury and job absenteeism. Sedentary jobs are connected to many diseases, but also osteoporosis, muscle degeneration or weakness, atrophy, and poor grip strength which increase falling. Already 2,000 years ago, Hippocrates highlighted the importance of active living. Regular physical activity prevents more than 25 chronic medical conditions. Still, the activity may cause injury and re-injury. The most common injuries are lower leg/ankle/foot. Through our isokinetic testing pro testing program we got significant outcomes useful for controllers.

Methods: Evaluation of 150 controllers used the data from clinical findings and diagnostic procedures, including: income questionnaire analysis, lab tests, isokinetic spine and knee tests, questionnaire after the program. We analysed isochronous knee testing at 60°/s.

Results: Isokinetic testing showed the disparity in sitting muscle groups, which accelerates premature changes and knee problems. From the results, we calculated the values of the relative strength of the left and right quadriceps, the strength ratio of the hamstrings--the deficit power of both muscle groups showed weakness of hamstrings in in both sexes. High 20% deficit of quadriceps power in men. In 40%, deficit in knee strength that is related to injuries.

Conclusion: Greater percentage of knee osteoarthritis is expected due to the flexural position. Regular isokinetic measurements can provide insight into the strength and endurance deficiency of muscle groups as well as the risks of unbalanced physical activity. Tests enable creating an individual exercise protocol to determine the progress of effective exercise, thereby preventing osteo-degenerative diseases of the knee and spine segments, as well as preventing injuries and re-injuries. Thus, strengthening capacity for physical activity is important for those are active and those who should become active.

O-51

SURVEILLANCE STUDY OF COCKROACHES INFESTATION AND EFFICACY OF NEW CONTROL MEASURE ON AIRCRAFT

ÉTUDE DE SURVEILLANCE DE L'INFESTATION COCKROACH ET DE L'EFFICACITÉ D'UNE NOUVELLE MESURE DE CONTRÔLE SUR UN AÉRONEF

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Introduction: The purpose of this study was to assess the current prevalence of cockroach infestation and field performance against cockroaches on aircraft and to identify microorganisms of medical importance from cockroaches.

Methods: From April to August 2016, public health specialists investigated cockroach infestation on 60 aircraft in China via standardized procedures (i.e. trap count and pyrethrum spray). Meanwhile, gel bait was applied in the field, and killing rate calculated after 1, 7, and 30 days; chemical insecticides were used at aircraft D check to control cockroaches. Finally, bacteria were identified by automated microbial identification system after isolation from samples.

Results: In total, 597 cockroaches were collected from 60 aircraft, of which 74.5% were nymphs; 27 aircraft were infested with cockroaches (45%). The infestation of cargo areas were higher than other locations ($X^2=36.39, P<0.01$). Cockroach infestation was positively associated with aircraft in which there was a lack of cockroach monitoring (OR=11.22, $P=0.04$), or pet transportation on board (OR=17.78, $P=0.04$). The killing rate was decreased 58.8%, 96.3%, and 93.2% after 1, 7, and 30 days, respectively, for different location on 4 aircraft. The cockroach killing rates of different days had statistical significance ($X^2=58.95, p<0.01$). There were no cockroaches on aircraft for six months after D check. 32 samples were collected; 8 species (26 strains) of bacteria and opportunistic pathogens were isolated from cockroaches.

Conclusions: The cockroach infestation rate was high in aircraft; cockroaches carry a large number of pathogenic bacteria and opportunistic pathogens, presenting a risk of disease transmission. Cockroach control measures should be more persistent on aircraft with pets. Application of gel bait agents hold good efficacy against cockroaches in aircraft.

O-52

JOINT AERO-MEDICAL EVACUATION IN AM-Hex 2016

ÉVACUATION AÉRO-MÉDICALE CONJOINTE AM-Hex 2016

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Introduction: The ADMM-Plus Military Medicine-Humanitarian Assistance and Disaster Relief Joint Exercise 2016 (AM-Hex 2016) was held from 1 to 11 September 2016 in Chonburi Province, Kingdom of Thailand.

Background: The participating forces were from 18 countries: Australia, Brunei, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Myanmar, New Zealand, Philippines, Republic of Korea, Russia, Singapore, Thailand, USA, and Vietnam. Among these countries, Australia, China, Indonesia, Japan, Russia, Thailand, and USA participated the types of exercise interested in aero-medical evacuation (AME) and mobile aeromedical staging facility (MASF). Chinese PLA sent the participating force consist of an Army engineers troop with 60 engineers, 2 Mi-171 helicopters, and excavator, truck, etc.; an Air Force troop with the medical team of 40 med personnel, 1 Y-9 fixed wing med plane; and a Navy troop with 1 cargo ship and 1 Z-8 helicopter.

Summary: The Author, as a participant from the Chinese PLA Medical Team, is pleased to share the Exercise experience with our international colleagues. The PPT presentation focuses on AME and MASF; on coordination for patient transfer; on triage, pre flight assessment and stabilization; on static demonstration, in flight patient care and/or fly away. There is discussion about fixed-wing med plane, aero-medevac using C130, modified ambulance helicopter, and aero-medivac team, and the AME/MASF at exercise site of U-TAPAO Air Base.

O-53

PHYSIOLOGICAL MONITORING AND AIRCRAFT AUTONOMY: AEROMEDICAL CHALLENGES FOR THE FUTURE

SURVEILLANCE PHYSIOLOGIQUE ET AUTONOMIE DES AÉRONEFS: DÉFIS AÉROMÉDICAUX POUR L'AVENIR

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Introduction: Future aircraft will incorporate physiological monitoring capabilities that will provide aviator data to aircraft computers to improve safety and ensure mission completion, in real time. In combination with other indicators, onboard systems enabled by algorithms derived from human programming and machine learning (i.e., artificial intelligence) will make decisions regarding aircraft control, flight path, and human-machine task allocation affecting human workload and performance. There are numerous aeromedical challenges related to these technology advances.

Background: While current aircraft autonomy systems are proving effective in saving aircraft and aircrew lives (e.g., automatic recovery of fighter jets), these are based only on computer interpretation of aircraft parameters. The next level of adaptive automation will include real-time data obtained directly from the human crew, indicating physiological and psychological state. Key challenges for the aeromedical community include: 1) Discerning which biological signals (i.e., data) convey reliable information regarding human operator state, 2) Developing methods for unobtrusively collecting those data streams from the aircrew, 3) Ensuring that algorithms account for the range of individual human differences, and 4) Validating that actions by the scalable autonomy systems have the desired effect on the human aircrew (e.g., preventing boredom and sleepiness).

Summary: This presentation will address these aeromedical challenges for the future and present a vignette illustrating the role of physiological monitoring in next-generation aircraft in improving aviation safety and enhancing the effectiveness of future human aircrew.

O-54

IN-FLIGHT PHYSIOLOGIC MONITORING: TACTICAL AVIATION AND AEROMEDICAL EVACUATION

SURVEILLANCE PHYSIOLOGIQUE EN VOL: AVIATION TACTIQUE ET ÉVACUATION AÉRO-MÉDICALE

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Introduction: This presentation will discuss the present and near-future state of physiologic monitoring in two aviation environments – tactical aviation and aeromedical evacuation. For each environment, specific sensor needs will be discussed and contrasted with what exists today and in the near future.

Background: In the tactical aviation environment, milliseconds matter, and peak performance is critical to mission success. Thus, sensors pertaining to the cardiorespiratory system, homeostasis, and cognition are paramount. Respiratory and cardiac sensors that work in a cockpit environment are actively being developed and are mature or near-mature. Core temperature sensing is mature, and indirect measures are maturing. In the near-term, hydration sensors and sensors for various biomarkers are in intermediate stages of development. Looking into the future, sensors for cognition (EEG) and indirect measures of eye tracking are in early development but show promise. Challenges for sensor efficacy in the tactical aviation environment will be discussed.

The aviation environment presents numerous challenges to patients undergoing medical evacuation. In order to understand the physiologic response to this environment, it is important to understand relevant environmental stressors. Thus, it is critical to measure stressors such as altitude, vibration, noise, and temperature; these sensors are mature and readily available. Next, understanding physiologic response of patients in this environment is integral to maintaining health.

Summary: While basic parameters (heart rate, SpO₂, blood pressure, temperature) have mature technology available, more work needs to be performed on biomarkers to predict patient outcomes. In the mid- to far-term, closed-loop technologies and predictive algorithms based on multiple sensors are in development and show promise for patient outcomes. The presentation will summarize the current status and next challenges in the field of physiologic monitoring in-flight.

O-55

FIRST-HAND EXPERIENCE OF A NEW APPROACH IN MILITARY AVIATION PSYCHOLOGY ADAPTED FOR NATO AREA OF OPERATION

*PREMIERE EXPERIENCE D'UNE NOUVELLE APPROCHE DE LA PSYCHOLOGIE DE L'AVIATION
MILITAIRE ADAPTEE A LA ZONE D'OPERATION DE L'OTAN*

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Introduction: For a long time our work-group has been involved in projects aiming at stress tolerance and resilience to improve our everyday routine in military aviation psychology. Right from the start our principal task was the closer integration of behavioral and physiological data. Our goal of the ongoing development process is to have a useable and portable configuration that can be used outside the test-room.

Background: In 2019 we had a chance to try out our prototype under real conditions of a NATO area of operations – BAP50 (Baltic air-policing mission) – in Lithuania. The essence of this method is the ability of synchronized recording of test phases and physiological data that is – in everyday use - gathered separately and the ability of real-time evaluation and tracking of behavioral changes. For this purpose this method is non-invasive, and makes use of – for instance - computer vision and machine learning. Our headline target is to have a tool that is portable and as simple as possible.

Summary: Instead of going into theoretical details in this presentation I try to give an impression of the present status of our development process speaking about the real conditions we were working under in BAP50. I am looking for and emphasize parallelism that can be found in this field be it military or civilian or commercial aviation.

O-56

EFFECTS OF ACCELERATED PILOT TRAINING ON LOADABILITY

EFFETS DE LA FORMATION ACCÉLÉRÉE DES PILOTES SUR LA CAPACITÉ DE CHARGE

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Introduction: We studied the effect of an accelerated training regimen on physiology and loadability in student helicopter pilots.

Methods: Eight helicopter pilot students (age: 32 ± 5 years; all males) participated in this study and took part in an accelerated training regimen. We used standardized, noninvasive methods to measure their loadability and physiological status through the training process.

Initial measurement was a medical and physiological check including vita maxima test. Measurements during the training were made monthly. Body composition was assessed by 24 anthropometry parameters; viscera, bone, muscle and body fat was calculated with Mészáros-Mohácsi method with the optimal- and fat-free body weight and Heath-Carter somatotypes. Sleep was measured using Beddit (Apple, Finland) a home-based, inexpensive, and unobtrusive ballistocardiography (BCG)-based system. These sensors measured heart rate, breath frequency, deep sleep time, apnea time, and sleep efficiency. During the vita maxima testing, Oxycon Mobile (Jaeger, Carefusion, Germany) was used to measure cardiopulmonary characteristics and breath-by-breath metabolic response. During six minutes of supine, closed eye resting, Arteriograph (TensioMed Ltd., Hungary) monitored cardiovascular status, endothelial function, central blood pressure and large arterial characteristics. Heart Rate Variability (HRV) was assessed, based on R-R intervals, measured by Polar H1 sensors and Polar Precision Performance 2.0 software (Polar Electro, Finland). This was complemented with a self-developed HRV and one lead ECG measurement method iQRS. We used the minimal and maximal pulse data and difference, frequency domain HRV analysis and spectral analysis.

Results: Body composition optimization was successful during training, in terms of reducing overweight and maintaining/elevating muscle mass. There was significant reduction in sleep quality and efficiency during training periods. On average, systolic and diastolic blood pressure were normal, rising slightly in the exam period. Pulse was also near normal, but in several cases serious elevation occurred during the latter stages of training. Endothelial function and arterial characteristics were unchanged. HRV data showed elevated min-max pulse difference ($24,58 \pm 8,46$ bpm) as a sign of subclinical upper respiratory problems, depressed dynamics with sympathetic overload that turned into heavy parasympathetic modulation during exam periods.

Discussion: The data were used to give monthly feedback to manage the training load of the participants and to monitor their physical status. The measurements are still in progress, and final results will be presented at the conference.

O-57

COGNITIVE NAVIGATIONAL STYLES: MILITARY PILOTS VERSUS NON –PILOTS

STYLE COGNITIF DE NAVIGATION: PILOTES MILITAIRES VERSUS NON PILOTES

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Introduction: The distribution of navigational cognitive styles (landmark, route and survey) was analyzed in military pilots and in a group of males without flight experience. Since previous studies demonstrated that military pilots are very proficient in spatial navigation, we hypothesized that military pilots show higher navigational abilities (survey style) than non-pilots.

Methods: Sixty-four (34 military pilots and 30 non- pilots) participants were enrolled. All participants, were asked to perform a reduced version of the Spatial Cognitive Style Test – SCST, consisting of six tasks (photo recall, figure recognition, environmental photo re-arrangement, map description, 3D rotation and sum and straighten) which distinguish individuals in landmark (people who orient themselves by using a figurative memory for environmental objects), route (people who use an egocentric representation of the space) and survey (people who have a map-like representation of the space) users.

Results: No differences between groups were detected in the Photo Task ($F_{1,62} = 1.04$; $p = 0.3$; partial eta-squared = 0.017); Figure Task ($F_{1,62} = 0.97$; $p = 0.3$; partial eta-squared = 0.016); Sequence Task ($F_{1,62} = 0.36$; $p = 0.55$; partial eta-squared = 0.006); Map Description Task ($F_{1,62} = 0.011$; $p = 0.9$; partial eta-squared = 0.0002) and Sum and Straighten Task ($F_{1,62} = 0.24$; $p = 0.6$; partial eta-squared = 0.004). On the contrary, the two groups differed in Three Dimensional Rotation Task ($F_{1,62} = 4.7$; $p = 0.034$; partial eta squared = 0.07); pilots outperformed non-pilots.

Discussion: Different from the hypothesis, results did not show any significant difference between military pilots and non-pilots with respect to the distribution of the three cognitive styles. However, in line with the previous studies, military pilots were better than non-pilots in Three Dimensional (3D) Rotation Task. These findings suggest that flight experience does not entail better navigational skills, but improves mental rotation abilities.

O-58

LET'S TAKE THE REAL WORLD INTO THE SPECIAL AERO MEDICAL LAB!

FAISONS ENTRER LE MONDE REEL DANS LE LABORATOIRE MEDICAL SPECIAL AERO!

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Introduction: We have launched the AVIATION HUMAN program for military air pilots, where we created specific simulation environment for monitoring human performance during extreme conditions and analysing stress-recovery reactions before-during-after aeromedical situations. The parts of invented support system are: 1) VR-Virtual Reality with Flight Simulation program, 2) Firstbeat HRV monitoring system, 3) Low Pressure Chamber, 4) NIRS+Capnograph instruments, which had been covered into a special instrument (called A.M.I.H. Aero Medical Instrument Helmet).

Methods: Several special passive simulated flight profiles had been created in the P3D Flight Simulation Environment running in Low Pressure Chamber. In the same time, we are conducting 24-hr-long HRV measurements to identify physiological stress reactions with special focus on measuring individual readiness (before) and human regeneration (after) flight operations, while we are also monitoring pilot's reactions during flight in real time. We synchronized all kind of data from different sources and collected all the measured data into a special data market.

Results: Even though the research program has not been closed up, we are able to show and talk about the main conclusions about understanding the patients' reactions in different and special flight situations, even emergency situations as well w/o any health and safety risks.

Discussion: Deep insights of individual HRV assessments can help to identify typical personal decisions on human stress coping abilities and recovery (sleep) analysis after flight simulations, thus the extended effect of special air conditions of flights can be shown.