2017 ABSTRACTS OF THE AsMA SCIENTIFIC SESSIONS

88th Annual Scientific Meeting **Sheraton Denver Downtown**
April 29 – May 4, 2017 **Denver, CO**

The following are the sessions and abstracts with rooms and presentation times for all presentations accepted after blind peer-review—in workshop, panel, slide, or poster sessions—for the 2017 Annual Scientific Meeting of the Aerospace Medical Association. The numbered abstracts are keyed to both the daily schedule and the author index. The Sessions numbers are listed as S-001 through S-101 (including workshops). Session chairs are included in the index to participants. The order of some sessions may have changed (check the Addendum provided at the meeting for the latest information). Abstracts withdrawn are listed as W/D. Presenters are underlined in the text.

SLIDES & PANELS: Each slide presentation is scheduled for 15 minutes. We strive to keep slide presentation on time. Panel presentations have more flexibility and may not keep to a strict 15 minute per presenter format. There will be a discussion period of 15 minutes at the end of each panel.

NEW THIS YEAR!!!! POSTERS: Posters Sessions will be on Wednesday and Thursday! They will be on display in the Exhibit Hall from 10:00–12:00/ 1:30 -3:30 on Wednesday or 9:30 – 11:30 / 1:30-3:30 on Thursday. Poster authors must be present for the full morning or afternoon session in which their poster is scheduled. The poster can remain up all day.

EXHIBITS: Exhibits will be open Sunday evening during the Welcome Reception, and 9:30 a.m. to 4:30 p.m. Monday and Tuesday. Please wear your badge and visit every exhibit.

CONFLICT OF INTEREST: All meeting planners and presenters completed financial disclosure forms for this live educational activity. All potential conflicts of interest were resolved before planners and presenters were approved to participate in the educational activity. Any conflicts of interest that could not be resolved resulted in disqualification from any role involved in planning, management, presentation, or evaluation of the educational activity.

PLEASE NOTE: FAA AME Sessions will be held in the Majestic Ballroom in the I.M. Pei Tower all week. The schedule will be posted when available.

Sunday, April 30 ***8:00 AM***
Governor's Square 10

S-001: WORKSHOP: INJURY MECHANISMS ANALYSIS IN AIRCRAFT AND AUTOMOBILE ACCIDENT INVESTIGATIONS

Sponsored by the AsMA Aerospace Safety Committee

Chair: Eduard Ricaurte
Edmond, OK

WORKSHOP OVERVIEW: In 2017, for the first time, AsMA will offer an Injury Workshop for members of the aeromedical community, forensic pathologists, occupational medicine, injury researchers, accident investigators, government agencies, academia, industry, and other health care workers. The purpose of this workshop is to provide the basis for 1) the appropriate methods of forensic evidence collection in the investigation of the biomechanics and biodynamics of aircraft accident injuries along with determination of the mechanism of injuries, 2) the role of forensic pathology in aircraft mishap investigations, and 3) the investigation of injury outcome in crashes to better understand the mechanism of injury and to formulate strategies to improve vehicle's occupant protection. Coordinated by Dr. Eduard Ricaurte, the workshop will be divided in two sessions. The first session, "On-Site Crash Medical Investigation" will start with Drs. Robert Banks and Rawson Wood from the Biodynamic Research Corporation; they will discuss the use of emergent technologies during an aircraft/spacecraft crash investigation. Next, Dr. Edward Mazuchowski from the Office of the Armed Forces Medical Examiner will describe the role of forensic pathology in aircraft mishap investigations. Dr. Matthew Lewis from the Accident Investigation and Human Factors, Royal Air Force, will complement the workshop by describing injury causation in military and civilian ejection seat accidents. Afterward, Drs. Mary Pat McKay and Kristin Poland from the National Transportation Safety Board will discuss injury causation/analysis in aviation accidents, along with Mr. Rick DeWeese from the FAA Civil Aerospace Medical Institute. Concluding the first session, Mr. Lee Roskop from the FAA Rotorcraft Standards will present post-crash fire and blunt force fatal injuries in U.S. Registered, type certificated rotorcraft. The second session, "Injury Epidemiology and Research," will start with Dr. Guohua Li from Columbia University discussing injury epidemiology in aerospace medicine. Dr. Eduard Ricaurte from Venesco/FAA Civil Aerospace Medical Institute will continue the session describing the FAA CAMI injury data collection and documentation.

Learning Objectives:

1. To learn current methods to determine injury mechanisms in aircraft and automobile accidents.

[001] THE SCOPE OF AIRCRAFT AND SPACECRAFT CRASH INVESTIGATION – THE FUTURE IS NOW

R.D. Banks and R.L. Wood
Biodynamic Research Corporation, San Antonio, TX

MOTIVATION: The scope of aircraft and spacecraft crash investigation ranges from the simple (gliding/powered parachutes) to the complex (space vehicles and air carriers). While the investigating process still rests on the lessons of more than 60 years of aircraft crash investigation, new developments in technology are emerging that have, and will, change our approach to these important events. **OVERVIEW:** Today, potential crash sites include wide areas of the earth, space and, in the future, other planets. On earth, crash sites may be inaccessible because of geographical remoteness, national boundaries, war, or climate. The plotting of debris fields, human remains and ground scars, and the defining of terrain, can now be done digitally through means that involve scanners, photogrammetry, and the use of the publically available data such as the digital elevation model (DEM) used by Google Earth. In the case of investigating flight surgeons, injury analysis and the evaluation of life support equipment (LSE) through kinematics modeling can be conducted virtually. Many of the relevant tools are becoming widely available at reasonable cost. **SIGNIFICANCE:** As space tourism evolves and becomes fact, and as the scope of commercial and general aviation operations broadens, the challenges facing accident investigators will become greater. Emerging technology offers new ways to meet these challenges.
Learning Objectives:
1. Attendees will learn modern technologies currently available to meet current challenges in aircraft and spacecraft crash investigation.

[002] INJURY CAUSATION IN MILITARY AND CIVILIAN EJECTION SEAT ACCIDENTS

M.E. Lewis
AIHF, RAF, Baldock, United Kingdom

PROBLEM STATEMENT: The speed and altitude at which modern military aircraft operate are such that inflight escape can only be achieved by the use of an ejection seat. Ejection seats, whilst generally lifesaving, exposes aircrew to forces that may be at the limits of human tolerance. Even so, ejection seats have saved many thousands of lives and though the potential for injury is ever present, technical improvements are on-going in an attempt to reduce the injury threat for ejectees. **TOPIC:** Aircraft ejection mishaps are uncommon yet they have serious consequences and survivability and injury causation are major concerns in military, and civil, aviation. Improvements in aircraft crashworthiness, design criteria, personal protective equipment and aircraft escape systems may make injuries preventable or could turn an otherwise non-survivable accident into a survivable one. As injuries can be produced in a number of ways, protection against ejection injury requires not only an understanding of the ejection environment and the dynamics of the escape system, but also of the tolerance of the human to physical forces. The characteristics of injuries seen in ejection accidents can differ markedly between aircraft types and even within a single multicrew accident there may be dissimilar injury patterns amongst the individuals involved. **APPLICATIONS:** The development of effective programs for reducing ejection injuries depends on gaining an understanding of how ejections cause injuries, the nature of the forces contributing to the injuries, and the characteristics of the types of accidents under investigation. An investigation should focus on how the technical, engineering and medical aspects of ejection seat accidents contribute to establishing how the aircrew sustained injuries and how any failings in the escape systems can be overcome or modified to improve safety and injury outcome. **RESOURCES:** This interactive presentation will be illustrated with real time accident case histories of both military and civilian ejection seat accidents. It will demonstrate how the knowledge of the functioning of escape systems can lead to the identification of possible injury mechanism associated with their normal operation, but will also delineate the more severe injuries associated with ejection system malfunctions.
Learning Objectives:
1. Understand the functioning of the aircraft assisted escape system.
2. Understand the causation of ejection injuries.
3. Understand how aircraft accident investigations can improve survivability and injury outcome.

[003] INJURY ANALYSIS IN AVIATION ACCIDENTS

M. McKay and K. Poland
National Transportation Safety Board, Washington, DC

PROBLEM STATEMENT: Understanding the cause of specific injuries in aviation accidents is the first step toward being able to mitigate them. **TOPIC:** It is vital to describe occupant injuries in a way that communicates the specifics and severity of each injury and allows the specifics and severity to be described and compared among occupants in a given accident as well as between occupants in different accidents. Then, understanding the forces applied and the likely kinematics of the occupant during the crash sequence, the contact points and likely sources of injury can be determined. We will describe how injury coding and description as well as detailed injury analysis led to safety recommendations in the Asiana Flight 214 landing accident (July, 2013), briefly compare those findings to passenger injuries in the 2009 Turkish Airlines landing accident in the Netherlands, and report on the process and results of a recent study of the effectiveness of airbags in general aviation aircraft by the National Transportation Safety Board.
APPLICATIONS: Detailed injury coding, description, and analysis are the keys that allow real world accidents to inform and innovate injury mitigation and crashworthiness strategies in both airliners and general aviation aircraft.
Learning Objectives:
1. Attendees will recognize the value of using standardized coding to describe injuries in aviation accidents in order to allow comparisons among occupants in the same accident and between occupants in similar accidents.

[004] INJURY CAUSATION ANALYSIS IN AVIATION ACCIDENTS - A CASE STUDY

R.L. DeWeese
Biodynamics Research, FAA Civil Aerospace Medical Institute, Oklahoma City, OK

INTRODUCTION: This workshop topic covers the process followed in determining the most likely cause of some injuries that occurred in a transport aircraft crash. **METHODS:** Data to conduct the analysis came from three sources. The condition of the seats and aircraft interior was documented at the crash scene by a team of investigators familiar with crashworthy seats and aircraft structure. Survivor injuries were summarized and classified using the AIS by a group formed to study the medical aspects of the crash. The impact scenario was determined from the flight data recorder, radar data, ground scar and aircraft wreckage condition and position. A panel of specialists reviewed the compiled evidence to determine injury causation. The 16 cases selected for review included some of the critical and severe injuries and some minor injuries that were common throughout the aircraft. A confidence level was assigned to each finding. **RESULTS:** Details of 4 representative cases are provided and include for each: the location in the aircraft, applied loads at that location, occupant interaction with seat/surrounding, occupant injuries, injury causation, and confidence level. Enough evidence was available for most of these cases to determine the injury causation with a confidence level of "probable" or greater. These case discussions illustrate the process followed by the panel. **DISCUSSION:** Once injury causation is known, then that information can be used to identify areas where safety improvements to equipment and operations could have the most benefit. For each of the injuries, a means of mitigation was suggested. Some of these suggestions are the subject of current study by FAA researchers, and at least one has led to product improvements by the aircraft manufacturer. Damage documentation from future crashes can determine whether improvements were mechanically successful. The effect of the improvements on occupant injury can only be determined if this entire process is repeated for future crashes.
Learning Objectives:
1. The participant will understand the process used to determine the cause of crash injuries, and how injury causation findings can be used to identify effective mitigation strategies.

[005] POST-CRASH FIRE AND BLUNT FORCE FATAL INJURIES IN U.S. REGISTERED, TYPE CERTIFICATED ROTORCRAFT

L. Roskop
Rotorcraft Standards Staff, and ASW-112, Safety Management Group, FAA, Fort Worth, TX

INTRODUCTION: Fatal injuries in rotorcraft accidents are an ongoing point of interest with both the government and the public. A specific concern is the role of post-crash fire and fatal thermal injuries. The FAA's Rotorcraft Directorate sought a more complete understanding of how frequently thermal injuries as compared to blunt force injuries contributed to fatalities in rotorcraft accidents. Past studies on the topic had significant limitations due to the absence of consistent "cause of death" information. To overcome these limitations, the Rotorcraft Directorate partnered with the FAA's Civil Aerospace Medical Institute (CAMI). CAMI's autopsy data provided more complete analysis of fatal injuries. **METHODS:** CAMI had autopsy data available from FY 2009 thru 2013 for pilots and some passengers involved in 97 fatal rotorcraft accidents. Analysis of autopsy results assessed the contribution of thermal injuries and blunt force injuries in each fatal accident. The study also examined whether the rotorcraft involved met the highest regulatory level of occupant protection for fuel system crash resistance and blunt force injury prevention. **RESULTS:** Fatal accidents attributable to thermal injuries occurred much less frequently than the Rotorcraft Directorate expected prior to the study. Even in cases where post-crash fire occurred, blunt force trauma was the cause of death in about 80% of the fatal accidents. In addition, the percentages of most skeletal and organ areas were not statistically different when compared to the previously published study of Taneja and Wiegmann using 74 fatal rotorcraft accidents from 1993-1999. Finally, the study found a low percentage of rotorcraft involved in the fatal accidents met the highest level of federal occupant protection regulations intended to prevent both post-crash fires and blunt force trauma. Further investigation found the same low percentage in the overall U.S. rotorcraft population. **DISCUSSION:** The prevalence of blunt force trauma as the cause of death, even in cases where a post-crash fire occurred, was significant. The most effective approach to reducing the number of fatalities in future rotorcraft accidents must improve the occupant protection of current and future rotorcraft by ensuring prevention of thermal injuries, while not neglecting prevention of blunt force trauma.

Learning Objectives:

1. To better understand the role of thermal injuries in the causation of fatalities in rotorcraft accidents and how to improve occupant protection by preventing thermal injuries.

[006] INJURY EPIDEMIOLOGY IN AEROSPACE MEDICINE

G. Li

Epidemiology and Anesthesiology, Columbia University, College of Physicians & Surgeons, New York, NY

INTRODUCTION: Injury epidemiology is a scientific discipline aimed at understanding the causes and prevention of unintentional and intentional injuries. It came of age in the 1970's but could trace its roots in aerospace medicine back to the early 1930's. **METHODS:** Studies relevant to flight safety and crash injury published in the official journal of the Aerospace Medical Association between 1930 and 2016 and other professional journals are reviewed and summarized. Contributions of injury epidemiology to improving aviation safety and occupant protection are illustrated through select case studies. **RESULTS:** Since 1930, the official journal of the Aerospace Medical Association has published numerous epidemiologic studies examining medical, behavioral, environmental, and aircraft factors influencing the propensity and severity of injuries sustained by pilots and other occupants. These studies used a variety of epidemiologic methods and research designs. For instance, case series and case-control analyses of injury data identified inadequate restraints as an important cause of occupant deaths in aviation crashes and contributed to the development of standards for general aviation and major airlines in terms of the strength of seats and restraint systems and their attachments to the aircraft structure; and cohort studies in professional pilots provided empiric evidence for understanding the interaction effects of health status and flight experience on safety performance during the process of aging and established the scientific basis for extending the mandatory retirement age for airline pilots from 60 years to 65 years. **DISCUSSION:** Injury epidemiology has played a significant role in the development of aerospace medicine, helped advance the knowledge base of injury biomechanics, human factors, and safety engineering and contributed substantially to improving aviation safety.

Learning Objectives:

1. Introduce the audience to the basic concepts of injury epidemiology.
2. Review the rich history of injury epidemiology research in aerospace medicine.
3. Illustrate the contributions of injury epidemiology to the development of aerospace medicine and aviation safety.

[007] INJURY DATA COLLECTION, CLASSIFICATION, CODING, AND ANALYSIS: THE FAA CIVIL AEROSPACE MEDICAL INSTITUTE'S APPROACH

E.M. Ricaurte[1,2] and C.A. DeJohn[2]

[1]Venesco, LLC, Edmond, OK; [2]Aerospace Medical Research Division, FAA Civil Aerospace Medical Institute, Oklahoma City, OK

INTRODUCTION: Since 2013, the Civil Aerospace Medical Institute (CAMI) has been collecting detailed occupant injury data in fatal aircraft accidents. Injury data acquisition is a key component of a complex process to determine the mechanism of injury. The Department of Transportation, National Highway Traffic Safety Administration (NHTSA) has collected similar data on automobile accidents for more than three decades. NHTSA's accomplishments in injury research have been followed by successful data-driven initiatives to protect occupants in vehicle accidents and evaluate advanced technologies designed to reduce fatalities. A complete injury mechanism analysis relies on: a detailed injury description and classification system, the documentation of the damage to the aircraft interior components, the documentation of damage to the occupant's restraint systems, exit methods used, and the documentation of the post-crash environment. Previous attempts to classify injuries and identify mechanisms that produce injuries and fatalities in otherwise survivable accidents have been limited by the lack of detailed injury and autopsy information in relation to aircraft damage, egress patterns, exits used, and the lack of databases using standardized injury coding for systematic analysis. The objective of this presentation is to describe the methodology CAMI is using for injury data collection, documentation, and analysis. **METHODS:** A detailed explanation on how CAMI is collecting, coding and analyzing injury data in a systematic and consistent fashion will be provided. **DISCUSSION:** The acquisition and classification of detailed injury information is a critical step in the determination of the mechanism of injuries and the development of injury prevention and mitigation strategies. Furthermore, injury mechanism analysis has proven to be an effective tool to improve crashworthiness and for developing suitable safety regulations in all modes of transportation. However, other key components, such as the information related to the circumstances of the crash and the vehicle involved, are necessary to determine injury causation.

Learning Objectives:

1. To better understand the importance of detailed injury data collection, classification, and analysis as a critical step in the determination of the mechanism of injuries and the development of injury prevention and mitigation strategies.

[008] INJURY SEVERITY SCALING, ANALYSIS AND RESEARCH

P.J. Gillich

Army Research Laboratory, Aberdeen Proving Ground, MD

This presentation provides the latest information on the Abbreviated Injury Scale (AIS) for rating injuries by type and severity, and its application for research and analysis activities. This comprehensive injury rating system is a common language used to classify trauma by medical professionals, engineers and researchers examining injury in population-based and policy-oriented applications, as well as for specific injury-causing events and scenarios. AIS's major design principles require it to remain as constant as feasible given changes that occur in injury epidemiology, vehicular environments and trauma care in the world over time. In the most recent revision, AIS 2015, many significant enhancements where performed that resulted in changes to approximately 20% of the AIS dictionary. These modifications included changes to improve the classification of high-energy combat injuries, resolution of problematic coding areas, and improvements to the coding of head and spinal injuries. Details of these changes will be discussed, as well as the best practices for injury scaling, data storage and exchange, and analysis. Relevant case studies will examine injury incidence, severity,

and outcome in order to objectively and accurately measure the significance of trauma in these events. Additional examples will be provided to demonstrate the utility of AIS for identification of injury prevention measures applicable to body armor protection, aircraft accident, and roadway incidences. Results can be objectively used to inform future system designs, operations, and policy decisions.
Learning Objectives:
1. To provide basic knowledge on the Abbreviated Injury Scale (AIS) for rating injuries by type and severity, and its application for research and analysis activities.

[009] MOTOR VEHICLE CRASH INJURY DATA COLLECTION AND DOCUMENTATION

R.W. Rudd
CIREN Program, DOT National Highway Traffic Safety Administration, NHTSA, Washington, DC

INTRODUCTION: The Crash Injury Research and Engineering Network (CIREN) is a field crash data collection program sponsored by the National Highway Traffic Safety Administration (NHTSA) that focuses on assessing and documenting injury causation due to automobile crashes. With a focus on serious injuries in recent model year automobiles, CIREN serves as a sentinel to identify emerging injury trends in crashes with advanced occupant protection equipment. Engineers and medical professionals jointly review vehicle and occupant findings to establish biomechanically-based injury causation scenarios, which populate a publicly-accessible database to support injury research. **METHODS:** The CIREN developed the causation coding scheme, dubbed BioTab, to objectively and comprehensively describe the interaction of the occupant with its environment and the injury mechanism(s) occurring during the injurious event. Key variables include the involved components (e.g. seat belt, instrument panel), body region(s) contacted, source of energy, and regional injury mechanisms. Vehicle and scene data collection follow standardized NHTSA protocols and extensive medical data, including digital radiology, are collected to support case coding. CIREN investigators draw on knowledge of injury biomechanics from the medical and engineering literature, as well as laboratory experience, to interpret the available evidence during case review. **RESULTS:** More than 24,000 injuries in over 2,900 occupant cases have been coded using the BioTab method. **DISCUSSION:** The implementation of the BioTab process addressed shortcomings in the traditional injury causation coding approach used in NHTSA field crash studies. Injury causation is linked to a specific source of energy, which is critical in multi-event crashes and in cases where restraint system deployments induce injury. Furthermore, multiple points of contact may be defined as required for certain injury mechanisms. Findings from this enhanced analysis have led to better delineation of injury sources for thoracic injuries, identification of emerging injury trends in the lumbar spine, and improved understanding of the role of various contributing factors such as occupant comorbidities and intrusion.
Learning Objectives:
1. Gain an understanding of a structured methodology to identify and code injury causation scenarios in motor vehicle crashes.
2. Recognize relevant evidence and causative factors for specific injuries sustained.

[010] THE ROLE OF FORENSIC PATHOLOGY IN AIRCRAFT MISHAP INVESTIGATION

E.L. Mazuchowski
Forensic Pathology, Armed Forces Medical Examiner System, Dover AFB, DE

On September 17, 1908 an airplane piloted by Orville Wright with 1st Lieutenant Thomas Selfridge as the sole passenger was involved in a mishap at Fort Meyer, Virginia resulting in the death of 1st Lieutenant Selfridge. An investigation board deemed the mishap an accident that occurred when a propeller blade broke resulting in the loss of control of the aircraft with subsequent impact of the aircraft with the ground. The cause of 1st Lieutenant Selfridge's death was determined to be a compound comminuted fracture of the left side of the base of the skull. These findings resulted in a design change of the aircraft and the proposition of protective equipment for aviators. Over the past century, the goals of an aircraft mishap investigation involving a fatality have remained the same: identify the individuals involved; determine the cause of death and injuries sustained; determine what caused the mishap to occur; and make recommendations for the prevention of future mishaps and deaths. The forensic pathology investigation is a critical part of the overall mishap investigation. The forensic pathology investigation determines the identification of the decedent, the injuries sustained, and the cause of death and manner of death. In order to make these determinations, a complete forensic pathology investigation including scientific identification, radiography, external examination, internal examination, and toxicology must be performed. Based on the findings of the forensic pathology investigation, the following questions may also be answered: what was the nature and sequence of the traumatic events; what interactions between the decedent and aircraft structures resulted in injury; was there a lethal post-mishap environment; what role, if any, did the decedent's play in the mishap sequence; and would any modification of the aircraft or its equipment have improved the chances of survival or reduced the severity of the injuries. The roles and limitations of the forensic pathology investigation in answering these questions will be discussed.
Learning Objectives:
1. Understand the roles and limitations of the forensic pathology investigation in the overall aircraft mishap investigation.

Sunday, April 30 ***8:00 AM***
Governor's Square 15

S-002: WORKSHOP: INTRODUCTION TO AEROSPACE EPIDEMIOLOGY

Chair: Pete Mapes
Rockville, MD

[011] INTRODUCTION TO AEROSPACE EPIDEMIOLOGY

P. Mapes
Healthcare Operations, Defense Health Agency, Falls Church, VA

WORKSHOP OVERVIEW: PURPOSE: Provide 8 hours of epidemiological instruction, including access to practice problems designed to introduce participants to Aerospace Epidemiology. This workshop addresses many concepts commonly found on the Board Examinations administered by the American Board of Preventive Medicine. Participation in this workshop prepares participants to conduct epidemiological analyses of rare events like aviation mishaps and helps them determine statistics, trends, probabilities, causes and potential prevention solutions. **METHOD:** Using lecture, Socratic discussion and guided problem solving, the workshop conveys key concepts regarding aerospace epidemiology to participants. **TOPICS:** Include selection and analyses of denominators, calculation and determination of power, numerator selection and analyses, validity, confidence intervals, hypothesis generation and testing, causation criteria, parametric and non-parametric analyses, calculation of 'p-values', data testing and analysis, bias and confounding, ANOVA and modelling. **DESIRED OUTCOME:** Attendees gain or refresh their ability to analyze uncommon events. They will be able to generate hypotheses, select denominators and numerators for study and analyses, find associations, understand the necessary steps for proving causation, select the appropriate tests and know the differences between parametric and non-parametric data. Participants will be familiar with the use of epidemiological computing programs. Participants must attend with a 'PC' computer containing EPI INFO software. (Available for download at no charge from the Centers for Disease Control and Prevention web site.) Note: This software is government freeware without license fee and is approved for use on U.S. Government computers.
Learning Objectives:
1. Know what data is required for the detailed stratified analyses of rare events and be able to work with data of this sort.
2. Know the differences between parametric and non-parametric analyses and understand when to select each type of data.
3. Be able to utilize epidemiological principles to formulate and test hypotheses using accepted epidemiological tools and techniques.

Sunday, April 30 ***9:00 AM***
Majestic Ballroom

S-003: WORKSHOP: AIRCREW FATIGUE: CAUSES, CONSEQUENCES, AND COUNTERMEASURES

Co-Chair: J. Lynn Caldwell
Yellow Springs, OH

Co-Chair: John Caldwell
Key West, FL

[012] AIR CREW FATIGUE: CAUSES, CONSEQUENCES, AND COUNTERMEASURES

J.A. Caldwell[2] and J. Caldwell[1]
[1]Aeromedical Directorate, Naval Medical Research Unit Dayton, Wright-Patterson AFB, OH; [2]Coastal Performance Consulting, Key West, FL

WORKSHOP OVERVIEW: MOTIVATION: Today's 24/7 aerospace environment presents a variety of challenges to human physiology and performance capacity. Lengthy work periods, constantly-changing duty schedules, insufficient sleep opportunities, and/or poorly-constructed or nonexistent fatigue-management systems often combine to pose a serious threat to the health, safety, and general wellbeing of our aviation and space personnel. However, this threat can be effectively managed once leaders, healthcare professionals, schedulers, and aircrew members are properly educated about the causes of fatigue and the strategies proven effective for managing fatigue in real-world environments. This course will equip everyone in the system with the tools they need to optimize crew safety across a wide array of operational domains. **OVERVIEW:** Unpredictable and long work hours, circadian disruptions, and disturbed or restricted sleep are common in the fast-paced world of modern military and civil aviation. If improperly managed, these factors can result in fitness-for-duty problems which will likely precipitate mistakes, cognitive difficulties, and mood disturbances that can jeopardize operational safety. However, once scientifically validated strategies are properly applied, both performance and safety can be not only preserved, but optimized. This workshop will provide a science-based overview of fatigue factors and relevant countermeasures based on the most-recently-published peer-reviewed literature and will emphasize the importance of implementing science-based educational, preventative, monitoring, and mitigation strategies throughout the aerospace system. **SIGNIFICANCE:** Effective, science-based fatigue management is an important key to optimizing operational performance and safety. State-of-the-art information on this topic is of broad interest to professionals who are in a position to safeguard and augment human performance in today's demanding operational environment.

Learning Objectives:
1. Know how to recognize the danger of fatigue in various settings and understand the major causes of fatigue.
2. Be able to understand and apply one or more scientifically-valid countermeasures for fatigue in specific operational contexts.
3. Understand the basics of a good Fatigue Risk Management System (FRMS).

Sunday, April 30 ***12:00 PM***
Governor's Square 16

S-004: WORKSHOP: AEROSPACE MEDICINE FACULTY DEVELOPMENT

Co-Chair: Richard Allnutt
Beavercreek, OH

Co-Chair: Mark Coakwell
Dayton, OH

WORKSHOP OVERVIEW: This workshop will present current information on various topics of interest to Aerospace Medicine faculty members. The Accreditation Council for Graduate Medical Education (ACGME) requires as part of its residency program accreditation process that faculty members participate in regular faculty development. This may include not only CME-type activities directed toward acquisition of clinical knowledge and skills, but also activities directed toward developing teaching abilities, professionalism, and abilities for incorporating Practice-based Learning & Improvement, Systems-based Practice, and Interpersonal and Communication Skills into medical practice and teaching. This can be accomplished via both didactic (conferences, grand rounds, journal clubs, lecture-based CME events) and experiential (workshops, directed QI projects, practice improvement self-study) types of activities. This conference-based workshop is presented toward the fulfillment of this requirement.

Learning Objectives:
1. To provide Aerospace Medicine faculty with current clinical knowledge, skills, and activities directed toward developing teaching abilities and professionalism that can be incorporated into their medical practice and teaching.

[013] MENTORING RESIDENTS IN PROFESSIONAL DEVELOPMENT

N. Almond[3], J.J. Venezia[1], C. Mathers[2], S.J. Gaydos[1] and S. Salmon[1]
[1]School of Aviation Medicine, US Army, Fort Rucker, AL; [2]Clinical Preventive Medicine, UTMB Health, Galveston, TX; [3]Naval Aerospace Medical Institute (NAMI), Pensacola, FL

PROBLEM STATEMENT: The ACGME requires competencies in professionalism: specially, IV.A.5.e of the ACGME Requirements for Graduate Medical Education in Preventive Medicine states that "Residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles." The military also requires officer professional development as part of developing leaders in their career progression. However, clearly defined methods to improve professionalism are not specified by ACGME. **TOPIC:** While still meeting ACGME programmatic requirements, different Programs, both military and civilian, may approach this topic uniquely based on the requirements of the graduating residents. **APPLICATIONS:** Multiple Program Directors will present professionalism-related curricula and programmatic processes to address the overlapping ACGME, military, and civilian requirements to improve professionalism for our residents. The panel will discuss lessons learned, to include successes and challenges, in mentoring residents in the area of professional development. Additionally, the panel will discuss best practices in mentoring residents in writing awards, writing evaluation reports, updating their personnel record, discussing future assignments, facilitating opportunities to expand skill sets by interacting with specialty leaders and potential mentors, and improving communications with senior personnel, junior personnel, and peers. Following the presentations, an open panel discussion will be facilitated to compare and contrast different programs while highlighting unique approaches and best-practices for consideration for GME faculty.

Learning Objectives:
1. Present professionalism-related curricula and programmatic processes to address the overlapping ACGME, military, and civilian requirements to improve professionalism for our residents.
2. Present and discuss lessons learned, to include successes and challenges, in mentoring residents in the area of professional development.
3. Present and discuss best practices in mentoring residents in writing awards, writing evaluation reports, updating their personnel record, discussing future assignments, facilitating opportunities to expand skill sets by interacting with specialty leaders and potential mentors, and improving communications with senior personnel, junior personnel, and peers.

[014] CONFLICT MANAGEMENT AND RESOLUTION

M.R. Coakwell
Residency in Aerospace Medicine, USAF School of Aerospace Medicine, Beavercreek, OH

PROBLEM STATEMENT: Conflict is a normal and even healthy part of relationships. Since differences of opinion are inevitable,

learning to deal in a healthy way with the conflict that may arise as a result can be crucial to personal and organizational success. When conflict is mismanaged, it can harm relationships and organizations. But, when approached in a respectful and positive manner, conflict can provide an opportunity for growth, strengthening bonds, and increasing organizational efficiency and effectiveness. **TOPIC:** This presentation will address techniques and interpersonal behaviors used in managing conflict situations. **APPLICATIONS:** These behaviors and techniques are based upon a two-dimensional model of conflict-handling that will be described after each workshop participant completes the "Thomas-Kilmann Conflict Mode Instrument" self-assessment.

Learning Objectives:

1. Upon completion of the presentation, participants will be able to characterize their own behavior tendencies in conflict situations.
2. During conflict situations, participants will be able to analyze interpersonal behaviors along the two dimensions of Assertiveness and Cooperativeness.
3. While managing conflict situations, participants will be able to recognize and apply components of the 5 conflict handling modes described in this model.

[015] UNDERSTANDING AND ADDRESSING GENDER BIAS IN MALE DOMINATED FIELDS: MANSPLAINING, ATTRIBUTION, AND AMPLIFICATION

M. Carminati
University of Houston Law Center, Pearland, TX

Gender bias in STEM and other male dominated fields is well documented and a data-driven fact of life. However, the reality of this bias remains viewed with suspicion. This makes it difficult to combat those same biases and implement techniques that counter the bias. Although large institutional change is evidently a good way to reduce gender bias, there are ways in which well-intentioned men and women can alter their daily interactions, in the workplace, to create tremendous impact on this issue. When men and women understand the concepts of mansplaining and (mis) attribution, as well as implement simple strategies like "amplification," day to day interactions are improved and gender bias in the workplace is significantly reduced. This workshop would provide both men and women in management and non-management positions vocabulary to identify issues and constructive ways to address gender bias. The goal of the Workshop is to improve communication and provide concrete ways in which aerospace physicians working in teams and improve everyone's participation at every level, from operations through management.

Learning Objectives:

1. To understand the reality of gender bias in STEM fields and in other traditionallly male-dominated fields such as aerospace medicine.
2. To learn to identify common patterns such as (mis) attribution and mansplaning, and using simple techniques such as amplification to counter them respectfully but effectively.
3. To identify who engrained patterns of behavior view the same character traits positively or negatively depending on whether men or women are exhibiting them.

[016] THE IMPAIRED RESIDENT PHYSICIAN

M.D. Jacobson
Aerospace Education, 711 HPW/USAFSAM, West Chester, OH

PROBLEM STATEMENT: Annual national surveys consistently show approximately 10% of the US population use illicit drugs. Similarly, of the nation's 177 million alcohol users, an estimated 10% (17 million) have an alcohol use disorder, and 61 million (23% of respondents) had binged in the 30 days prior to being surveyed. The physician population is not immune from SUDs, but demonstrates similar prevalence rates both prior to and after graduation from medical school and graduate medical education. Despite this, SUDs continue relatively undetected and under-diagnosed, with only a fraction of primary care physicians ever inquiring as to their presence. **TOPIC:** The Centers for Disease Control estimates that excessive alcohol use directly leads to 88,000 deaths per year. Global data confirm that substance use disorders are responsible for a significant percentage of disability-adjusted life years (DALYs) worldwide. Earlier detection and intervention can significantly mitigate morbidity and mortality. **APPLICATIONS:** A comprehensive review of the literature regarding impaired resident physicians will be presented, as well as a larger view of epidemiology, risk factors, detection, prevention and intervention of SUDs, The session will seek to provide useful tools for program directors and faculty to mitigate the risk of SUDs in their respective residency populations.

Learning Objectives:

1. The participant will comprehend the significant morbidity and mortality of substance use disorders (SUDs).
2. The participant will be able to discuss and implement screening for impairment in the resident population by using the Physician Well-Being Index (PWBI).
3. The participant will be empowered and motivated to reduce the morbidity and mortality of SUDs within his/her sphere of influence through early detection and intervention.

[017] BASE-LEVEL CLINICAL TRAINING AT AN AIR LOGISTICS CENTER

E. Rodriguez
Aerospace Medicine Residency, USAFSAM, Oklahoma City, OK

MOTIVATION: USAF Air Logistics Centers (ALC) are complex industrial sites entrusted with depot level maintenance of multiple airframes. The diversity and variety of the industrial processes performed at the ALC present a great opportunity for Aerospace Medicine residents to observe complex industrial operations associated with the aerospace industry. **OVERVIEW:** Current USAF Aerospace Medicine residents have the opportunity to rotate through Tinker AFB home of the AF Materiel Command Oklahoma City Air Logistics Complex (OC-ALC) as well as the Air Combat Command 552nd Air Surveillance Wing. These organizations with very unique missions provide a great patient population with a diverse spectrum of clinical presentations. The ALC provides opportunities to challenge the residents' knowledge on areas such as toxicology, ergonomics, hearing conservation, and assessment of compliance with personal protection equipment. The ALC provide residents the opportunity to observe the different stages of the depot level maintenance of large aircrafts such as E-3 AWACS Sentry, KC-135 Stratotanker and B-1B Lancer. The experience allows better understanding of the coordination necessary to accomplish each stage of the depot maintenance along with the complexity associated with the tasks performed at each level. Faculty members need to explore ways to effectively present all the information while challenging the residents in order to maximize the educational experience. Integration of the extensive learning opportunities and challenges into the clinical experience curriculum represents an exceptional opportunity for the faculty to develop essential skills needed by the future Aerospace Medicine Specialist. **SIGNIFICANCE:** USAF Aerospace Medicine specialist are entrusted with the oversight of the installation aerospace medicine enterprise to include occupational health. Clear understanding of the health risks associated with the performance of aircraft maintenance at the base level will allow residents to effectively apply gained knowledge and clinical skills to mitigate the identified risks and decrease occupational health illness among the at risk population upon graduation.

Learning Objectives:

1. Explore and identify training oportunities present at an USAF Air Logistics Center and ways to integrate them into clinical training of residents in Aerospace Medicine.

[018] EXCELLENCE IN TEACHING -- THE "CORE" CHARACTERISTICS OF GREAT TEACHERS

J. LaVan
Naval Aerospace Medical Institute, Pensacola, FL

Throughout history, great teachers have inspired their students. Many of these great teachers have had such an influence that they remain household names to this day. And, almost everyone has a memory of a teacher who guided or motivated them. While most of us can name that person and can remember the impact they had on our

lives, most of us would be hard pressed to identify what made that one teacher stand out from the rest as being the "great" teacher in our lives. This presentation will help identify the things that make great teachers great through. This will proceed through a rapid review of learning theory to an exploration of characteristics of great teachers illustrated with examples from popular culture and conclude with a discussion of strategies that we can employ to make ourselves better and more effective teachers.

Learning Objectives:

1. Review the history of learning theory.
2. Identify the value of great teachers.
3. Discuss the characteristics of great teachers and strategies for adopting some of those characteristics for ourselves.

[019] DOES FLIGHT SIMULATION IMPROVE INITIAL INSTRUMENT TRAINING FLIGHT PERFORMANCE?

R. Allnutt
USAFSAM, Beavercreek, OH

INTRODUCTION: It seems intuitively obvious that use of a high fidelity, FAA approved advanced aviation training device (AATD) would be helpful in the early training of aviators in instrument procedures such as scanning of instruments and maintaining altitude while referencing only aircraft instruments. But what seems obvious is not always true. **METHODS:** A group of residents in Aerospace Medicine, all of whom had previously been trained to the level of solo flight in a light civilian aircraft, were divided randomly into two groups. Group 1 residents had four individual 1.25-hour instrument lessons taught by an FAA Certified Flight Instrument Instructor (CFII) on an AATD simulator. Group 2 residents had no instrument simulator training. All residents (Group 1 and Group 2) then underwent four 1.25-hour, in-aircraft, instrument instructional flights. All residents were objectively rated for each flight on their ability to maintain speed, heading, altitude, and bank angle as prescribed with a 5 point scale (0-4) for each variable. **RESULTS:** Five residents were simulator trained (group 1) and eight were not simulator trained (group 2). All 13 residents completed the 4 in-aircraft training flights. Each resident had the potential to achieve up to 16 points on each flight for a total of 64 points for the 4 flights. The range of overall scores for each resident was 4-57 points. The average score for simulator trained residents was 36.7 points as compared to 44.6 points for the residents not exposed to the simulator. This difference was not statistically significant. **DISCUSSION:** Simulator training had no demonstrable effect on in-aircraft performance on the rated aspects of instrument precision. AATD simulator training is an inadequate substitute for in-flight training when introducing the complexities of IFR flight to aerospace medicine residents.

Learning Objectives:

1. Understand the difference between different types of flight simulators.
2. Understand the types of instrument training sorties that might best be enhanced with simulator training.
3. Understand the lack of statistical validation of simulator training in enhancing instrument proficiency early in instrument flight training.

NOTE: AEROSPACE MEDICINE BOARD REVIEW SESSIONS S-005A (Abstracts 020, 021, 022); S-005B (Abstracts 023, 024); and S-005C (Abstracts 025, 026, 027,028) WILL BE HELD ON TUESDAY, MAY 2, IN GOVERNOR'S SQUARE 10.

MONDAY, May 1, 2017

Monday, May 1 ***8:00 AM***
Majestic Ballroom

63rd ANNUAL LOUIS H. BAUER LECTURE

Michael R. Barratt, M.D.
"N=1: Medical Debrief on an ISS Expedition"

Monday, May 01 ***10:30 AM***
Plaza A/B

S-006: PANEL: OCCUPATIONAL INJURIES IN CABIN CREW

Sponsored by the AsMA Air Transport Medicine Committee

Co-Chair: Paulo Alves
Tempe, AZ

Co-Chair: Rui Pombal
Lisbon, Portugal

PANEL OVERVIEW: This panel presents an overview of occupational injuries (OIs) in cabin crew across a range of international airlines. The first presentation will give a general picture of the topic by describing the epidemiology of OIs and their operational impact in terms of days of work lost in a medium-sized airline with a composite route network of medium and long-haul flights. The second presentation will zoom in detail into two specific injuries to the wrist that are often missed at initial medical observation and which have prompted changes to case management. Procedural aspects and the role of occupational medicine in the management of OIs in a major world airline will be discussed in the third presentation. The fourth presentation, from another major world airline, will look at the impact of initiatives aimed at identifying causes of lost time from injuries, reducing time lost following accidents and preventing recurrence. The fifth presentation will further discuss strategies to assist cabin crew in returning to work after prolonged sick leave including for serious OIs. Both variation and common ground in case management across various organizational and cultural settings will be highlighted in this panel. It is expected that the broad range of data and approaches presented will constitute a useful reference for future discussions on the topic.

[029] EPIDEMIOLOGY OF OCCUPATIONAL INJURIES IN CABIN CREW IN AN AIRLINE

M. Lima, R. Pombal, A. Jorge and H. Peixoto
UCS - TAP Portugal Group, Lisbon, Portugal

INTRODUCTION: Cabin crew are exposed to multiple hazards in the workplace which can contribute to the occurrence of occupational injuries with an impact on the wellbeing of crewmembers and on airline productivity. The analysis of occupational injuries is essential to the development of targeted occupational safety programs. **METHODS:** All the occupational injuries sustained by cabin crew in a medium-sized European airline in the period 2011-2015 were studied for incidence, severity, causality nexus and time lost. **RESULTS:** For an average of 2,600 cabin crew, the annual frequency rate varied from 134 to 169 injuries per million hours worked. The overall 5-year incidence rate was 238 per 1,000 persons and the overall 5-year severity rate was 2.417 work days lost per million hours worked. Occupational injuries in cabin crew were account on average for 8,900 days away from work per year. The most frequent occupational injury was ear barotrauma (61%), corresponding to 33% of total time lost and an average of 7 days lost per episode. Musculoskeletal injuries came second, accounting for 37% of all the occupational accidents but 65% of time lost and an average of 24 days lost per episode. From another perspective, 12% of all the accidents and 21% of total time lost were related to cabin trolley handling, whereas 8% of the accidents and 13% of time lost were related to galley work. **DISCUSSION:** Knowing the characteristics of occupational injuries sustained by cabin crew and understanding their causes is essential for designing relevant preventive health and safety interventions in the workplace. This epidemiological study provides baseline data for this type of assessment.

Learning Objectives:

1. To know the most frequent causes of occupational injuries in airline cabin crew.
2. To know the most frequent lesions resulting from cabin crew occupational injuries.
3. To know the impact of cabin crew occupational injuries in terms of time lost to work.