2016 ABSTRACTS OF THE AsMA SCIENTIFIC SESSIONS

87th Annual Scientific Meeting — **Harrah's Resort Hotel**
April 24-28, 2016 — **Atlantic City, NJ**

The following are the sessions and abstracts with rooms and presentation times for all presentations accepted after blind peer-review—in slide, poster, or panel sessions—for the 2016 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-01 through S-94 (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 Abstracts withdrawn are listed as W/D. Presenters are underlined in the text.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.

POSTERS: Posters will be on display in Avalon 18-19 from 10:00–12:00 and 2:30–4:30 on Monday and Tuesday. Poster authors should be present for at least 90 minutes and are encouraged to be present, or have a representative attend the poster, during the entire session. AsMA Committees, and Constituent and Affiliate organizations are encouraged to display posters on Wednesday morning to promote their activities and recruit new members.

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.

Sunday, April 24 — ***9:00 AM***
Wildwood 8-9

S-01: WORKSHOP: AIRCREW FATIGUE: CAUSES, CONSEQUENCES, AND COUNTERMEASURES

Fee: $150, Advance registration only
6 AMA PRA Category 1 Credits™

Chair: J. Caldwell
Yellow Springs, OH

Chair: John Caldwell
Yellow Springs, OH

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

J.A. Caldwell[1] and J.L. Caldwell[2]
[1]*Coastal Performance Consulting, Yellow Springs, OH;* [2]*Naval Medical Research Unit Dayton, Wright-Patterson AFB, OH*

MOTIVATION: Human fatigue stemming from lengthy work periods, circadian disruptions, and insufficient sleep poses a serious threat to performance, safety, and general wellbeing. Leaders, healthcare professionals, schedulers, and aircrew members need to understand the causes of fatigue and the scientifically-valid strategies for fatigue mitigation. This course will equip aerospace professionals with the information required to overcome fatigue in challenging operational environments. **OVERVIEW:** In modern aerospace settings, unpredictable and long work hours, circadian disruptions, and disturbed or restricted sleep are common. These factors often result in personnel reporting for duty in a fatigued state, leading to mistakes, cognitive difficulties, and mood disturbances that can lead to performance problems and safety hazards. It is possible to effectively mitigate these difficulties if scientifically validated strategies are systematically applied, including the implementation of crew scheduling practices that are based on a scientific understanding about the underpinnings of fatigue. This workshop will provide a fully-updated, science-based overview of fatigue factors and relevant countermeasures and will emphasize the importance of implementing educational, preventative, monitoring, and mitigation strategies within the context of a fully-integrated fatigue risk management system. **SIGNIFICANCE:** Effective fatigue management is an important key to optimizing operational performance and safety within aerospace contexts. Up-to-date, evidence-based 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 dangers of fatigue in various settings as well as understand the major causes of fatigue (both operational and physiological).
2. Be able to know and apply one or more scientifically-valid countermeasures for fatigue in specific industrial/operational contexts.
3. Understand the basics of a good Fatigue Risk Management System (FRMS).

Sunday, April 24 ***9:00 AM***
Wildwood 20-21

S-02: WORKSHOP: INTRODUCTION TO AEROSPACE EPIDEMIOLOGY

Fee: $200
8 AMA PRA Category 1 Credits™

Chair: Pete Mapes
Rockville, MD

[002] INTRODUCTION TO AEROSPACE EPIDEMIOLOGY

P.B. Mapes
Clinical Support, Defense Health Agency, Falls Church, VA

PURPOSE: Provide eight 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 America Board of Preventive Medicine. Participation in this workshop prepares participants to conduct epidemiological analysis 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, hypotheses generation and testing, causation criteria, parametric and non-parametric analyses, calculation of p-values, data testing and analysis, bias and confounding, ANOVA and modeling. **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 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. Be able to form cogent hypotheses and select denominator and numerator data that would support or deny the chosen hypotheses once collected and analyzed.
2. Identify both parametric and non-parametric data and be able to apply appropriate epidemiological and statistical tests.
3. Be able to utilize epidemiological computing resources to quickly answer questions regarding collected data. This includes the selection and calculation of appropriate test statistics.

Sunday, April 24 ***12:00 PM***
Avalon 3-4

S-03: WORKSHOP: AEROSPACE MEDICINE FACULTY DEVELOPMENT WORKSHOP

Fee: $75
3 AMA PRA Category 1 Credits™

Chair: Richard Allnutt
Beavercreek, OH

Chair: Patrick Storms
Dayton, OH

[003] QUALITY AND PROCESS IMPROVEMENT AS SCHOLARLY ACTIVITY

P.R. Storms
FEEG, USAF School of Aerospace Medicine, Dayton, OH

PROBLEM STATEMENT: The Accreditation Council for Graduate Medical Education expects residents to systematically analyze practice using quality improvement methods and implement changes with the goal of practice improvement. Additionally, residents should participate in scholarly activity. Traditionally, resident scholarly activity has been focused on operational or clinical aeromedical research, but opportunities exist to execute quality or process improvement projects that serve as scholarly activity while addressing quality or process improvement. **TOPIC:** Describe the transition from traditional clinical or operational aeromedical research to scholarly activity focused on quality and process improvement. **APPLICATIONS:** Developing strengths in identifying quality/process improvement opportunities, executing quality/process improvement activities, and following up on the impact of those activities represent skills pertinent and useful to a resident in Aerospace Medicine. **RESOURCES:** Formal instruction in quality and process improvement methodologies, mentorship in the selection and execution of quality/process improvement activities, and a forum for presenting and discussing the results of quality/process improvement activities form the backbone of a transition in scholarly activity to quality/process improvement.
Learning Objectives:
1. Describe quality and process improvement and how it can be viewed as scholarly activity.
2. Explore one method of building a training course in quality and process improvement.
3. Understand the benefits of graduating residents proficient in designing and executing quality and process improvement activities.

[004] CAPABILITIES OF MOTION-BASED AND NON-MOTION-BASED SIMULATORS FOR SPATIAL DISORIENTATION TRAINING

R. Allnutt
USAF School of Aerospace Medicine, Beavercreek, OH

PROBLEM STATEMENT: Spatial disorientation (SD) continues to be a major cause of aircraft incidents. Training pilots to recognize SD potential is important in reducing the risk of SD incidents. **BACKGROUND / LITERATURE REVIEW:** The physiologic basis for most SD incidents is related to one or more of three body systems: the visual, vestibular, and proprioceptive complexes of body organs. Training to prevent SD incidents has included classroom didactics, classroom discussion, incident evaluation, unusual attitude recovery in flight, and training in flight simulators. Simulator training has included both motion-based and non-motion-based simulators. **CASE PRESENTATION:** Considerable experience has been collected on the use of motion-based simulators for spatial disorientation training. Currently, many military pilots and other aviators (including flight surgeons) receive training on a purpose-built simulator that spins and leans about a vertical axis. Motion-based simulators are seldom faithful to a specific aircraft cockpit, in the manner of most non-motion-based training simulators. In addition, having a separate simulator for SD training does not allow frequent exposure to potential SD events in general flight training simulator sorties. **OPERATIONAL / CLINICAL RELEVANCE:** If a portion of SD events can be simulated in type-specific simulators with high fidelity to the aircraft systems, then such training can be introduced/interspersed at times that the aircrew is not expecting them. Many of the visual SD illusions can be introduced on non-motion-based simulators, and mismatch between proprioceptive and visual systems can be used to practice visual dominance in recovery from SD events. This can allow more frequent and less expected exposure to SD events that require pilot input for recovery.
Learning Objectives:
1. Understand the differences between rotatory spatial disorientation simulators and non-motion based flight simulators in spatial disorientation training.

[005] ENHANCING CLINICAL PROFICIENCY TRAINING IN AEROSPACE MEDICINE RESIDENTS THROUGH COLLABORATIVE RELATIONSHIPS

M.D. Jacobson[1,2]
[1]*Aerospace Education, 711 HPW/USAF School of Aerospace Medicine, West Chester, OH;* [2]*Family Medicine, Wright State University, Dayton, OH*

MOTIVATION: Aerospace medicine (AM) training programs have long experienced inherent tension between the need to understand aeromedical implications for a broad spectrum of potential pathologies and the length of training required to develop such expertise. The challenge does not end with graduation, as AM specialists often find it difficult to maintain clinical proficiency while delivering care and aeromedical dispositions to perhaps the healthiest patient population in the world. **OVERVIEW**: The Residency in Aerospace Medicine-Family Medicine Program (RAM-FM) was conceptualized by U.S. Air Force (USAF) leadership to address the need to develop clinically proficient, operationally experienced flight surgeons in an accelerated training environment. Launched in 2013, the RAM-FM is a joint venture between the USAF School of Aerospace Medicine and the Wright State University Family Medicine Residency. **SIGNIFICANCE**: Entering its third year, the RAM-FM is in line to produce an average of at least two graduates per year, with nine currently in the training pipeline. In addition, collaborative relationships built during the RAM-FM's development and deployment have spawned (1) formation of the Operational Family Medicine Residency, (2) electives designed to assist other RAMs in recapturing clinical proficiency, and (3) a template by which AM training programs can use existing institutional structures to work collaboratively with other clinical residencies to produce double-boarded graduates.

Learning Objectives:

1. Understand basic organizational components and accreditation requirements for graduate medical education (GME) programs and how these can impact collaborative training efforts.
2. Understand how training programs can work collaboratively to offer dual certification in an accelerated training environment while minimizing staffing and administrative costs.

[006] THE ESTABLISHMENT OF A UK SPECIALTY AND FACULTY OF AVIATION AND SPACE MEDICINE

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

MOTIVATION: The UK, enjoys an international position in civilian and military aviation and has a proven record. UK doctors trained in the specialty make critical contributions to research, teaching and the practice of Aviation and Space Medicine (ASM). Such expertise aids the delivery of safe and reliable air travel, the safe transportation by air of the injured or ill, contributes to military operations and delivers significant contributions to the economy. **OVERVIEW:** ASM practitioners require robust training programs for specific skills and distinct competencies. The USA and some European States have established national specialties in ASM and the UK is to do likewise. Aviation regulation is by international rather than national legislation and European regulations now dictate that physicians working in this field are to "have received training in ASM and regular refresher training in ASM to ensure that assessment standards are maintained". An established ASM specialty and faculty will permit practitioners to comply with National and International directives and regulations. Failure to do so could ultimately adversely affect flight safety, lead to a loss of medical certification capability and result in the failure to deliver aviation medicine training for pilots and crew. This presentation examines the strategy to develop a single body to oversee training in ASM in the UK and how the need for governance in this area is being address by the formation of an ASM specialty. This need is driven by the overall changes in the regulation of doctors who require revalidation and re-licensing. The training pathway for ASM follows a similar pathway to the other specialties and typically last 4-6 years. A distinct ASM training scheme and specialty, provides an efficient, economic and timely route to specialist accreditation and will equip candidates with the required competencies. **SIGNIFICANCE:** There is a National need to establish a specialty of ASM and support in this endeavor has been forthcoming from many organizations. A cadre of specialists in ASM will give the UK medical profession the capability to continue to preserve its pre-eminent position in the world-wide civilian and military aerospace spheres.

Learning Objectives:

1. Identifies the opportunities for the establishment of a specialty and faculty of aviation and space medicine in the UK.

[007] FEEDBACK: MORE THAN JUST A HAM SANDWICH

T. Castleberry
Preventive Medicine & Community Health, UTMB, Galveston, TX

Feedback is an important but often overlooked aspect of residency training. Without feedback, mistakes go uncorrected, good performance is not reinforced, and clinical competence may be stifled. The ACGME requires that residencies provide feedback to its trainees, but it also mandates that the program and its faculty receive and implement change based on communication from the residents. This presentation will review some of the common techniques of feedback and provide examples of effective and validated ways of giving and receiving feedback.

Learning Objectives:

1. The learner will understand the different aspects of feedback, and be able to describe some of the effective forms of communication and critique.

[008] AEROSPACE MEDICINE RESIDENCY, CRITICAL CARE AIR TRANSPORT PATHWAY

D. Olson
Aerospace Medicine, Wright State University, Kettering, OH

PROBLEM STATEMENT: Military training for Critical Care Air Transport Teams (CCATT) has been a training component for Aerospace Medicine residents participating in the Wright State University, Aerospace Medicine Residency Program for some time. Historically, no similar civilian training component has been established in U.S. based Graduate Medical Education. **TOPIC:** In the setting of patient care, transport of patients by air may take place over varying distances. Within the U.S. Air Force, a training program is available for managing critically ill patients during long distance transfers, from the combat theater anywhere in the world to military hospitals within the US. Transfers of this type present new challenges for patient management. Long distance transfers take place in the civilian realm as well. Based on patient condition, support requirements for civilian transfers may range from the use of an escort on commercial airlines with limited equipment to highly specialized fixed wing and rotary wing aircraft staffed with critical care physicians. Critical care transport flight operations may be conducted by organizations that are independent of any hospital or clinic or by world renowned medical centers. Traditionally, civilian training programs for physicians regarding air transport consist mainly of EMS fellowships. These programs typically provide training for 'scene to hospital' or 'hospital to hospital' transfers over relatively short distances. In July of 2015, the Wright State University, Division of Aerospace Medicine, an ACGME accredited civilian residency program introduced a critical care air transport training pathway. **APPLICATIONS**: The benefit of training physicians for civilian application of critical care transport should be considered. As civilian transport programs continue to grow, physicians will be required to fill leadership positions overseeing program operations. The Wright State University, Division of Aerospace Medicine has begun a new program to train physicians for this specialty area.

Learning Objectives:

1. The audience will gain perspective on the current state of civilian critical care air transport training in the United States as well as the program offered at Wright State University.

[009] INTEGRATED FLIGHT TRAINING CURRICULUM FOR WSU RAMS: MAXIMIZING EDUCATIONAL OPPORTUNITIES

T. Jarnot
Aerospace Medicine, Wright State University, Kettering, OH

PROBLEM STATEMENT: Preventive medicine residency programs with a concentration in aerospace medicine must have a flight training program available as part of their educational program. Incorporating flight training after a traditional Master's Degree year may place increased burden on existing rotation schedules and compete with Accreditation Council for Graduate Medical Education (ACGME) clinical experience requirements. Additionally, aerospace medicine residents entering into their training program may possess varying degrees of piloting experience, thus creating unique challenges for programs to provide an equally beneficial flight training experience for all residents. **TOPIC:** Although required as a component of education in aerospace medicine residency programs, no specific details are provided by the ACGME which define the scope or breadth of flight training. Wright State University has recently restructured and advanced the timing of its flight training curriculum to begin in the first month of residency while expanding the content to include a broad set of flight experiences. Flight training now occurs concurrently with and parallel to the resident's Master of Science year and serves as an adjunct to clinical experience in the Division's Flight Medicine Clinic. Immediate implementation of flight training has provided an optimized educational environment for residents while providing a pathway to adhere to ACGME requirements without impacting second year rotation schedules or clinical requirements. **APPLICATIONS:** Incorporating flight training into a traditional Master's Degree year may reduce scheduling burdens and rotation conflicts experienced during subsequent residency training and offer potential educational benefit previously unutilized. **RESOURCES:** Accreditation Council for Graduate Medical Education (ACGME) Program Requirements for Graduate Medical Education in Preventive Medicine. Revised Common Program Requirements effective: July 1 2016.

Learning Objectives:

1. Participants will be able to review current Accreditation Committee on Graduate Medical Education (ACGME) requirements for flight training and the potential educational advantages of incorporating this experience during a traditional Master's Degree year.

[010] REVIEW OF FLIGHT TRAINING CURRICULUM IN U.S. AEROSPACE MEDICINE RESIDENCIES

J.T. Lavan
Naval Aerospace Medical Institute, Pensacola, FL

The American Board of Preventive Medicine has identified Flight Training as an integral part of Aerospace Medicine Residency Training. There are five active Aerospace Medicine Residencies in the United States, and each approaches the Flight Training Curriculum in a different way. The varying approaches to meeting this requirement will be reviewed and Resident satisfaction with each method will be discussed.

Learning Objectives:

1. Describe the requirement for Flight Training in American Board of Preventive Medicine accredited Aerospace Medicine Residencies.
2. Review the varied approaches to meeting the curriculum requirement for Flight Training.
3. Discuss Resident satisfaction with the various flight training curricula.

MONDAY, APRIL 25, 2016

Monday, April 25 — ***8:00 AM***
Wildwood 27-28

62ND ANNUAL LOUIS H. BAUER LECTURE

Douglas Robb, Lt. Gen. (Ret.), USAF, MC

"Aerospace Medicine: Adapt or Perish"

Learning Objectives:

1. Describe the supported operator trends in the evolution of Industrial Age to Information Age Warfare and its effect on Team Aerospace Medicine support:
    a. Industrial Age Warfare: relied on mass and the mass production capability by industrial nations to create military capability.
    b. Information Age Warfare: precision has replaced mass as a dominant capability.
2. Understand the human factors complexities that precision warfare requires to create an effective "Kill Chain:"
    a. Communications technology enables an operator network that provides real time knowledge and air strike to forces globally.
3. Articulate the global distribution of the Distributed Common Ground System (DCGS):
    a. Gathering required knowledge crosses the traditional domains of air, space, and cyberspace.
    b. The time scale of developing this kill chain knowledge is compressed to a near real time requirement for Combined Operations.
    c. DCGS is the first global network-centric weapon system developed to support the increased ISR requirement and the warfighter.
4. Understand that the evolution of Aerospace Medicine support to the Warfighter must shift to fewer "aviators" and to more "special duty" operators:
    a. More non-aviators in Aerospace domain will be directly involved in combat operations.

Monday, April 25 — ***10:30 AM***
Avalon 18-19

S-04: POSTER: HUMAN PERFORMANCE

Chair: John Hatfield
Dayton, OH

Chair: Jay Phelan
Birmingham, AL

[011] POSSIBLE DELAYED RECOVERY OF ENERGY METABOLISM IN BRAIN TISSUE AFTER EXPOSURE TO HIGH +G_z ACCELERATION

O. Tokumaru[1,5], M. Goto[3], S. Maruyama[2], M. Hiruma[4], T. Kemuriyama[4], K. Ogata[5] and Y. Nishida[4]
[1]Faculty of Welfare and Health Sciences, Oita University, Oita, Japan; [2]Aeromedical Laboratory, Tachikawa, Japan; [3]School of Medicine, Oita University Faculty of Medicine, Yufu, Japan; [4]Department of Physiology, National Defense Medical College, Tokorozawa, Japan; [5]Department of Neurophysiology, Oita University Faculty of Medicine, Yufu, Japan

INTRODUCTION: Exposure to high +G_z acceleration induces decrease in cerebral blood flow (CBF) resulting in G-induced loss of consciousness. Following high +G_z acceleration, partial pressure of oxygen in brain recovers after the recovery of CBF (Sugimoto et al., 2012). We examined the change in high-energy phosphates (ATP, ADP and AMP) in brain tissue during and after exposure to +8 G_z acceleration environment and compared with that in CBF. **METHODS:** Eleven C57BL/6NCrSlc mice (mean 24.4 g) were divided into the following three groups; control (Con, n = 3), ischemia (Isc, n = 4) and ischemia-reperfusion (IscR, n = 4). Mice were anesthetized with urethane intraperitoneally. ECG and CBF were monitored. An anesthetized mouse was placed in a prone position on the centrifuge for small animals (Tomy Seiko, Tokyo, Japan). +8 G_z acceleration was applied to the mouse for 30 s. The brain was *in-situ* frozen at the following time points; before acceleration (Con), right after the acceleration (Isc) and 5 min after the acceleration (IscR). Serial coronal sections with 8-µm thickness were sliced with a cryomicrotome and thaw-mounted on indium tin oxide-coated glass slide. Imaging mass spectrometric analysis was performed by a matrix-assisted laser desorption ionization time-of-flight mass (MALDI TOF/MS) spectrometer (AXIMA, Shimadzu, Kyoto, Japan) in the negative ionization mode with 9-aminoacridine as the matrix. **RESULTS:** +8 Gz acceleration reduced CBF in cerebral cortex to 15.2 ± 8.1% and pulse rate to 33.5 ± 33.6% of the baseline. Adenylate energy charge (AEC = {[ATP] + 1/2[ADP]} / {[ATP] + [ADP] + [AMP]}; an indicator of cellular states of energy metabolism; Atkinson, 1968) in cerebral cortex decreased in Isc (56.6 ± 6.2%) compared with Con (61.3 ± 5.4%). After 5 min (IscR), although CBF returned to the baseline level (105.2 ± 12.9%), AEC remained low and did not show any recovery (54.5 ± 4.5%). **DISCUSSION:** No recovery was observed in AEC 5 min after the cessation of +G_z acceleration when CBF had already recovered to the baseline level.