

Annual Progress Report Fiscal Year 2011

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United States Army Aeromedical Research Laboratory

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**U.S. Army Medical Research and Materiel Command
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Background

The United States Army Aeromedical Research Laboratory (USAARL) was originally established as the United States Army Aeromedical Research Unit (USAARU) in October 1962. As envisioned by Major General Spurgeon Neel, U.S. Army, the unit's mission was to provide direct aviation medical research support to all Army aviation and airborne activities, and to provide a central aeromedical research and reference library. Technical evaluation of aircraft and personnel equipment, aeromedical in-flight observations, and field problems analysis reported by other aviation agencies were part of the unit's early research program.

In 1969, USAARU was redesignated a Laboratory. Construction began on a new vivarium, and a year later, the Helicopter In-flight Monitoring System (HIMS), an airborne system capable of simultaneously measuring pilot and helicopter performance, was designed, built, and installed aboard the Laboratory's JUH-1J research helicopter. Lighting systems and paint schemes for collision avoidance were being addressed.

In May 1978, ground was broken for a new laboratory facility, with completion in March 1981. During the 1980s, USAARL scientists and support staff became increasingly involved in field studies throughout the Army in assessing hazards of military systems and operations, and biomedical means of enhancing Soldier selection, performance, and protection.

In 1990, USAARL was honored with the Department of Defense Award for Excellence. For its support and contributions to Desert Shield/Desert Storm, USAARL was awarded the Army Superior Unit Award in 1992.

In April 2004, USAARL was dedicated in memory of the "Father of Army Aviation Medicine," Major General Neel, for his integral role in the development of the principles of aeromedical evacuation of battlefield casualties.

Today, laboratory and field studies continue on the ground and in helicopter flight in those research disciplines unique to USAARL – vision and visual enhancement/protection, auditory injury/protection, impact injury/protection, jolt effects, crew stress/workload, and physiological life support. A JUH-60A aircraft and an NUH-60 flight simulator with specialized cockpit environmental controls help researchers with their flight performance investigations. Physicians, engineers, and safety experts work together to understand human injuries and damage to personal protective equipment from a crash. Researchers analyze and correct design and operational deficiencies in flight helmets, crashworthy seating, restraint systems, and develop criteria for future Warfighter systems.

This report presents an overview of USAARL activities during fiscal year 2011 (FY11), identifies current areas of research, and gives a brief description of the research programs being conducted.

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From the Commander

The USAARL is proud to present this summary of achievements for FY11. USAARL continued to make significant contributions to preserving and enhancing the health, safety, combat effectiveness of the Warfighter. USAARL established new, exciting and relevant collaborative partnerships with other DoD organizations and academia.

The Warfighter Health Division (WHD) was productive in FY11 publishing thirteen technical reports, which provide comprehensive summaries of research on topics such as tactile sway cueing, unmanned aerial systems, and hypoxic hypoxia. In FY11, the WHD developed a novel dynamic marksmanship battery based on established clinical vestibular assessments for return-to-duty determinations. WHD investigated the effects of traumatic brain injury (TBI), diagnoses, and treatments. USAARL's involvement in the development of and research on the noise immune stethoscope (NIS) continued in FY11, contributing to U.S. Food and Drug Administration 501(k) clearance of the NIS, airworthiness release of the NIS for use on the Black Hawk helicopter. The NIS is being evaluated by clinicians in real-world operational environments.



The Warfighter Protection Division (WPD) continued to provide relevant contributions to protecting medical personnel and patients during MEDEVAC. They tested and evaluated the performance of numerous medical systems for use during en route care, ensuring the safe interaction among the vehicle, medical systems, patients, and care providers. The division delivered to Natick Soldier Research, Development, and Engineering Center (NSRDEC) head, neck, and facial injury assessments to be used to develop a humanitarian ration that can be dropped over populated areas. The WPD also began work on the Warrior Injury Assessment Manikin (WIAMan) effort, a multi-organization blast injury research partnership aimed at creating a Warrior-representative test dummy and associated biomedically-validated injury assessment tools for use in live-fire test and evaluation and vehicle development efforts.

During FY11, the Sensory Research Division (SRD) continued to lead a research effort evaluating the impact of repetitive blast exposure on the auditory, vestibular, and visual systems of U.S. Marine Corps breachers. The division also completed the research for two extramurally funded grants, one on novel strategies to hasten corneal healing and restoration of normal vision and the other on the effects of hypoxia on the cognitive function of individuals who have had a mild traumatic brain injury.

USAARL enjoyed great success with its first ever Gains in the Education of Mathematics and Science (GEMS) program, which is funded by the U.S. Army Medical Research and Materiel Command (USAMRMC). The science, technology, engineering, and mathematics (STEM) educational outreach program engaged 51, 5th and 6th grade students and 6 college-aged near-peer mentors in experiments focused on problem solving, estimation, water properties, physical/forces of motion, and forensics.

We are proud of the work we accomplished this year. During FY12, we will remain dedicated to our research efforts focused on protecting the Warfighter and supporting the U.S. Army Medical Department's mission to "conserve the fighting strength."

A handwritten signature in black ink, appearing to read "D. Renta".

DANA K. RENTA
Colonel, Medical Corps
Commanding

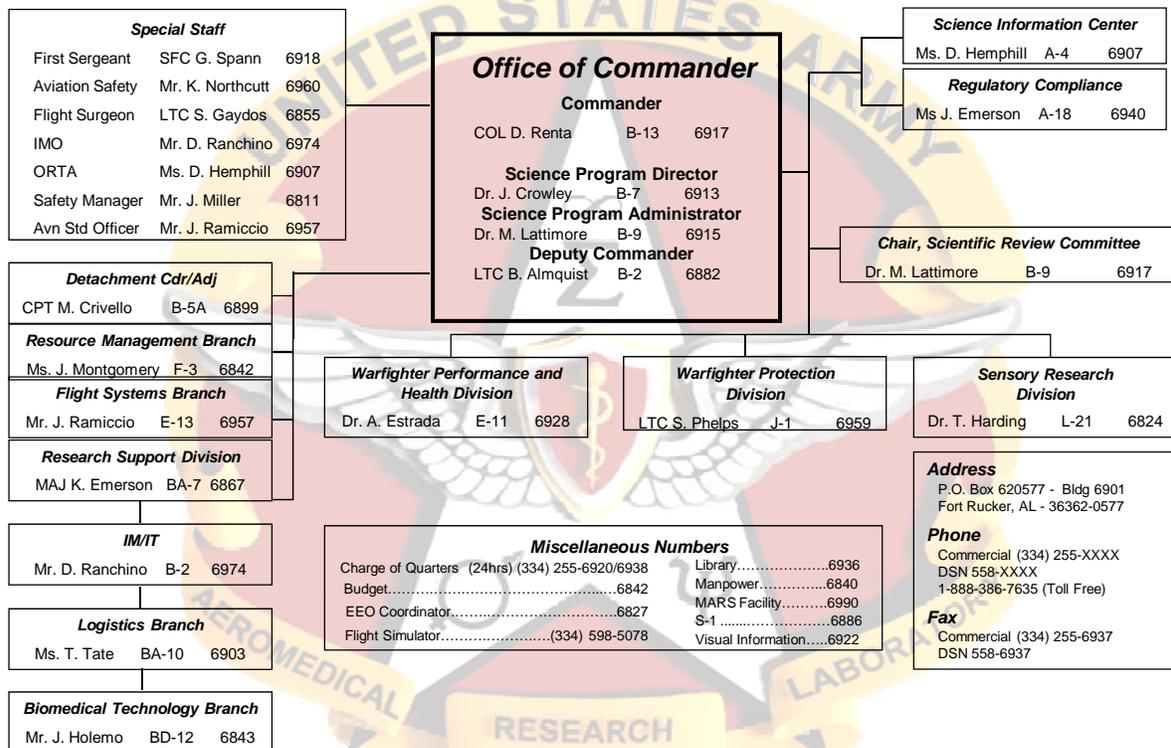
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USAARL Mission and Vision

The USAARL's mission is to deliver medical research, development, test, evaluation, and solutions to our air and ground Warriors.

Our vision is to be a premier team dedicated to excellence in innovative aeromedical and operational medical research.

USAARL Organizational Chart



Scientific Programs

Warfighter Health Division

The WHD is comprised of two branches: the Aeromedical Factors Branch (AFB) and the Cognitive Assessment and Diagnostics Branch (CADB). Together these branches maintain a unique capability in basic and applied research relating to the modern Warfighter. During FY11, the research objectives of WHD were to investigate current and anticipated medical issues related to Warfighter injury prevention and reduction; psychological health and resilience, including TBI, post concussion syndrome (PCS), return-to-duty (RTD)/fitness-for-duty (FFD) issues, and physiological health. General scientific disciplines included aviation medicine, biomedical engineering, human factors, systemic and neurosensory physiology, and research psychology. In addition, WHD maintained its capability and competency to develop and document effective means of optimizing the performance of military personnel subjected to stressors such as spatial disorientation; disrupted sleep, work, and rest cycles; high cognitive workloads; and sustained operations. Within this heterogeneous framework, the WHD defined the biomedical impact of prototype and developmental military equipment in terms of individual tolerance and performance effectiveness; assessed emerging technologies in all of the above research fields; and translated these research results into useable, relevant recommendations to the field. The WHD developed, maintained, and actively integrated technology transfer between other DoD laboratories and agencies, academia, the civilian scientific sector, and allied countries.

In FY11, the WHD staff was composed of both military and civilian employees. There were 11 investigators on staff (seven Ph.D., one Ph.D./M.D., one M.D., and two master's-level) with varying specialty areas including physiology, neurophysiology, neuropsychology, cognitive psychology, medicine, educational leadership, and human factors. The division staff was complemented by a research program coordinator, four research technicians, two contractors, two students, and five Soldiers skilled in medically-related fields. Division research included the use of a Black Hawk helicopter, helicopter flight simulator, tactile systems, cognitive assessment software tools, and an engagement skills weapons trainer.

Aeromedical Factors Branch

The AFB's mission is to support the Warfighter by conducting basic and applied research to quantify, attenuate, and mitigate operational stressors. During FY11, the research mission focused on the following areas: RTD, crew/operator endurance and sustainment (aviation and ground vehicles), operator workload, collective team performance, situational awareness, motion sickness prevention, and advanced medical diagnostic tools. The AFB objectively and subjectively evaluated strategies to ameliorate the performance decrements and safety issues associated with fatigue and motion sickness through pharmacologic and non-pharmacologic intervention. Ongoing research in emerging tactile technologies and visual displays pursued solutions for spatial disorientation and loss of situational awareness experienced during helicopter flight operations in areas of limited visibility/contrast (e.g., "brownout" landings, hovering over snow/desert/water). In addition, new medical devices designed for use in high

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noise environments and novel equipment designed to aid the rehabilitation of wounded Soldiers were developed, tested, and evaluated for their clinical efficacy and applications. This contributed to a U.S. Food and Drug Administration 501(k) clearance of the NIS and an airworthiness release of the NIS for use on the Black Hawk helicopter. Collaborations were established within the U.S. Army, other U.S. government research agencies, national and international agencies, and civilian universities.

In FY11, AFB projects included the following:

A Comparison of the Efficacy of Modafinil and Dextroamphetamine as Alertness Promoting Agents in Aviators Performing Extended Operations

The objective of this study was to determine the side effect profile and degree to which low doses of modafinil and dextroamphetamine sustain alertness, performance, cognition, vigilance, judgment, mood, and decision-making throughout 40 hours of continuous wakefulness. Results were presented at a recent symposium, a technical report published, and a manuscript is currently undergoing review for open literature publication.

Effects of Ketamine and Morphine on the Performance of Warrior Skill Tasks

This study compared the ability of Soldiers to perform Warrior tasks (representative of Soldier skills) following administration of ketamine and morphine to evaluate the potential utility of low-dose ketamine as a battlefield analgesic. Results were recently presented at a medical specialty symposium.

Motion Sickness Prevention by Stroboscopic Environment during Actual Air Transport

The objective of this study was to evaluate the effectiveness of 8-hertz (Hz) stroboscopic environments in reducing visually-induced motion sickness (retinal slip) during military transport. Results were recently published as a USAARL Technical Report, are currently being formatted for an upcoming symposium poster presentation, and a manuscript is currently undergoing review for open literature publication.

The Effects of Spatial Disorientation on Working Memory and Mathematical Processing

The aim of this study was to examine the effects of spatial disorientation on aviators' cognitive processing in real-time. Results were recently published as a USAARL Technical Report and a manuscript is currently in preparation for open literature publication.

Clinical Assessment of the Noise Immune Stethoscope

Patients with cardiopulmonary pathology in real-world operational environments (a medical center and a U.S. Navy carrier) were evaluated using the NIS, a dual mode electronic and Doppler device. Results have been published as a USAARL Technical Report.

Unit Cohesion and Considerations for Reintegration

The objective of the study is to characterize perception of Soldiers with PCS following a head injury sustained during a combat deployment with respect to reintegration success and then to evaluate the impact on team performance.

Tactile Cueing for Rehabilitation following Traumatic Brain Injury

The goal of this project was to carry out an initial exploration of three different systems for providing tactile sway cueing as a compensatory strategy for patients suffering from disequilibrium due to TBI. Agreements and the protocol are in preparation.

Tactile Situation Awareness System

The objective of this study was to develop capabilities that provide non-visual, intuitive orientation and targeting information to the Aviator to complement existing flight instruments and situation awareness systems.

A Workload Assessment of Aviation Maneuvers

The objective of this study explored the subjective measure of workload in an effort to move towards an operational definition of the construct. Results were recently presented at the Annual Scientific Meeting of the Aerospace Medical Association (AsMA).

Development of a Fitness-for-Duty Assessment Battery for Recovering Dismounted Warriors

The purpose of this study is to examine the effects of mild traumatic brain injury (mTBI) on dynamic marksmanship abilities and weapons utilization tasks. The study will also demonstrate whether a new marksmanship assessment battery can supplement RTD assessment and determinations.

Efficacy of Directional Tactile Cues from a Tactile Garment for Target Orientation in Helicopter Extractions over Moving Targets

The study assessed the efficacy of a tactile cueing system to provide nonverbal, tactile directional cues to the pilot as to the target's ever-changing position. Data have been collected and are being analyzed.

Team Performance Metrics and their Appropriateness for the U.S. Army: A Systematic Review

The study conducted a systematic review of team performance metrics to identify those suitable for the Army's team performance research needs. Two abstracts have been presented and the final report is in preparation.

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A Simple Field Test for Balance Impairment

The objective of this study was to develop an easily-administered test of vestibular function for use by field clinicians to identify otolithic impairment. The prototype device has been constructed and will be received soon for evaluation.

The Perception of Looming Tactile Stimuli

The objective of this study is to determine whether tactile stimuli can convey the approach of significant objects. Pilot testing has been completed. Data collection is set to begin.

Studies Project: Touch/Tactile Feedback for Rehabilitation of Wounded Warriors

This project convened several select study groups of subject matter experts to assess the state of tactile balance feedback systems ultimately making recommendations concerning next generation devices and protocols. One report is submitted for publication and a second is in preparation.

Post-Concussion Tools to Assist Assessment, Treatment, and Return to Duty

This project focused on the development, optimization, and evaluation of prototype balance measurement and cueing systems for the evaluation and rehabilitation of TBI patients experiencing disequilibrium. The collaborative agreement has been signed and offsite data collection is expected to commence immediately.

Modeling Acceleration Effects on Spatial Orientation

The goal of this project is to develop a prototype model of spatial orientation reactions during acceleration stimuli. The team has been assembled, the existing information has been reviewed, and the model is under construction.

Traumatic Brain Injury Effects on Return to Duty for Specific Military Occupational Specialties

The goal of this project is to identify military occupational specialties likely to sustain TBI relative to the abilities required by those specialties for RTD. Information on injury patterns has been gathered and evaluation is underway.

Hypoxic Hypoxia at Moderate Altitudes

This systematic literature review evaluated the current 'state of the science' regarding acute hypoxic hypoxia at moderate altitudes with focus on cognitive impairment, sensory deficits, and other pertinent performance effects. Results were recently published as a USAARL Technical Report and are currently under revisions for publication in open literature.

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Cognition-enhancing Drugs and their Appropriateness for Aviation and Ground Troops: A Meta-analysis

The goal of this study was to critically review and conduct a meta-analysis of the existing literature in order to identify cognition-enhancing drugs that may be suited for use in ground and aviation troops.

The Effect of Sleep Deprivation on Assessment of Casualty, Correlation Detection, Illusory Correlation, and Performance on an Engagement Skills Trainer task in Soldiers.

The objective of this study evaluated the accuracy on a series of casual judgment tasks and the Engagement Skills Trainer 2000 (marksmanship simulator) after a period of sleep deprivation and recovery sleep. Results were recently published as a USAARL Technical Report.

Risky Behavior and Attitudes about Risk in Soldiers Pre- and Post-deployment

The objective of this study was to assess risk propensity in Soldiers pre- and post-deployment. A secondary goal was to assess risk propensity and actual risk behaviors in Soldiers post-deployment; comparisons between those with Post Traumatic Stress Disorder (PTSD), TBI, and poly-traumas. Currently the report is under revision for publication.

Sleep Disturbances and U.S. Marine Corps Breacher Crewmen

This study evaluated the sleep patterns (i.e., quantity and quality of sleep) and cognitive functions of U.S. Marine Corps (USMC) breacher crewmen students and instructors before, during, and after training. Results were published as a USAARL Technical Report.

Validation of a Weapons Simulator, the Engagement Skills Trainer 2000, as a Measure of Cognitive Performance

This study investigated the construct validity of a weapons simulator as a measure of cognitive performance using convergent/divergent validation methodology. A secondary goal of the study was to explore relationships between cognitive abilities and marksmanship in an uninjured, healthy sample of U.S. Army Soldiers. Results were published as a USAARL Technical Report.

Identifying Functional Concussion Thresholds for Cognitive Impairment

The primary objective of this project was to systematically review the literature regarding performance decrements associated with various impact magnitudes and concussion grades. A secondary objective was to compile a list of currently available measurement technologies. Results are currently in preparation for publication as a USAARL Technical Report.

The Effect of Combat Experience on the Perception of Risk in U.S. Army Soldiers Post-deployment

This study tested the hypothesis that a cognitive impairment associated with combat deployment and TBI is a mechanism driving behavioral changes with regard to health risk in Soldiers post-deployment. Data collected from this study may be useful in developing intervention techniques to decrease the number of preventable injuries and fatalities in Soldiers post-deployment. Results were published as a USAARL Technical Report.

Cognitive Assessment and Diagnostics Branch

The mission of the CADB is to enhance the Warfighter's performance through psychological and physiological health. Today's combat operations in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) have created unique conditions that can have deleterious effects on the cognitive and emotional well-being of our Warfighter. During FY11, the CADB investigated the effects of TBI, sleep deprivation, substance use/misuse (licit and illicit), pre-morbid psychopathology, individual differences, and combat experiences on neuropsychological functioning and psychological health. Clarifying the contribution of specific variables precedes accurate diagnosis, assessment, and the development of efficacious treatments for both TBI and other combat-related psychopathology such as PTSD. CADB accomplishes this with a multidisciplinary, biopsychosocial approach, which integrates genetics, proteomics, metabolomics, brain imaging, psychophysiology, diagnostic, and self-report measures. Overall, it is the goal of CADB to contribute to the proficiency and long-term stability, health, and psychological well-being of the Warfighter.

In FY11, CADB projects included the following:

Effects of Selective Serotonin Reuptake Inhibitors on Cognition and Sleep

This study focuses on assessing the effects of selective serotonin reuptake inhibitors (SSRI) on the behavior, cognition, motivation, and daytime wakefulness of Soldiers being treated for combat operational stress. The investigation explores the relationship between measures of neurocognitive performance, sleep latency and wakefulness, and sleep quality and quantity.

Long-chain Polyunsaturated Fatty Acid Status and Cognitive Performance

The goals of this research were to assess changes in behavior, cognition, and motivation of Soldiers with chronic symptoms from mTBI/PTSD and to explore the relationship between neuroimaging, neurobehavioral, biological, and psychological measures. Results are being prepared for publication.

The Effects of Controlled Repetitive Blasts on Neuropsychological Functioning

This study aims to examine the effects of repeated exposure to blasts in U.S. Marine Corps (USMC) instructors at the USMC Dynamic Entry School (DES). Specifically, the effects of repeated blast exposure on neuropsychological functioning are being assessed multiple times annually using a battery of validated neurocognitive tests.

Longitudinal Proteomic, Genetic, and Neurobehavioral Assessment of Post-Concussion Syndrome and Underlying Psychological Health of the U.S. Warfighter

The objective of this prospective study is to explore blood-based biomarkers, genetic, psychological, neurocognitive, and psychosocial factors that may contribute to the development of persistent PCS in Soldiers with a history of combat-related mTBI.

Effects of Omega-3 EPA/DHA for Soldiers at Risk for Mood Disorders: A Mood Resiliency Trial

The objective of this study was to investigate the efficacy of Omega-3 supplementation on neuropsychological functioning by using a double-blind, placebo-controlled, randomized trial in deployed Soldiers with mild-to-moderate depression. Results are being prepared for publication.

Auditory and Vestibular Effects in the Warfighter Associated with Blast Induced Traumatic Brain Injury

The purpose of the study is to evaluate and characterize the vestibular, auditory, oculomotor, and cognitive sequelae to blast exposure in Warfighters diagnosed with TBI.

The Effects of Subthreshold Visual Cues on Flight Performance in the NUH-60FS Blackhawk Research Simulator

The purpose of this study was to determine if visual cues presented at subthreshold levels can prime pilots to check for new flight information without distraction or deterioration from performance. Results were published as a USAARL Technical Report.

Warfighter Protection Division

The WPD is comprised of three branches, namely the Operational Survival Analysis Branch (OSAB), the Injury Biomechanics Branch (IBB), and the Airworthiness Certification and Evaluation (ACE) Branch. WPD's overall vision is to focus on injury prevention including primary protection in the identification of health hazards, secondary protection in the development of standards for better protective equipment, and tertiary protection in the advancement of mitigating factors in the post-injury phase. The WPD mission is to conduct research on and develop standards for Warfighter injury mechanisms, human tolerance levels, injury risk mitigation technologies, and health hazards present in the full spectrum of Army operational and training environments including aviation and ground operations, MEDEVAC platforms, combat vehicles, and weapons systems.

Operational Survival Analysis Branch

The OSAB's research efforts focus on primary protection in the identification of health hazards. The OSAB functions within the framework of the Joint Trauma and Prevention of Injury in Combat (JTAPIC) Program. The JTAPIC Program is administered by the USAMRMC and encompasses multiple organizations as partners; the USAARL contribution focuses on data procurement, analysis, and synthesis. During the past year, USAARL conducted a detailed analysis of vehicle incidents (to include enemy actions and accidents) and personnel injuries.

The U.S. Army continues to face challenges regarding quantifying the performance of protective systems (including personal protective equipment [PPE] and vehicle-mounted safety systems) provided to combat Soldiers. Current U.S. Army military trauma databases, although able to answer myriad questions regarding trauma care, provide virtually no information regarding the circumstances of wounding or the use of protective equipment – lacking even such basic details as to whether the protective system was in use when the injury occurred. Gaps include the lack of data describing the operational environment, as well as no comprehensive mechanism for the collection, examination, or cataloging of damaged protective systems and equipment associated with combat injuries. As a result, program managers (PMs) have no way of knowing how well their products are functioning on the battlefield; they are forced to rely on case reports and anecdotes, combined with sterile laboratory evaluations, when deciding whether to invest in product improvements. Frustrated vehicle and equipment developers have little information on which improvements will provide maximal protection. The USAARL framework provides a reliable estimation of protective system performance in present and future combat operations.

Operational Survival Analysis Section

The OSAS personnel have continued to be instrumental in developing short notice responses to U.S. Army and other government and non-government customers involving questions about eye protection, ear and hearing protection, as well as helping inform research groups about the distribution and types of wounds occurring in the current conflicts. The OSAS continues to collaborate via secured data and video conference venues with organizations globally.

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FY11 accomplishments include:

U.S. Army Combat Readiness/Safety Center:

The OSAS continued fostering a cooperative working relationship with the U.S. Army Combat Readiness/Safety Center (USACR/SC) at Fort Rucker. This working relationship has specifically been supported, along with the Aviation Life Support Equipment Retrieval Program (ALSERP) staff in providing presentations at USACR/SC's quarterly Aviation Safety Officers' Course (ASOC) and Ground Safety Officers' Course (GSOC).

Mine Resistant Ambush Protected Joint Program Office:

The OSAS continued providing support to the Mine Resistant Ambush Protected (MRAP) Joint Program Office with accident data procurement and analysis as well as participating during periodic forums to include the MRAP Joint Users Working Group (JUWG) and MRAP Joint Training Integrated Process Team (JTIPT).

U.S. Army Research, Development and Engineering Command Tank Automotive Research, Development and Engineering Center Field Assistance for Science and Technology Team:

The OSAS continued providing support to U.S. Army Research, Development and Engineering Command (RDECOM) Tank Automotive Research, Development and Engineering Center (TARDEC) community and its programs with accident data procurement and analysis as well as participating during monthly Field Assistance for Science and Technology (FAST) Team Update teleconferences and semi-annual FAST Team Orientation and Reach Back Training sessions.

Aviation Life Support Equipment Retrieval Program/ Aviation Life Support Equipment

The ALSERP serves a vital role in maximizing the level of protection afforded to Army aircrew members by analyzing aviation life support equipment (ALSE), studying injury mechanisms, tracking patterns, and bringing awareness to issues that can potentially decrease the level of protection afforded to Army aircrew members. Analyses of equipment and the discovery of deficiencies often prompt core research projects. During FY11, ALSERP and ALSE combined their efforts to increasing the extent of work produced by both departments. In FY11, ALSERP supported six USACR/SC Class A mishap investigations, providing reports on analyses by both ALSERP and ALSE personnel.

The objective of the ALSE section is to collect and analyze safety and protective equipment used or considered for use in U.S. Army aviation (and/or other DoD and non-DoD entities). Furthermore, this program is involved in the evaluation of aircraft interiors and other human factors issues within crew spaces. Results from this section frequently identify unforeseen or previously unrecognized gaps in deployed equipment subsystems, in levels of human tolerance, and/or in current protection research. As such, the gaps are evaluated and transitioned into the core research program at USAARL, at the DoD-level through USAARL's close associations with other research and development entities, and through various PMs and combat developers.

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Personnel contributions

Personnel from ALSE/ALSERP contributed in ALSE IPT meetings helping to optimize the contents of the ALSE vest. The ALSE chief also attended the Fire Resistant Environmental Ensemble (FREE) working group.

ALSERP continues to contribute to the education of military and civilian personnel through presentations and guided tours of USAARL. The department hosts regular visits from the ASOC, GSOC, and students in the flight surgeons courses. ALSERP personnel are constantly working to improve the quality and standards of visual aids and equipment used in these teaching sessions.

ALSERP personnel attended the following external training courses: National Training Safety Board (NTSB) accident investigation course, Safety and Occupational Health (CP-12) course, accident investigation section of the ASOC. Two USAARL personnel completed the ALSE course.

MEDCOM aviation safety officer attended the Army Aviation Association of America (AAAA) Symposium, Senior Safety Symposium, the Armed Forces Professional Health Conference, and the Worldwide Aviation Logistics Conference. Emphasis at each conference was bringing awareness to the ALSERP program to the Aviation Safety community. The MEDCOM helipad database was updated, with four inspections performed and working with MEDCOM Standardization on procedures for the designing the Brooke Army Medical Center (BAMC) rooftop helipad at Fort Sam Houston, TX.

Research

Members of ALSERP remain active in research. The ALSE research protocol “A Study to Examine the Prevalence of Neck and Back Pain amongst Personnel at the Extremes of Anthropometric Measurements” was approved and the data will be collected early in FY12. ALSERP research protocol “Case Control Study to Investigate the Risk Factors for Developing Spinal Injuries during Helicopter Mishaps” is currently undergoing revision and data collection and is expected to begin early in FY12. Subject recruitment and data collection has begun on the 3 year study, “Mitigation of Acute and Chronic Neck Pain in Military Aircrew,” which is being operated in collaboration with the Naval Air Warfare Center-Aircraft Division (NAWCAD) in Patuxent River, MD.

WPD purchased the FARO Laser scanner, which will enable precision measurement during equipment evaluation during destructive and non-destructive testing.

Injury Biomechanics Branch

The IBB’s research centers on the impact of a full-spectrum of Army operational and training environments of Warfighters. The IBB is uniquely staffed with a multi-disciplinary team of biomechanical and aeronautical engineers, aviators, aerospace medicine specialists, safety professionals, and Soldiers. The team studies the effects of exposure to physical forces (e.g., localized and whole body impacts as well as repeated jolt) on the health, safety, and performance

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of U.S. Army aviation and ground, mounted, and dismounted Warfighters. The IBB team uses various standardized and unique methods (e.g., epidemiological research, computer modeling, laboratory simulation, crash manikins and human volunteers, mishap investigations of combat ALSE studies, and the investigation of ground vehicular incidents). It also uses tools such as the helmet vertical drop tower, the 18-inch shock tube, the Multi-Axis Ride Simulator (MARS), and the NUH-60 Black Hawk Simulator. IBB team members serve on various inter-governmental and multi-national biodynamics research working groups that seek to develop internationally-recognized, biomechanically-validated injury standards. These groups recommend injury prevention and protection strategies to researchers, equipment developers, and major commands.

Blast Injury Research

The WIAMan effort is creating a Warrior-representative test dummy and associated biomedically-validated injury assessment tools for use in live-fire test and evaluation and vehicle development efforts. The WIAMan efforts include collaboration with Medical College of Wisconsin, University of Virginia, Virginia Technical Institute, and Johns Hopkins University – Applied Physics Laboratory. IBB has begun to define a Warfighter Baseline Environment based on injury analysis for academic partners doing medical research for the WIAMan project. The dataset was collected by JTAPIC. USAMRMC/USAARL/IBB is responsible for the WIAMan medical research program.

In the first quarter of FY11, IBB researchers participated in a live fire blast test of a Generic Hull. This first Generic Hull test was a collaboration between the DoD, academia, and private industry. Army collaborators included TARDEC and U.S. Army Research Laboratory (USARL). Academic partners included Wayne State University, Virginia Technical Institute, Johns Hopkins University, University of Virginia, and University of Michigan. Industry collaborators were Humanetics, DTS, Inc., Cosworth America, Vicon Motion Systems, and Luminys Systems Corporation. The testing was conducted at the U.S. Army Aviation and Missile Research Development and Engineering Center (AMRDEC) at Redstone Arsenal, AL. The test was performed on a TARDEC fabricated generic v-shaped hull vehicle. The goal of this testing was to collect unclassified, releasable live fire data from an underbelly blast. The data produced enabled better understanding of the dynamics of underbody blasts.

During FY11, IBB scientists continued their collaboration with the University of Virginia under a Cooperative Agreement to investigate lower extremity injuries resulting from underbelly blast events. The Cooperative Agreement was the result of an FY10 Extramural Defense Medical Research and Development Program (DMRDP) Applied Research and Advanced Technology Development Award. University of Virginia collaborators have devoted much of FY11 to the design of a blast simulation test rig capable of reproducing underbody blast (UBB)-representative floor and seat acceleration levels; the current design will produce a peak acceleration of 1800 Gs within 1.5 milliseconds. Additionally, research was initiated to explore the concept of acoustic impedance mismatch as an injury mechanism for bone. This research is intended to identify whether lower extremity injuries are a result of the shockwave being passed from a material with a high sound-propagation speed, e.g., metal, into a material with a much lower sound-propagation speed, e.g., bone. Initial computation modeling results substantiate this

hypothesis; experimental evaluation of this hypothesis will be conducted in FY12.

In the spring of 2010, IBB scientists were awarded funding through the FY10 Intramural DMRDP for Applied Research and Advanced Technology Development for a three-year effort to integrate experimental and computational methods to investigate blast wave brain biomechanics that will support design efforts to improve helmet protection under blast exposure. This research entitled, “Integrated Experimental and Computational Framework for the Development and Validation of Blast Wave Brain Biomechanics and Helmet Protection” is in collaboration with CFD Research Corporation and Applied Research Associates, Inc. (ARA). In FY11, IBB received and installed an 18-inch diameter shock tube, which was originally designed and built by ARA. The shock tube, which can theoretically produce incident pressures of nearly 60 psi, was a deliverable under a Scientific Services Program Task Order contract between IBB researchers and ARA. Industrial hygiene measurements were conducted to assess hearing protection requirements for shock tube operators. A safety and control system was designed (currently under construction) that will allow IBB research personnel to remotely pressurize the shock tube’s driver section, initiate membrane rupture, and safely de-pressurize the driver section in an emergency. Full characterization of the shock tube will commence after the safety and control system is installed in FY12. The shock tube will support research efforts designed to investigate blast wave brain biomechanics, which will support design efforts to improve helmet protection under blast exposure.

Spinal and Head Injury Research

In FY11, the IBB continued the R.MRM.2010.06 / Cervical SPine INjury Evaluation (C-SPINE) Army Technology Objective (ATO). C-SPINE efforts include collaboration with Medical College of Wisconsin, Wright State University, Harvard/Massachusetts Institute of Technology (MIT) Beth Israel Deaconess Medical Center, University of Pennsylvania, and Naval Air Systems Command (NAVAIR). C-SPINE research will provide the capability to assess neck response to chronic and acute exposures occurring in high risk military environments.

As a part of in-house C-SPINE efforts, research is ongoing to determine if the Hoffmann Reflex is a valid measure of acute nerve root compression which may be leading to short- and long-term symptoms reported by aviators. Anecdotal reports include numbness and tingling in the hands and fingers, atrophy of the deltoid muscles, loss of range-of-motion, and pain. Additional measures will include range-of-motion, neck muscle activity, and subjective discomfort.

IBB scientists have also continued their collaboration with investigators from the Medical College of Wisconsin to investigate several injury biomechanics topics: cervical disc arthroplasty, lumbar spine injury assessment, and head-supported mass. Based on a clinical review of artificial disc replacement (ADR) and biomechanical studies on the topic, two artificial discs were selected for inclusion in longitudinal studies with a Caprine model. Studies involving the Caprine model are intended to provide data on the effects of cervical spine stability and strength as compared to spinal fusion and no surgery (control) cases. Sled tests have been

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conducted to characterize load transmission from the pelvis through dorsal spine and into the head and neck using anthropomorphic test devices (ATDs). Preliminary analysis indicates a progressive time lag trend in biomechanical outputs from the seat pan to pelvis to dorsal spine to neck and head. As the lumbar spines of ATDs are considered to be stiffer than the human, the results suggest that the time lag may be greater in the human than the dummy, implying a more gradual transfer of the external load to the rostra regions of the lumbar spine in the human. This issue along with continued data analyses will be explored using post-mortem human subjects (PMHS) studies in FY12. Medical College of Wisconsin researchers also initiated analysis of lower neck (C7-T1 disc level) load data from in-house head-supported mass (HSM) research, as well as data generated during IBB-sponsored PMHS tests, for possible development of an interaction-based criterion for neck injuries.

The IBB team continued to support PM-Apache in its development and maturation of an Apache-specific variant of the HGU-56/P flight helmet. IBB evaluated the effect of trimming the lower 0.5 inch of helmet shell material from the eardome regions and cutting a notch out of the visor housing and visor for the monocular head-up display (HUD) of the HGU-56/P on the lateral and frontal impact protection. IBB's research showed the lateral and frontal blunt impact protection of the HGU-56/P to be unaffected by trimming the helmet shell material from the eardome. IBB also evaluated the effect of adding crown spacer pads to the super comfort liner and the Zeta II liner on the dynamic stability of the helmet system. The research showed the addition did not degrade the dynamic stability.

Under a Cooperative Agreement, the University of Pennsylvania is currently conducting pilot testing and further developing test procedures for the research effort, "Development of a Novel Translational Model of Vibration Injury to the Spine to Study Acute Injury in Vivo." In conjunction with the procedural testing being conducted, the University of Pennsylvania will use data previously collected at USAARL to help further define desired vibration signatures for testing.

IBB researchers are currently developing a protocol in conjunction with the Auburn University Neuromechanics Research Laboratory to further previous research efforts assessing the effects of pressure on physiological and biomechanical markers. The goal of the new protocol is to develop biometrics of potential impairment by quantifying the relationships between human orthopaedic/neuromuscular response and exposure during (actual or simulated) mounted and dismounted operational exposures.

The development of injury risk functions relating impact forces, measured using the Facial and Ocular Countermeasures for Safety (FOCUS) head form, to the risk of facial fractures during lateral impacts continued throughout FY11. In mid FY-10, IBB collaborators at the Virginia Technical Institute-Wake Forest Center for Injury Biomechanics (CIB) conducted lateral blunt impacts to the mandible, nasal bone, and zygoma of 20 PMHS tests; for each test, impactor acceleration and impact force were measured, as was acoustic emission data needed for determining the onset of fracture. In FY11, these data were analyzed to determine biofidelity corridors for the different facial bones subjected to lateral impacts. In FY12, CIB researchers will conduct matched testing using the FOCUS head form; data from the matched tests will establish

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the biofidelity of the FOCUS headform during lateral impacts and allow loads measured by the FOCUS head form to be correlated to risk of zygoma, nasal bone, and mandible fracture. These injury risk functions will become part of a comprehensive set of facial fracture injury risk functions for use by combat developers and materiel evaluators.

Throughout FY11, IBB researchers supported the NSRDEC's Warfighter Protection and Aerial Delivery Directorate in the development of a humanitarian ration that can be dropped over populated areas. The IBB team impacted the FOCUS headform with a series of candidate humanitarian rations traveling at varying velocities; the rations included individual water packets packaged in several types of energy-attenuating foam, U.S. Agency International Development food bars, and survival rations. Face and eye impact load data, as well as head accelerations and upper neck load data, were collected during each ration impact. These data were analyzed to provide NSRDEC's aerial delivery experts with head, neck, and facial injury assessments for each candidate ration and impact velocity. The IBB team will continue to support the NSRDEC's efforts on a cost reimbursable basis in FY12.

Several years ago, the IBB team was successful in acquiring key research equipment and the internationally-recognized biodynamics data repository from the Naval Biodynamics Laboratory (NBDL) in New Orleans, LA. The NBDL equipment and repository data were scheduled to be decommissioned and/or destroyed due to defunding and damage to the facility by Hurricane Katrina in the fall of 2005. Through the IBB's long-cultivated collaborations with the U.S. Navy research community and with academia, the USAARL secured and assumed control of this national asset. Working with USAARL, Fort Rucker, and USAMRMC facilities divisions, approval was obtained for a location for the building that will house the vertical acceleration tower (VAT) that was acquired from the NBDL (The VAT was refurbished in FY09.). The building design process was completed in FY11, with construction to begin in FY12. The refurbishment process for the horizontal acceleration sleds and supporting equipment were completed during FY11. Also during FY11, IBB continued safely archiving the NBDL data repository for ongoing digitization and eventual utilization by biodynamics researchers worldwide.

Airworthiness Certification and Evaluation Branch

The ACE Branch maintains the unique capability of testing and evaluating the efficacy of medical systems in the U.S. military aeromedical evacuation environment, ensuring the safe interaction among medical equipment, patients, aircrew, and aircraft. As such, the ACE Branch contributes to the protection of the injured or ill Warfighter through the MEDEVAC system.

Test and Evaluation Program

In FY11, the ACE Branch performed airworthiness testing and/or certification in support of the U.S. Army. Twenty-one items of carry-on medical equipment were tested for use aboard all H-series MEDEVAC helicopters; six tested items were added to the fleet-wide Airworthiness Release (AWR). Twelve items were tested for use aboard the UH-72 Lakota. Seven items were tested for U.S. Army Special Operation Forces (SOF) and added to fleet-wide MH-60 and MH-

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47 AWRs. An additional thirty-two items are planned for testing in FY12. The U.S. Air Force (USAF) testing laboratory at Wright-Patterson Air Force Base (AFB) in Dayton, OH accepted ACE test data for multiple medical items. This interaction has streamlined the joint certification process.

During FY11, ACE developed an airworthiness process for carry-on medical items for use on the UH-72 Lakota. ACE has initiated and plans to develop the process for fleet-wide certification on the CH-47.

In FY11, the ACE Branch continued to collaborate with the USMC. Through this coordination, the ACE Branch performed test and evaluation on eight medical equipment items in the laboratory ensuring satisfactory operation in the military medical environment. This collaborative effort directly supported critical procurement decisions fielding some of the most advanced medical technology to the Warfighter in support of OEF/OIF and other military operations.

The ACE Branch gave formal presentations on test program updates at the Defense Medical Materiel Program Office (DMMPO), Test, Evaluation, and Standardization Working Group meeting as well as the Global Patient Movement Joint Advisory Board (GPMJAB), sponsored by the U.S. Transportation Command (USTRANSCOM). During both meetings, ACE interfaced with key board members to understand joint medical service requirements. ACE held a stakeholders meeting at USAARL for development of hoist testing for USAMRMC. Personnel also presented “Medical Equipment Test, Evaluation, and Certification” to MG (Retired) David Rubenstein and Dr. Kenneth Bertram at the International Aeromedical Evacuation and En Route Medical Care Conference. In addition, personnel presented the previously mentioned lecture as well as an overview of ongoing test and evaluation projects and future research projects to USAMRMC. ACE personnel also participated in the National Neurotrauma Symposium, Advanced Technology Applications to Combat Casualty Care Conference (ATACCC), American Society for Testing and Materials (ASTM) Working Group, Emergency Medical Services Expo, ISO 2631 Meeting, NATO Meeting, Air Medical Transport Conference (AMTC), GPMJAB, Burn Resuscitation Decision Support System (BRDSS), Joint En-route Care Symposium (JERC), and Special Operations Medical Association (SOMA).

The ACE Branch initiated development of a Testing and Qualification Program to establish test procedures for medical evacuation strap and hoist items. Personnel conducted tensile strength testing of the New York City Industries for the Blind Litter Strap II for to describe the breakpoint and tensile strength of the strap.

Standards Development Program

Based on a tri-service meeting on patient movement items (PMI) testing held at USAARL, the ACE Branch refined a draft of the Joint En Route Care Equipment Testing and Certification Standard (JECETS). The JECETS document addresses revisions to the existing Joint Airworthiness Certification (JAC) requirements document to include ground and sea environments. New stakeholders in the document revision include the U.S. Navy and USMC. The document is currently in the review and approval process.

Research Activities

Shock and Vibration Isolation System for Patient Litters

Personnel in the ACE Branch are involved in identifying and developing shock and vibration isolation systems for patients during ground and air MEDEVACs. Currently, the ACE Branch is collaborating with the University of Nevada Las Vegas (UNLV) using a modified existing air bladder technology to fit under supine litter patients and seated patients. This effort was funded by the U. S. Army Medical Materiel Development Activity (USAMMDA). A portion of the funds is directed to the ACE Branch for field testing on military medical evacuation platforms.

A test team composed of USAARL and UNLV personnel traveled to Fort Detrick, MD to evaluate seated and supine prototypes of the modified air bladder technology. Mechanical shock and vibration data was collected on an RG-33L MRAP ambulance that is stationed at the USAMMDA test facilities. Data was collected with and without the air bladder technology during simulated patient transport over various terrain types. Analysis has indicated that the air bladders provide shock and vibration attenuation in key frequency ranges. The same test team traveled to USAARL and performed similar data collection procedures using the HH-60M helicopter.

Fixed Position Litter Loading Assessment

An aircraft manufacturer proposed an alternative medical interior that would replace the Baseline Medical Interior (BMI) currently in use in the HH-60M MEDEVAC helicopter. This interior would replace the motorized litter lift system on the BMI with a non-mechanized litter pan system that can be shifted between various heights before a litter is loaded onto the pan. The UH/HH-60 PM Office requested that USAARL determine if the manual loading of patients into a fixed-position six litter configuration interior was feasible, how this compared to loading patients with the moving litter lift system and if adequate care could be performed on patients in the fixed position configuration. USAARL conducted two single day assessments using Army Soldiers as litter bearers and acting medics performing the loading tasks. The first assessment took place at the U.S. Army School of Aviation Medicine (USASAM) Medical Suite Trainer (MST), a mock-up of an HH-60M helicopter equipped with External Stores Support System (ESSS) and BMI. The second assessment took place on the USAARL helipad with an HH-60M helicopter equipped with the BMI.

Immobilization Technologies Assessment

USAARL has initiated a test program to evaluate immobilization technologies currently found in the Air Ambulance and Ground Ambulance Medical Equipment Sets (MES). Testing will also be performed on novel immobilization technologies intended for vibration and mechanical shock isolation/mitigation. The MARS motion platform will be the test bed for these evaluations. Measures collected during testing include vibration and shock, pressure mapping and motion capture.

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Quality Assurance Milestones

In FY11, the ACE Branch initiated quality milestones per American National Standards Institute/ International Organization for Standardization /International Electrotechnical Commission (ANSI/ISO/IEC) 17025:2005 (General Requirements for Competence Testing and Calibration Labs and ISO 9001 Laboratory Accreditation Program Requirements). The ACE Quality Manual, Procedure Manual, and Training Manual drafts as well as associated forms and instructions were written. ACE personnel began implementing these policies and procedures. The branch also initiated an internal audit program. Development will continue during FY12.

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Sensory Research Division

The SRD maintains a unique capability in applied medical and operational research in the areas of visual and auditory sciences through the Visual Sciences Branch and Acoustics Research Branch. The research mission of the Division is to conduct sensory research to protect, sustain, and extend the operational capabilities of our Army's Warfighters. These objectives include conducting applied medical research in the areas of (a) eye and ear injury prevention; (b) development of sensory biomarkers (e.g., electrophysiological, behavioral, and clinical) for the evaluation of visual, auditory, and vestibular consequences of traumatic brain injury and fitness for duty criteria development; (c) development of realistic models for the assessment of protection technologies and sensing performance with these technologies; (d) development of unique visual and auditory standards for service occupations and performance standards for optical, acoustical and communication devices; and (e) establishment of a sensory performance research base to support the development and integration of soldier technologies (e.g., night vision devices, hearing protection, communications equipment, advanced optical systems, etc.) into military systems.

Visual Sciences Branch

The SRD maintains a unique capability in the visual sciences as they relate to military operational medicine. The division builds on its expertise in the clinical and allied vision sciences to enhance Warfighter effectiveness and safety in the evolving battlefield environment of today. The SRD's vision science, optical, clinical, and technological capabilities provide a basis for the development and integration of optical and electro-optical displays in military systems; the evaluation of physical, physiological, and functional vision associated with military occupational demands and combat, the definition of countermeasures to improve and preserve vision and visual efficiency, particularly as applied to unaided visual target detection, recognition, and identification. Of particular concern are the evolving threats to the visual system posed by battlefield blast injuries.

In FY11, VSB projects included the following:

Sensory Biomarkers for Traumatic Brain Injury

It is generally agreed that more than 70% of brain processing involves the visual system and the cognitive processes associated with visual perception. This creates the potential for vision to serve as an indicator of the integrity of the brain. Current research is directed toward developing the rich potential of vision as a tool for assessing and diagnosing the effects of mTBI. Thus the assessment of vision provides insight into the effects of mTBI on the ability of patients/ Warfighters to see at the same time that the assessment provides insight into the effects of the trauma on the brain.

Advanced Optical Measurement and Correction

The objective of this research is to determine the operational efficacy of refractive surgery for specialized Army applications. However, higher order aberration of the eye, as well as corneal physiological modeling, are currently being investigated to enhance visual performance to 20/8 or better. If found safe and effective, these techniques will provide the capability to increase the recruitment population, enhance visual performance levels, and potentially increase future mission success in visually demanding military occupational specialties.

Oculometrics and Other Sensory Indices of Alertness, Fatigue, and Time-on-Task

This research aims to assess biologic indices of Warfighter FFD using real-time measurements that could be incorporated into the Warfighters' battledress. Research is directed for the simultaneous measurement of an operational task (e.g., rotary-wing hover performance) with biologic measures to yield correlational indices of fatigue, alertness, and operational performance.

Primary Blast Wave Effects on Ocular Components and Protective Optical Surfaces

Military personnel working in the combat zones are at particular risk of ocular damage caused by blasts. The spectrum includes penetrating eye injury, retinal detachment, eye rupture, intraocular hemorrhage, and corneal lacerations. Most investigations and models of eye injuries have focused on such secondary mechanisms of ocular blast injury, however a spectrum of eye injuries may be due to primary blast overpressure. This study investigates: (a) the relationship between blast-produced ocular damage and the use of Military Combat Eye Protection (MCEP); (b) the primary blast overpressure and its affect upon ocular structures and the integrity of MCEP; and (c) the level of primary blast overpressure protection provided by MCEP in order to differentiate blast effective design properties.

Combat Eye Protection to Preserve Visual Sensitivity of Warfighters during Abrupt Changes in Lighting Conditions

Breaching into buildings from bright daylight into the dark interior puts our Warfighters at a visual disadvantage. The vision of individuals inside the building has already adapted to that illumination level while the vision of our Warfighters is impaired. Currently our Warfighters have two options to minimize their visual disadvantage: they either have to remove their combat eye protection or use clear lenses in their combat eye protection. Neither of these options is satisfactory. Removing the eye protection presents obvious risks, but using clear lenses in a bright environment greatly reduces their ability to subsequently fight in a darkened interior. The goal of this project is to provide Warfighters with better options, by evaluating technologies that may be effective in eye protection that facilitates visual transition between dim and bright illumination environments. The findings will provide design guidance for eye protection that will allow continuous uninterrupted use between bright and dark environments. Increasing the use of protective eyewear by ground Warriors enhances their safety and facilitates mission completion.

Effects of Repetitive Blast Exposure on Visual System

Traumatic injuries as the result of blast are very common during the current conflicts in Iraq and Afghanistan. Warfighters are exposed to high-level blast overpressures that can cause a variety of injuries from primary blast effects. However, the effects of repetitive primary blast exposure to the ocular structures and visual system have not been studied in detail. This research intends to evaluate the effects of repeated blast exposure on the instructor cadre at the USMC Weapons Training Battalion (WTB) DES in Quantico, VA. The purpose of this research protocol is to evaluate the ocular and visual changes among cadre during assignment to the school. This will be done by assessing visual functions and ocular structure integrity over the course of their assignment. Comparisons will be made to help identify the hazards to the eye structure, as well as the effects on visual functions that are associated with exposure to repeated high-level blasts. This will also begin to define the recovery, adaptation, and compensation of sensory decrements, as well as ocular structural damage, resulting from primary blast.

Advanced Display Concepts and Physiological Optics

This research will improve image output standards to optimize visual performance with advanced electro-optical designs and visual performance models to predict Warfighter performance in operational environments. The National Research Council, in its review of tactical displays for Warfighters, identified a major weakness in the understanding of human factors related to perceptual and cognitive issues with such devices.

Visual Performance Modeling

The objective of this research was to develop computer models of human physiology and performance and models of military hardware and operational stressors to assess human performance in an operational environment. Models of interest include health hazards of impulse noise from crew-served weapon systems; HMD and HUD models for day-night operations; target detection and identification models; and sensory processing models.

Acoustics Research Branch

The SRD maintains a specialized capability in the acoustics research. The objectives of the Acoustics Research Branch are to conduct research to improve the operational capabilities of Army aviation, mounted, and ground forces by predicting and reducing hazards from excessive exposure to noise, and to improve the safety and mission capabilities of Army personnel by improving the auditory displays and communications systems utilized in military aircraft and ground vehicles. Warfighters' survivability depends on accurate sensory perception of the environment. Despite the technological advances in hearing protective devices, the likelihood of exposure to continuous and impulse noise on the modern battlefield remains high. As a result, the prevalence of hearing loss and tinnitus in returning OIF and OEF Soldiers is at an all-time high; making protection of the critical sense of hearing a priority of the Acoustics Research Branch. Warfighter auditory performance research efforts focus on prevention of noise-induced hearing loss and enhancement of auditory performance. Furthermore, research efforts are

focused on evidence-based criteria for standards to determine the level of operational competence required to RTD following an auditory or vestibular injury.

Hearing Hazards in Army Operations

This program investigates and evaluates hazards to hearing in the Army operational environment. Principally, this includes noise in rotary-wing and mounted environments but also includes impulse noise hazards for mounted and dismounted Warfighters, which is measured using specifications of Military Standard (MIL-STD)-1474D “Noise Limits.” In rotary-wing environments, noise measurements are made on both sides of the pilot’s head and at the unoccupied copilot (observer) position at approximate head height during specific flight maneuvers and aircraft configurations. Measurements are also made during weapon firing to measure impulsive noise. An example of quantifying a dismounted operational environment would be the measurement of blast overpressure at the USMC WTB Method of Entry (MoE) School. Furthermore, while the most common hazard to hearing is high-level continuous and impulse noise, other hazards may include ototraumatic and ototoxic agents such as inhalants, disease, and drugs.

Hearing Protection and Enhancement for the Warfighter

This program focuses on traditional and advanced technologies and systems to enhance hearing while protecting the vital survival sense of hearing in the combat environment. As stated previously, exposure to dangerous levels of combat noise is causing an epidemic of high rates of acute and chronic acoustic injuries. New technologies can prevent most of these injuries while preserving combat effectiveness. Non-linear hearing protection and communication systems provide the dismounted Warfighter with hearing protection and communication while still allowing enhanced situational awareness of the battlefield and face-to-face and wireless communications. Non-linear hearing protective devices permit normal or near-normal hearing during periods of quiet or low-level noise while providing protection from the very high impulse noises generated by friendly or opposing forces weapon systems. Research is focused on laboratory evaluations of commercial off-the-shelf (COTS) non-linear hearing protection and communication systems and includes quantification of hearing protection, speech intelligibility, sound localization, and signal detection and recognition.

Auditory Performance in Army Tactical Environments

This program encompasses research on human auditory performance, typically in noise, by normal and hearing-impaired listeners. The objective is to enhance the safety and operational mission capabilities of Warfighters by evaluating new hearing protection and enhancement technologies for use by normal hearing and hearing-impaired listeners. Additional research in this area examines a novel tinnitus treatment to reduce the debilitating operational effects of tinnitus resulting from blast and other acoustic trauma. Functional hearing assessments are also being developed and validated against operational performance in an effort to equip clinical providers with hearing assessment tools and standards that guide RTD decisions.

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Bioacoustics and Noise Standards

The program emphasizes collaborative work in conjunction with the Acoustical Society of America (ASA)'s standards working groups on acoustical hazards and hearing protection measurement methods. Several Acoustic Research Branch personnel serve on various standards working groups. The current ANSI method for testing the effectiveness of hearing protective devices was developed with participation by USAARL investigators. The Acoustic Research Branch has engaged in a multi-laboratory, multi-national research program that has resulted in the revision of standard ANSI S12.6 "Methods for Measuring the Real-Ear Attenuation of Hearing Protectors."

Sensory Biomarkers for Traumatic Brain Injury

Nearly 80% of the brain's processing involves sensory signals and cognition associated with sensory perception. In-house research is directed at finding electrophysiological and/or performance indices that may provide early diagnosis of mTBI. Research is being focused toward the development of vestibular and oculomotor biomarkers of TBI to aid in the development of RTD standards.

Research Activities

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- Wang, Z., Yang, H., Capó-Aponte, J. E., & Reinach, P. S. (2011). Tak1 Interactions with TRPV1 and CB1 Control IL-6 and IL-8 Release in Human Corneal Epithelial Cells. *Association for Research in Vision and Ophthalmology Annual Meeting*, 416/D1063.
- Wang, Z., Yang, H., Capó-Aponte, J. E., Wolosin, J. M., & Reinach, P. S. (2010). JNK-1 and DUSP1 Mediate TRPV1 Control of Inflammation in Human Corneal Epithelial Cells. *American Academy of Optometry Meeting*, Abstract 105120.
- Yang, H., Wang, Z., Capó-Aponte, J. E., Wolosin, J. M., & Reinach, P. S. (2010). Dual Specific Phosphatase 6 Regulates EGF Induced NKCC1 Phosphorylation and Proliferation in Corneal Epithelial Cells. *American Academy of Optometry Meeting*, Abstract 105153.

Technical Reports

- Rupert, A., & Lawson, B. (2010). *Initial Consideration of the Feasibility and Optimal Application of Tactile Sway Cueing to Improve Balance among Persons Suffering from Disequilibrium*. (Report No. 2011-01). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA531557).
- Kelley, A., Athy, J., Webb, C., & King, M. (2010). *The Effect of Sleep Deprivation on Detection of Correlational and Causal Relationships, and Performance on an Engagement Skills Trainer Task in Soldiers*. (Report No. 2011-02). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA528334).

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

- Hall, B. D., Eshelman, R. E., Bowers, B., Hayes, J. R., & Barazanji, K. W. (2010). *Test and Evaluation of the Impact 731 EMV+ ventilator*. (Report No. 2011-03). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADB365594).
- Walters, P. L., & Brozoski, F. (2010). *Identification of Built-in-Test Failure Patterns in Electronic Crash Sensor Units from OH-58D(R) Aircraft*. (Report No 2011-04). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADB365240).
- Estrada, A., Kelley, A. M., Webb, C. M., Athy, J. R., Crowley, J. S., Milam, L. S., Gaydos, S. J., Jones, H. D., King, M. R., Erickson, B. S., Chiaramonte, J. A., Moon, S. M., MacNeill, R. S., Ramiccio, J. G., & Leduc, P. A. (2010). *A Comparison of the Efficacy of Modafinil and Dextroamphetamine as Alertness Promoting Agents in Aviators Performing Extended Operations*. (Report No. 2011-05). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA533725).
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- Athy, J. R., Hitzig, A., Jones, H. D., Moon, S. M., Hewett, J., Saini, N., & Ramiccio, J. G. (2010). *Aerial Command and Control of Unmanned Aircraft Systems*. (Report No. 2011-07). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA533728).
- Webb, C. M., Estrada, A., Kelley, A. M., Ramiccio, J. G., Rath, E., Reeves, E. R., Hill, M. E., Crivello, M. J., & Jones, H. D. (2010). *The Effect of Spatial Disorientation on Working Memory and Mathematical Processing*. (Report No. 2011-08). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA534074).
- Hayes, J. R., Hall, B. D., Bowers, B., Eshelman, R. E., & Barazanji, K. W. (2011). *Rotary-Wing Airworthiness Certification Evaluation of the Verathon Medical GlideScope Ranger*. (Report No. 2011-09). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADB367290).
- Hall, B. D., Eshelman, R. E., Hayes, J. R., Bowers, B., & Barazanji, K. W. (2011). *Rotary-Wing Airworthiness Certification Evaluation of the Mobile IV System*. (Report No. 2011-10). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADB367928).

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- Jones, H. D., King, M. R., & Gaydos, S. J. (2011). *A Novel Application of the Point of Aim Trace Feature for the Engagement Skills Trainer 2000*. (Report No. 2011-14). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA539426).
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- Petrassi, F., Gaydos, S. J., Ramiccio, J. G., Walters, P. L. (2011). *Hypoxic Hypoxia at Moderate Altitudes: State of the Science*. (Report No. 2011-17). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA545310).
- Hayes, J., Hall, B., Bowers, B., Eshelman, R., & Barazanji, K. (2011). *Rotary-Wing Airworthiness Certification Evaluation of the Philips Medical Systems HeartStart MRx Defibrillator*. (Report No. 2011-18). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADB370849).
- Athy, J., Estrada, A., Rath, E., Born, S., & Ramiccio, J. (2011). *The Effects of Subthreshold Visual Cues on Flight Performance in the NUH-60FS Black Hawk Research Simulator*. (Report No. 2011-19). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA546612).

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- Walters, P. L. (2011). *Review of Post-mishap UH-60 Troop Seat Damage: 1999-2009*. (Report No. 2011-20). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADB375595).
- Webb, C. M., Estrada, A., Athy, J. R., & King, M. R. (2011). *Motion Sickness Prevention by 8 Hz Stroboscopic Environment during Actual Air Transport*. (Report No. 2011-21). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA553665).
- Kelley, A. M., Athy, J. R., Erickson, B., King, M. R., & Cruz, P. (2011). *Risk Propensity in Soldiers Post-deployment: A Series of Studies Exploring Contributing Factors to Risk-taking after a Combat Deployment*. (Report No. 2011-22). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA553800).
- Kelley, A. M., Athy, J. R., King, M. R., Erickson, B., Chiaramonte, J. Vasbinder, M., & Thompson, A. (2011). *Think before You Shoot: The Relationship between Cognition and Marksmanship*. (Report No. 2011-23). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory. (Defense Technical Information Center No. ADA553803).

Technical Memoranda

- Eshelman, R. (19 October 2010). *Test Results for the Physio-Control Lifepak 1000 Automated External Defibrillator (AED)*. (Memorandum No. 2011-01). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.
- Walters, P. (26 October 2010). *Aviation Life Support Equipment Retrieval Program Case Number 10-06 (Class A Mishap, OH-58D, Memorial Range, Speicher Airfield, Iraq, 8 November 2009)*. (Memorandum No. 2011-02). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.
- Eshelman, R. (26 October 2010). *Science Powerheart G3 Pro, Automated External Defibrillator (AED)*. (Memorandum No. 2011-03). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.
- Walter, P., & Northcutt, K. (26 October 2010). *Aviation Life Support Equipment Retrieval Program Case Number 10-05 (Class A Mishap, AH-64D, Fort Carson, CO, 30 June 2010)*. (Memorandum No. 2011-04). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.
- Rupert, A., & Lawson, B. (2 December 2010). *Afriqiyah Airways Flight 771: Evaluation of Perceptual Factors*. (Memorandum No. 2011-05). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

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Chancey, V. (17 February 2011). *Review of Relevance and Applicability of Lower Leg Injury Criteria*. (Memorandum No. 2011-06). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Williams, R. (10 March 2011). *Impulse Noise Evaluation of the M3P Machine Gun on the Armed Bell 407 Aircraft*. (Memorandum No. 2011-07). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Walters, P. (1 February 2011). *Aviation Life Support Equipment Retrieval Program Case Number 11-01 (Class A Mishap, Parachuting, Rickenbacker Joint Guard Base, Columbus, OH, 20 Oct 2010)*. (Memorandum No. 2011-08). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Brozoski, F. (27 April 2011). *Effects of Magnetic Receiver Unit (MRU) Installation on the Blunt Impact Protection of the HGU-56/P Aircrew Integrated Helmet System (AIHS) – Part II*. (Memorandum No. 2011-09). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Walter, P. (2 May 2011). *Aviation Life Support Equipment Retrieval Program Case Number 11-02 (Class A Mishap, OH-58D(R), Fort Rucker, AL, 14 Dec 2010)*. (Memorandum No. 2011-10). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

McLean, W. (5 April 2011). *Optical Distortion Assessment of Joint Service Aviation Mask (JSAM) MPU-6 lenses*. (Memorandum No. 2011-11). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Walter, P. (8 June 2011). *Aviation Life Support Equipment Retrieval Program Case No. 11-02 (Class A Mishap, OH-58D(R), Fort Rucker, AL, 14 Dec 2010)*. (Memorandum No. 2011-12). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

McLean, W. (16 June 2011). *Exploratory Optical Assessment of the M-53 Protective Mask for Aviation Use*. (Memorandum No. 2011-13). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Walters, P. (15 July 2011). *Aviation Life Support Equipment Retrieval Program Case No. 11-03 (Class A Mishap, UH-72A, San Juan, PR, 20 Dec 2010)*. (Memorandum No. 2011-14). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Williams, R., & Reeves, E. (12 July 2011). *Evaluation of Impulse Noise produced by the M3P Machine Gun on the Armed Bell 407 During Flight*. (Memorandum No. 2011-15). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Williams, R., & Reeves, E. (12 July 2011). *Acoustical Analysis of the MH-60 Direct Action Penetrator (DAP) Weapon Systems*. (Memorandum No. 2011-16). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

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Walters, P. (23 June 2011). *Aviation Life Support Equipment Retrieval Program Case No. 11-04 (Class A Mishap, AH-64D, Near Monroeville, AL, 28 April 2011)*. (Memorandum No. 2011-17). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Walters, P. (11 August 2011). *Aviation Life Support Equipment Retrieval Program Case No. 11-05 (Class A Mishap, Oh-58D, Bagram, Afghanistan, 5 June 2011)*. (Memorandum No. 2011-18). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Kinsler, R. (7 September 2011). *Test results for “Assessment of the Fixed Position Litter Loading in the HH-60M MEDEVAC Helicopter.”* (Memorandum No. 2011-19). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Bowers, B. (19 September 2011). *OxLife Independent Model KXIN001 Oxygen Concentrator*. (Memorandum No. 2011-20). Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.

Book Chapters

Thiel, K. J. & Dretsch, M. N. (2011). The basics of the stress response: A historical context and introduction. In Conrad, C. D. (Eds), *The Handbook of Stress: Neuropsychological Effects on the Brain* (chapter 1). Wiley-Blackwell.

Presentations

MAJ José Capó-Aponte and co-authors H. Yang, Z. Wang, J. M. Wolosin, and P. S. Reinach presented “Dual Specific Phosphatase 6 Regulates EGF Induced NKCC1 Phosphorylation and Proliferation in Corneal Epithelial Cells” and “JNK-1 and DUSP1 Mediate TRPV1 Control of inflammation in Human Corneal Epithelial Cells” at the American Academy of Ophthalmology meeting in Chicago, IL, 16-19 October 2010.

Dr. Alessio Medda presented “Bootstrap Statistics Distribution of Modal Parameters Estimation for the Advanced Combat Helmet,” co-authored by Dr. Carol Chancey, at the Shock and Vibration Information Analysis Center’s 81st Shock and Vibration Symposium in Orlando, FL, 24-28 October 2010.

Dr. Ben Lawson presented “Meetings with a Remarkable Man: A Toast to Fred Guedry” at the Spatial Orientation Symposium in Honor of Fred Guedry in Pensacola, FL, November 2010.

Dr. Alessio Medda and V. DeBrunner presented the poster “CDF resampling for dataset expansion in Gaussian mixture models density estimation” at the 44th Asilomar Conference on System, Signals, and Computers in Pacific Grove, CA, 7-10 November 2010.

Mr. Keith Northcutt and Lt Col P. Lynne Walters presented “The USAARL Perspective on ALSE/ALSERP” at the 48th Annual SAFE Association Symposium in San Diego, CA, 7-11 November 2010.

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Ms. Elmaree Gordon presented “Custom-Molded Earplugs with the Communications Ear-Plug” at the 27th Army Science Conference in Orlando, FL, 29 November-2 December 2010.

Dr. Ben Lawson presented “A Tool for Monitoring Soldier Fatigue and Predicting Cognitive Readiness: The Sleep History and Readiness Predictor” at the 27th Army Science Conference in Orlando, FL, 29 November-2 December 2010.

Ms. Jill Emerson presented “What to Do With 40 Tons of Old But Irreplaceable Data - An Ethical Framework for Evaluating Later Research with Previously Collected Data” at the PRIM&R conference in San Diego, CA, 4-9 December 2010.

COL Joseph McKeon presented “Medical Technology Focus: Enhanced Aviation and Combat Life Support Equipment” at the Battlefield Healthcare Series sponsored by the Institute for Defense and Government Advancement (IDGA) in San Antonio, TX, 7-8 December 2010.

Lt Col P. Lynne Walters presented “UK/US Physician Exchange Program (PEP) & Experiences of a PEP Officer” at the Operational Aeromedical Problems course in Pensacola, FL, 10-14 January 2011.

Mr. Bob Giffin presented a USAARL / JTAPIC / OSAS briefing for USACR/SC’s GSOC for 32 students at Fort Rucker, AL, 27 Jan 2011.

Mr. Bob Giffin presented an USAARL / JTAPIC /OSAS briefing for USACR/SC’s ASOC for 34 students at Fort Rucker, AL, 31 Jan 2011.

Dr. Angus Rupert & Dr. Ben Lawson presented “Return to Duty Initiative” to USAMRMC Clinical and Rehabilitative Medicine Research Program, at Fort Detrick, MD, February 2011.

Dr. Angus Rupert & Dr. Ben Lawson presented “Role of Tactile Feedback in Rehabilitation of mTBI-Affected Personnel” to representatives of DoD Human Performance Training and Biosystems Directorate, Office of Assistant Secretary of Defense for Research and Engineering, and Office of the Deputy Under Secretary of Defense of Defense, Science and Technology, in Arlington, VA, February 2011.

CPT Nick Spangler presented “Past, Present, and Future of Army Aviation” at the Vietnam Helicopter Pilots Association in Daleville, AL, 2 February 2011.

LTC Jose Capó-Aponte presented “TBI Vision Research Update” at the TBI Vision Rehabilitation Symposium in Bethesda, MD, February 2011.

CPT Michael Dretsch presented “No Significant Differences between Blast and Blow Concussions in Soldiers in a Combat Environment across Multiple Neurocognitive Measures and Symptoms” at the 39th Annual International Neuropsychological Society (INS) meeting in Boston, MA, 2-5 February 2011.

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Mr. Bob Giffin presented an USAARL / JTAPIC / OSAS briefing for JCAT for 16 personnel at Fort Rucker, AL, 14 February 2011.

COL Bernstein presented a poster entitled “Being Overweight While Deployed... A Time for Intervention?” at the Preventive Medicine and Lifestyle Medicine Conference in San Antonio, TX, 16-20 February 2011.

Mr. Bob Giffin briefed CSM Kevin Stuart, USAMRMC, on USAARL / JTAPIC / OSAS Overview Briefing at Fort Rucker, AL, 17 February 2011.

Dr. Ben Lawson & LTC Steven Gaydos presented “TBI Effects on Return-to-Duty for Specific MOSs” at a Program Review briefing to Research Area Directorate (RAD) 3-Military Operational Medicine Research Program (MOMRP) representatives at USAARL, Fort Rucker, AL, March 2011.

LTC Steve Gaydos presented “Comparison of the Effects of Ketamine and Morphine on the Performance of Representative Military Tasks” at the American College of Emergency Physicians Government Services Symposium in San Antonio, TX, 5-9 March 2011.

LTC Kristen Casto presented “Functional Hearing Assessment of Aviators” at the Audiovestibular Center for Excellence Fitness for Duty Workshop in San Diego, CA, 11 March 2011.

Dr. Ben Lawson & Dr. Angus Rupert presented “Treatment of MTBI Balance Dysfunction via Multimodal Feedback: SBIR Initiative” to DoD SBIR Phase II program, through a video conference (VTC) from USAARL to USAMRMC Fort Detrick, MD, 13 March 2011.

Mr. Bob Giffin presented a USAARL / JTAPIC / OSAS briefing for USACR/SC’s GSOC, for 24 students at Fort Rucker, AL, 22 March 2011.

MAJ Frank Petrassi presented the results of the study entitled “Hypoxic Hypoxia at Moderate Altitudes” at the Society of Armed Forces Medical Laboratory Scientists conference in New Orleans, LA, 27 March-1 April 2011.

Dr. Amanda Kelley presented “Individual Differences in Risk Propensity in Soldiers Pre- and Post-Deployment” to the Industrial/Organizational Psychology and Human Factors departments of University of Central Florida in Orlando, FL, 4-6 April 2011.

Dr. Ben Lawson presented “How I Learned to Stop Worrying About Space Exploration and Start Loving the Vestibular Organs” at the 8th Symposium on the Role of Vestibular Organs in Space Exploration in Houston, TX, 9 April 2011.

Dr. Ben Lawson presented a poster “The Case for Intuitive Displays for Extraterrestrial Landings in Dusty Environments: Lessons from Helicopters” at the 18th International Academy of Astronautics Humans in Space Symposium in Houston, TX, 9 April 2011.

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Dr. Ben Lawson presented “Intuitive Displays May Help Prevent Spatial Disorientation in Degraded Visual Environments: Lessons from Helicopters” at the 8th Symposium on the Role of Vestibular Organs in Space Exploration in Houston, TX, 9 April 2011.

CPT Michael Dretsch presented “From Adolescence to Adulthood: Factors that Impact Brain Development” for Department of Criminal Justice students at Troy University in Troy, AL, 21 April 2011.

Lt Col P. Lynne Walters presented “Validation of an Exercise Protocol Targeted for Military Pilots” at the NATO Technical Panel-7 of the Technical Cooperation Program Human Resources and Performance Group in Anchorage, AK, 8 May 2011.

USAARL researchers presented at the AsMA 82nd Annual Scientific Meeting in Anchorage, AK, 8-12 May 2011.

Researchers who presented lectures were:

Athy, J., Estrada, A., Rath, E., Born, S., & Ramiccio, J. “The Effects of Subthreshold Visual Cue on Flight Performance in the NUH-60FS Black Hawk Research Simulator.”

Bernstein, S., & Porter, W. “Being Overweight While Deployed... A Time for Intervention.”

Estrada, A., Groen, E., & Lif, P. “Display Technologies for Orienting Pilots in Brownout.”

Lawson, B., Kelley, A., & Athy, J. “Team Performance Measures for use in Military Research.”

Lattimore, M., Lawson, B., & Rupert A. “Delayed Adoption of Important Aeromedical Innovations.”

Kelley, A., Athy, J., Erickson, B., & King, M. “Risk Propensity and Health Risk Behavior across the Deployment Cycle: Implications for Return-to-Duty and Reintegration.” On behalf of authors, Catherine Webb presented the study.

Rupert, A., & Lawson, B. “Potential Prevention of Operational Helo Mishaps.”

Still, D. L., & Temme, L. A. “Oculometrics Under Mild Normobaric Hypoxia.”

Temme, L. A., & Still, D. L. “Visual Fields in Battlefield Injuries.”

Walters, P. L. “IAMFSP Panel – Rotorcraft Safety Technology.”

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Webb, C., Gaydos, S., & Estrada, A. “Toward an Operational Definition of Workload: A Workload Assessment of Aviation Maneuvers.”

Researchers who presented posters were:

King, M., Athy, J., Kelley, A., & Erickson, B. “The Relationship between Visual Spatial Ability and Marksmanship.”

Powell-Dunford, N., & Kelley, A. “U.S. Army Flight Surgeon and Aeromedical Physician Assistant Training: Aviation Commander and Graduate Perspective.”

Temme, L. A., Capó-Aponte, J., & Still, D. L. “Blunt Force Ocular Trauma from Paintballs: A Method for Model Verification.”

Walters, P. L. “British Army Apache Pilots’ Satisfaction with the Communication Ear Plug.” Presented on behalf of LTC Greg Lang.

Ms. Catherine Webb presented “A Comparison of Efficacy of Modafinil and Dextroamphetamine as Alertness Promoting Agents in Aviators Performing Extended Operations” at the Aviation Fatigue Research Roadmap Symposium in McLean, VA, 5-8 June 2011.

Mr. Bob Giffin presented an USAARL / JTAPIC / OSAS MRAP Accident & Injury Analysis Brief (FY06 – 2nd Qtr, FY11) at the MRAP JPO Joint User’s Coordination Group at Detroit Arsenal, Warren, MI, 23 June 2011.

Mr. Matthew Cox presented “Paratroopers in the Army” to the participants of the Gains in the Education of Mathematics and Science (GEMS) program at Fort Rucker, AL, 12 & 19 July 2011.

Dr. Khalid Barazanji presented “Airworthiness Certification and Aeromedical Research: Current and Future Initiatives” at the International Aeromedical Evaluation and En Route Medical Care conference at McChord AFB, WA, 20-22 July 2011.

Mr. Bob Giffin presented a USAARL/ JTAPIC / OSAS briefing to USACR/SC’s GSOC, for 15 students at Fort Rucker, AL, 26 July 2011.

LTC Jose Capó-Aponte presented “Effectiveness of a Computerized Oculomotor Testing in a Military Population” at the ATACCC meeting in Fort Lauderdale, FL, 16 August 2011.

USAARL researchers presented at the WIAMan IPT at Fort Rucker, AL, 22-24 August 2011.

Chancey, V. C., Scherer, R., & Tegtmeyer, M. “Generic Hull 1 Overview and Results.”

Vasquez, K. “JTAPIC WIAMan RFI Analysis.”

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McEntire, J., Chancey, V. C., & Emerson, J. “MRMC Policies for Postmortem Human Subjects (PMHS) Research.”

Brozoski, F., & Tegtmeier, M. “Instrumentation, Data Acquisition (DAQ), and Equipment Discussion.”

McEntire, J., Scherer, R., & Blackwell, C. “Anthropometry Discussion.”

USAARL researchers presented at the USAARL Initiatives meeting at Fort Rucker, AL, 24-26 August 2011.

Rupert, A., & Ramiccio, J. “Tactile Interface Aviation and Clinical Programs: Update and Demonstration.”

Barazanji, K. “MEDEVAC Refit.”

Harding, T. “Breacher Cadre Study.”

Crowley, J. “Other Key Initiatives.”

Statz, W., & Chancey, V. C. “Underbody Blast.”

Mr. Bob Giffin presented a USAARL / JTAPIC / OSAS briefing to the RDECOM FAST team at NSRDEC, 30 attendees at NSRSDEC, Natick, MA, 25 Aug 2011.

Dr. John Crowley presented “USAARL’s Research Projects Related to Neck and Back Pain” at the 59th International Congress of Aviation and Space Medicine (ICASM) in Bucharest, Romania, 9-15 September 2011.

CPT Michael Dretsch presented “Dietary Supplement Use among Soldiers Deploying to Combat” at the American Dietetic Association, Food & Nutrition Conference & Exposition in San Diego, CA, 24-27 September 2011.

Mr. Bob Giffin presented a USAARL / JTAPIC / OSAS briefing to USACR/SC’s GSOC, for 32 students at Fort Rucker, AL, 28 September 2011.

LTC Jose Capó-Aponte presented “Eyecare in Remote Locations: Iraq” at the Ophthalmology Department Resident Lectures in Danville, PA, 30 September 2011.

Dr. Thomas Harding, Mr. Frederick Brozoski, Dr. David Still, Dr. William McLean, Mr. Robert Williams, & LTC Jose Capo-Aponte presented “The Eye Protection Research Program at USAARL” at the RDECOM Ballistic and Blast Community of Practice Eye Protection Workshop at the Natick Soldier Center, Natick, MA.

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Grant Proposals

- Ahroon, W. A. (Principal Investigator). *Auditory, Vestibular, and Cognitive Effects from Repeated Blast*. Telemedicine and Advanced Technology Research Center (TATRC) Army Medical Department (AMEDD) Advanced Medical Technology Initiative (AAMTI). \$200,000 (USAARL, funded).
- Ahroon, W. A. (Principal Investigator). *Evaluation of Hearing Protector Fit Test Systems*. FY10 USAMRMC Intramural War Supplemental Program. \$1,848,383 (USAARL, funded).
- Brill, C. (Principal Investigator), & Lawson, B. (Co-Investigator). *Neurocognitive Assessment of International Space Station (ISS) Astronauts: Space Adaptation Syndrome (SAS) and Post-adaptation Effects*. National Aeronautics and Space Administration (NASA) Research Announcement (NRA). \$67,000 (Old Dominion University, not funded).
- Brozoski, F. (Principal Investigator), & Duma, S. (Co-Investigator). *Facial Fracture Injury Risk Functions for Assessing the Performance of Improved Face and Eye Protective Equipment*. FY08 USAMRMC Intramural War Supplemental Program. \$448,375 (USAARL, funded).
- Capo-Aponte, J. (Principal Investigator), & Reinach, P. (Co-Investigator). *Determination of Novel Strategies for Hastening Corneal Wound Healing and Reducing Tissue Inflammation*. FY08 USAMRMC Intramural War Supplemental Program. \$360,453 (USAARL, funded).
- Chancey, V. C. (Principal Investigator) *Integrated Experimental and Computational Framework for the Development and Validation of Blast Wave Brain Biomechanics and Helmet Protection*. FY10 Intramural Defense Medical Research and Development Program. \$1,500,000 (USAARL, funded).
- Ciuffreda, K. (Principal Investigator), & Capo-Aponte, J. (Co-Investigator). *Treatment of TBI-induced Oculomotor Dysfunctions and Associated Reading Problem*. FY10 TATRC Extramural Vision Research Program. \$225,000 (State University of New York [SUNY] State College of Optometry and USAARL, funded).
- Cripton, P. (Principal Investigator), & Barazanji, K. (Co-Investigator). *Vibration and Shock Exposure Limits for Transport of the Acute Spinal Cord Injured*. FY10 Extramural Defense Medical Research and Development Program. \$2,348,595 (University of British Columbia, funded).
- Dretsch, M. (Principal Investigator). *Alternative Behavioral and Electrophysiological Treatments of Cognitive Rehabilitation for Chronic Combat-Related Mild Traumatic Brain Injury*. Psychological Health and TBI Research Program. \$1,999,331 (USAARL, Auburn University, University of Alabama at Birmingham, and Mind Fitness Training Institute, not funded).

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- Estrada, A. (Co-Principal Investigator). *Sensorimotor Displays and Controls to Enhance Lunar Landing*. National Space Biomedical Research Institute. \$149,645 (Massachusetts Institute of Technology, funded).
- Gaydos, S. (Principal Investigator) *Assessment of Noise Immune Stethoscope in Noisy Clinical and Military Applications*. FY10 Intramural Defense Medical Research and Development Program. \$687,650 (USAARL, funded).
- Hill, M. (Principal Investigator). *Auditory, Vestibular and Cognitive Effects due to Repeated Blast Exposure on the Warfighter*. FY07 Intramural TBI Investigator Initiated Research Award. \$1,207,026 (USAARL, funded).
- Joyner, K. (Principal Investigator), & Barazanji, K. (Co-Investigator). *Effects of Transport on Traumatic Brain Injured and/or Spinal Cord Injured Miniature Swine (Sus scrofa) used as Patient Models*. \$515,000 (U.S. Marine Corps Systems Command, funded).
- Lawson, B. D. (Principal Investigator), & Rupert, A. H. (Associate Investigator). *Home-Based System to Improve Balance Rehabilitation for mTBI Sufferers and Other Personnel with Balance Problems*. TATRC AMEDD AAMTI. \$1,220,000 (USAARL, funded).
- McEntire, B. J. (Principal Investigator), Bass, C. (Co-Investigator), & Walilko, T. (Co-Investigator). *Helmet Sensor - Transfer Function and Model Development*. FY07 Intramural TBI Investigator Initiated Research Award. \$625,230 (USAARL, funded).
- Parra, L. (Principal Investigator), & Casto, K. (Co-Investigator). *Tinnitus as a Result of Central Gain Adaption: Implication to Diagnosis and Treatment with Auditory Stimulation*. FY10 Peer Reviewed Medical Research Program. \$329,960 (City College of the City University of New York, not funded).
- Rupert, A. H. (Principal Investigator). *Post-concussion Tools to Assist with Assessment, Treatment, and Return to Duty*. FY08 USAMRMC Intramural War Supplemental Program. \$817,970 (USAARL, funded).
- Rupert, A. H. (Principal Investigator), & Lawson, B. D. (Associate Investigator). *Touch/Tactile Feedback for Rehabilitation of Wounded Warriors*. Coalition Warfare Program. \$200,000 (USAARL, funded).
- Rupert, A. H. (Principal Investigator), & Lawson, B. D. (Associate Investigator). *Return-to-Duty*. Coalition Warfare Program. \$950,000 (USAARL, funded).
- Salzar, R. (Principal Investigator), & Chancey, V. C. (Co-Investigator). *Investigation of Injuries to Armored Vehicle Personnel Subject to Blast: Preliminary Study with Emphasis on Lower Extremity Fractures*. FY10 Extramural Defense Medical Research and Development Program. \$2,781,000 (University of Virginia, funded).

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Temme, L. A. (Principal Investigator), Still, D. (Co-Investigator), & Reeves, D. (Co-Investigator). *The Effects Hypoxia on Cognitive Function in Aviators and Complex System Operators that have had an mTBI*. FY07 DoD TBI Investigator Initiated Research Award. \$598,198 (USAARL, funded).

Winkelstein, B. (Principal Investigator), & Chancey, V. C. (Co-Investigator). *Development of a Novel Translational Model of Vibration Injury to the Spine to Study Acute Injury in Vivo*. FY10 Extramural Peer Reviewed Orthopaedic Research Program. \$3,126,303 (University of Pennsylvania, funded).

Wise, D. (Principal Investigator). *Helmet-mounted Sensor Recorded Blast Data in Combat*. FY07 Intramural TBI Advanced Technology/Therapeutic Development Research Award. \$1,357,629 (USAARL, funded).

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Research Seminars

In January 2003, the USAARL began a series of research seminars. The purpose of these seminars is to promote communication and discussion about scientific interests, achievements, research methods and general principles among our laboratory staff members. Seminar presentations are offered by members of the USAARL research staff and, through invitation, by qualified visitors. Announcements of seminar presentations are sent to the entire USAARL staff, several divisions of the U.S. Army Aeromedical Center (Lyster Army Health Clinic), and the USACRC/SC.

The following seminars were offered during FY11:

Date: 5 January 2011

Place: USAARL Lecture Room

Speakers: Dr. Pat Walker (PCB Electronics and Texas Christians University [TCU])

Title: Successful Measurement of Dynamic Force, Pressure, and Acceleration.

Abstract: not provided

Date: 4-18 February 2011

Place: USAARL Lecture Room

Speakers: Dr. Gordon Vos & Mr. Donald Goff (Wyle Laboratory)

Title: not provided

Abstract: not provided

Date: 7 March 2011

Place: USAARL Lecture Room

Speakers: Mr. Yuval Steinman & Ms. Marieke van den Oord (Royal Netherland Air Force, Centre of Men in Aviation)

Title: Current Research Efforts on Human Factors Impacting Aircrew

Abstract: Mr. Steinman & Ms. van den Oord presented their current research efforts that focus on human factor issues impacting aircrew. The discussion topics included neck pain in military helicopter aircrew; optimal helmet use and adjustments with respect to neck load; pilot anthropometry and selection; user evaluation of custom-molded communication earplugs; evaluation of the HGU-56/P and Alpha 200 helicopter helmets; and evaluation of the Portable Helicopter Oxygen Delivery System (PHODS).

Date: 23 June 2011

Place: USAARL Lecture Room

Speaker: Dr. Alessio Medda (USAARL)

Title: Signal Processing Techniques for the Discrimination of Blast, Blunt, and Ballistic Events: Theory and Preliminary Experimental Results.

Abstract: not provided

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Date: 22 August 2011
Place: USAARL Lecture Room
Speaker: COL John Alvarez (Program Manager for JTAPIC)
Title: Jumpstart Efforts, Goals, and Timeline
Abstract: not provided

Date: 24 August 2011
Place: USAARL Lecture Room
Speaker: Dr. John Glenn (Principal Assistant for Research and Technology)
Title: USAMRMC Command Overview
Abstract: Dr. Glenn presented an overview of MRMC's future initiatives.

Date: 25 August 2011
Place: USAARL Lecture Room
Speaker: Ms. Kristina Pottol (Member of Plans, Programs, Analysis, and Evaluation)
Title: PPBE Deskbook and Cost-Benefit Analysis
Abstract: not provided

Date: 26 August 2011
Place: USAARL Lecture Room
Speaker: Ms. Dawn Rosarius (Director of Plans, Programs, Analysis, and Evaluation)
Titles: Decision Gate Process and Integrated Product and Process Development (IPPD), and POM Process
Abstract: not provided

Tours/Distinguished Visitors

Tours of USAARL are provided to distinguished visitors, military students studying at Fort Rucker, and local schools. Tours typically include demonstrations of USAARL's research capabilities, technologies, and current and historical research efforts in support of the U.S. Army Aviator and Soldier.

Dates: 7 October 2010, 20 October 2010, 22 February 2011, and 11 July 2011
Visitors: Students from Fort Rucker's Flight Surgeon course
Purpose: To examine USAARL's capabilities in preserving and enhancing the health, safety, combat effectiveness, and survivability of the U.S. Army Warfighter.

Date: 18 October 2010
Visitors: Dr. Paul Michaels (Principal Assistant Responsible for Contracting [PARC] at USAMRMC and U.S. Army Medical Research Acquisition Activity [USAMRAA] Director) and MAJ Sean McMurry (USAMRAA's Executive Officer)
Purpose: To examine USAARL's capabilities

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Date: 20 October 2010

Visitor: Mr. Andrew Drwiega (writer for *Rotor & Wing* magazine)

Purpose: To write an article about USAARL's aeromedical research areas

Dates: 1 November 2010, 31 January 2011, and 7 July 2011

Visitors: Students from Fort Rucker's Aviation Safety Officer course

Purpose: To examine USAARL's capabilities in preserving and enhancing the health, safety, combat effectiveness, and survivability of the U.S. Army Warfighter.

Date: 8 December 2010

Visitors: Officials from the U.S. Air Force Air Mobility Command and Canadian Forces

Purpose: not provided

Date: 14 December 2010

Visitors: Mr. Barker, principal, & students from the Dale County Christian School

Purpose: To gain knowledge about physics, focusing on acoustic sound waves.

Date: 25 January 2011 and 14 February 2011

Visitors: Students from Fort Rucker's Spanish Aviation Safety course

Purpose: To examine USAARL's capabilities in preserving and enhancing the health, safety, combat effectiveness, and survivability of the U.S. Army Warfighter.

Date: 26 January 2011

Visitors: NATO Panel members

Purpose: To discuss the development of standards for UAS casualty evacuation.

Date: 27 January 2011

Visitors: Dr. Elliot & Dr. Davis (Army Research Laboratory Human Research & Engineering Directorate [ARL-HRED])

Purpose: To exchange scientific and technical information regarding our respective tactile research efforts and their plans for Air Soldier testing.

Date: 1-2 February 2011

Visitor: CSM Kevin Stuart (USAMRMC)

Purpose: Guest speaker for USAARL NCO ceremony

Date: 16 February 2011

Visitors: Mr. Ben Mozo & 3 Navy personnel

Purpose: not provided

Date: 16 February 2011

Visitors: Dr. Gordon Vos & Mr. Donald Goff (Wyle Laboratory)

Purpose: To discuss potential research collaborations with USAARL scientists.

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Date: 24-25 February 2011

Visitors: CAPT Christopher Daniel & Dr. Kenneth Bertram (USAMRMC)

Purpose: not provided

Date: 23-25 February 2011

Visitors: Walter Reed Army Institute of Research (WRAIR)'s logistics, resource management, & information technology personnel

Purpose: To receive General Fund Enterprise Business System (GFEBS) training.

Date: 1-2 March 2011

Visitors: COL Carl Castro & Dr. Dennis Goodes (RAD3, MOMRP)

Purpose: To evaluate funding for future research projects.

Date: 2 March 2011

Visitor: COL Andy Jose (Office of the Surgeon General [OTSG], British Liaison Officer)

Purpose: To discuss the technology behind TSAS.

Date: 3 March 2011

Visitor: Mr. Rama Myers (Seeing Machines)

Purpose: To demonstrate the Facelab 5 system for tracking a subject's eyes, face, and head.

Date: 7-8 March 2011

Visitors: Mr. Yuval Steinman & Ms. Marieke van den Oord (Royal Netherland Air Force, Centre of Men in Aviation)

Purpose: To examine USAARL's capabilities and discuss possible collaboration.

Date: 10 March 2011

Visitors: Students from Fort Rucker's Aviation Maintenance Senior Leaders course

Purpose: To examine USAARL's capabilities in preserving and enhancing the health, safety, combat effectiveness, and survivability of the U.S. Army Warfighter.

Date: 21 April 2011

Visitor: COL John Rouse (British Embassy)

Purpose: not provided

Date: 20 April 2011

Visitors: Mr. Dan Johnson & MG(R) Zannie Smith (GDIT)

Purpose: To meet with General Dynamics Information Technology (GDIT) employees and tour laboratory.

Date: 24 May 2011

Visitors: Students from Fort Rucker's Aviation Warrant Officer Advanced course

Purpose: To examine USAARL's capabilities in preserving and enhancing the health, safety, combat effectiveness, and survivability of the U.S. Army Warfighter.

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Date: 15 July 2011

Visitors: GEMS program participants and staff

Purpose: To learn more about the research conducted at USAARL and to explore DoD professions in the fields of science, engineering, and psychology.

Date: 15 July 2011

Visitor: MG Anthony Crutchfield (USAACE and Fort Rucker Garrison Commander)

Purpose: Guest presenter at the GEMS award ceremony.

Date: 22 July 2011

Visitor: Dr. Vivianne Wersel (USAMRMC GEMS coordinator)

Purpose: Guest presenter at the GEMS award ceremony.

Date: 3-5 May 2011

Visitor: Mr. Jay Winchester (USAMRMC JAG)

Purpose: To meet with USAARL Command staff, researchers, and research support personnel and to learn more about USAARL's research capabilities.

Date: 31 August 2011

Visitors: Students from Air Warrior College at Maxwell AFB

Purpose: To examine USAARL's capabilities in preserving and enhancing the health, safety, combat effectiveness, and survivability of the U.S. Army Warfighter.

Date: 18-24 September 2011

Visitor: CAPT William Murphy (National Institute for Occupational Safety and Health [NIOSH])

Purpose: To test two new artificial test fixtures and hearing protection using USAARL's shock tube.

Date: 21 September 2011

Visitors: Creare, Inc. representatives

Purpose: To discuss the SBIR on functional hearing tests.

Date: 27-29 September 2011

Visitors: Ms. Sarah Donahue & Ms. Andrea Kline (USAMRMC Human Research Protections Office [HRPO])

Purpose: To inspect USAARL's Regulatory Compliance Office (RCO).

Date: 28-30 September 2011

Visitors: COL Norman Leonard (Coalition Warfare) & Mr. John Noulis (Under Secretary of Defense for Acquisition, Technology, and Logistics [OUSD AT&L])

Purpose: To retrieve the electronics and garment for the TSAS.

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Date: 17-29 September 2011

Visitors: Mr. Ed McDaniel (NAVAIR), MAJ Bryan Wiley (APM Air Warrior), Dr. Karen Atkins (Balance Sense), & Ms. Heather McGee (Graduate student)

Purpose: To attend a meeting on mutual research and technology development efforts.

Date: 29 September 2011

Visitors: International guests from Austria and Canada

Purpose: To see a demonstration of the TSAS.

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Research Support

Flight Activities

Since 1959, USAARL's Flight Systems Branch (FSB) has served the aviation community by providing world-class aeromedical research aboard our one-of-a-kind aircraft and unique flight simulator. USAARL's prestigious identity and the ability to conduct this critical aeromedical mission depend on the unique capabilities we possess and our aviation assets.

During FY11, the FSB personnel included one Department of the Army Civilian Supervisory Research Helicopter Instructor Pilot, one Army Reserve (Individual Mobilized Augmentee [IMA]) Army Medical Department (AMEDD-67J O-4) Officer, and two active-duty (AMEDD-67J O-3) officers (Flight Operations Officer and Safety Pilot).

Assigned assets in FY11 were:

JUH-60A: 88-26069 Black Hawk helicopter (Research 069)

NUH-60FS: 85-00009 UH-60 Aeromedical/environmental research flight simulator

Flight hours in the USAARL aircraft/simulator in FY11 were:

Rotary-wing flight: JUH-60A = 305.2 hours
UH-60M = 20.4 hours
HH-60M = 19.3 hours
= 344.9 hours

Flight Simulator: NUH-60FS utilization = 406.5 hours
Peripherals utilization = 920 hours
= 1326.5 hours

Note: Simulator peripheral use included VIP tours; research support set-up process; test runs; software load demonstrations; fit, form, and equipment function checks; test preparation; protocol rehearsal and train-up; static cockpit demonstrations; device capabilities presentations; and simulator reaccreditation.

Regulatory Guidance for Aircraft Utilization

- a. MEDCOM and USAMRMC Research objectives and Congressional priorities.
- b. Army Regulation (AR) 95-1 8-1c *The Surgeon General will coordinate health hazard assessment for research, development, testing, and evaluation of medical materiel and related items; medical design criteria; and other medical aspects of nonmedical ALSE items.*
- c. AR 40-61 "Airworthiness Certification of Patient Movement Items Medical Services Medical Logistics Policies."

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Note: MEDCOM/USAARL fulfills these requirements through testing medical items aboard Research 069.

JUH-60A Research Black Hawk “Research 069”

Research Support

The Memorandum of Agreement (MOA) with USAACE/Aviation Center Logistics Command (ACLC)/G-3 remains strong and has proven to be beneficial to all organizations involved. The USAACE G-3 has flown over 275 VIP and general support flight hours utilizing the aircraft this year.

FSB began demonstration flights with the TSAS installation aboard the JUH-60A Research Black Hawk helicopter. TSAS serves as an effective tool in preventing accidents related to brownout/degraded visual environments (DVE). TSAS enhances situational awareness, reduces pilot workload, prevents spatial disorientation, and is an excellent DVE landing tool. TSAS has an approved Initial Capabilities Document (ICD) and is progressing through the Army acquisition process as a workload management and supplemental DVE landing tool.

A successful RTD in-flight speech intelligibility flight evaluation was conducted by SRD personnel utilizing USAARL’s Research Black Hawk. This resulted in returning one senior U.S. Navy aircrewmen to flight status. This novel approach, used to determine functional hearing ability, saved a flying career and set a new standard for acoustical assessments within the DoD.

Configuration/ Equipment

Sikorsky’s Airborne Information System (AIS) and human physiological telemetry devices serve as data collection and transmission systems that are unique only to this aircraft.

The Garmin 530W was installed as part of a DSOC initiative, which assessed COTs solutions for enhancing pilot situational awareness and preventing controlled flight into terrain (CFIT) accidents. This Global Positioning System (GPS) has a moving map display, Helicopter Terrain Avoidance Warning System (HTAWS), Traffic Collision Warning System (TCAS), WAAS enabled GPS precision approach capability, storm scope, and NEXRAD weather radar.

Also installed, was a 200 gallon Internal Robertson fuel tank and a 12-point VIP II ICS System which allows extended range/endurance research protocols and supports USAACE’s cross-country VIP mission.

Wx1000+ Storm scope, ASN 128D GPS, and Bendix King Color Wx Radar provide an all-weather solution that reduces risk and increases capabilities. These attributes serve both the research and VIP utilization requirements.

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Other installations include:

- Distance Measuring Equipment, which provides for definitive navigation during risky protocols;
- MEDEVAC Carousel, which is necessary for internal and external hoists;
- Aircrew Wireless Intercom System (AWIS), which serves as the MEDEVAC representation needed to properly assess medical items and systems;
- Lima model Improved Durability Gear Box main transmission;
- Blue Force Tracker EDM kneeboard; and
- Fiber Optic Gyro attitude and heading referencing system.

NUH-60FS Black Hawk Research Flight Simulator

Research Support

The NUH-60FS Black Hawk Research Simulator supported the following WHD protocols:

- “The Effects of Subthreshold Visual Cues on Flight Performance in the NUH-60FS Blackhawk Research Simulator”
- “The Effects of Spatial Disorientation on Working Memory and Mathematical Processing”
- “Efficacy of Directional Tactile Cues from a Tactile Garment for Target Orientation in Helicopter Extractions over Moving Targets”

Equipment Utilization

Dozens of tours and demonstrations were conducted for researchers and their colleagues to demonstrate the capability of the NUH60FS world’s only environmentally controlled full-motion simulator. Organizations such as the Program Executive Office for Simulation, Training, and Instrumentation (PEO STRI); Utility PM Office; USAACE headquarters; Concepts and Requirements Directorate (CRD); TRADOC Systems Management Office; Technology Applications Program Office (TAPO); several foreign dignitaries and aviation liaison officers; and academia partners participated in these tours.

Nearly one-half of the total device utilization this year was comprised of training on a no-cost basis to the following installations: USAACE; Department of Simulation (DoS); Director of Evaluation and Standardization; Army Training Modernization Directorate (ATMD)/G-3; E Company 1-212th Flight School XXI; the Foreign Officer Liaison offices; MEDEVAC

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Proponency; and students of the U.S. Army Flight Surgeons' Course and ASOC.

USAARL flight crews used the simulator to maintain aircraft and instrument proficiency. External Annual Proficiency Evaluations (APART) and training were conducted for Fort Rucker agencies in accordance with the USAACE/ACLC/USAARL MOA.

USAARLs' Enhanced Brownout Dust Model Software development in collaboration with PEOSTRI and DoS is regularly used to demonstrate degraded visual environment technologies and TTP development for brownout landing hazard mitigation. This highly realistic dust model produces a variety of dust cloud characteristics which includes the dust characterizes found on the moon's surface.

Maintenance

The NUH-60FS simulator received two hardware and software upgrades in FY11. The device received the new APX-123 Transponder and the Enhanced ASN-123D GPS, which added an expanded IFR capability database.

USAARL's flight simulator sets the fleet-wide standard for accreditation. The device is frequently used by the DoS and PEOSTRI to assess new software and hardware installs and as the standard of performance for the UH-60 flight simulator fleet world-wide.

HH-60M MEDEVAC Helicopter

Research Support

FSB performed ground breaking vibration mitigation testing aboard the HH-60M MEDEVAC Black Hawk using a vibration absorbing blanket system that will help shield litter-fastened patients from the environmental vibration caused by helicopters in flight.

FSB conducted a novel patient litter load test for A-PM MEDEVAC Program Office. This functional test was used to determine the need for a moveable litter lift system versus a fixed position litter system aboard the H-60 MEDEVAC equipped helicopter fleet.

Airworthiness Certification of Patient Movement Items Program

Spanning over 11 years, FSB has supported USAARL's ACE Branch's test and evaluation program. In collaboration with U.S. Army Engineering Directorate, the USAARL ACE Branch has developed and approved standardized Electromagnetic Interference (EMI) determination test procedures. These test procedures are unique to the testing of medical devices for the MEDEVAC H-60 fleet. The testing is comprised of laboratory bench testing, environmental, vibration, EMI/EMC analysis, human factors assessments by flight surgeons and flight medics, and is validated by a comprehensive in-flight evaluation aboard USAARL's JUH-60A by FSB Research Pilots.

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The JPRIMES facility, located at Eglin AFB, FL, was used during FY11 for the inaugural testing of the UH-72 Lakota MEDEVAC helicopter. This testing combined with ground and in-flight testing conducted at Fort Rucker, resulted in 12 new AWR certified medical devices that are approved for use aboard the Lakota MEDEVAC aircraft. JPRIMES was also used this year by USAARL FSB/ACE for medical item testing involving the HH-60M MEDEVAC helicopter. This effort resulted in seven additional medical items for use aboard the H-60 MEDEVAC fleet.

Our charter, AR 40-61 “Medical Logistics for Patient Medical Items,” designates USAARL as the test laboratory for this robust and rapidly expanding program. USAARL is on the verge of becoming ISO certified and thereby will lead both “industry” and DoD in airworthiness certifications of medical items. This is a platform specific service (JUH-60A) affords AWR coverage for the entire medical evacuation fleet and subsequently produces AWR1330R authorizing the use of patient medical items aboard these aircraft. This is a critical mission for our medical evacuation fleet of helicopters, for the MEDEVAC community, and for USAARL.

FY11 ACE- PMI Program highlights included:

- a. USAARL’s JUH-60A was used for user evaluation testing in collaboration with the Army Medical Department (AMEDD) Test Board, Air Force Medical Support Activity (AFMESA), SOCOM, and USMC. These collaborative efforts are critical test & evaluation processes for all organizations mentioned.
- b. JPRIMES EMC testing, Eglin AFB aboard HH-60M Advanced Aeromedical helicopter for medical item certification (July 2011).
- c. JPRIMES EMC testing, Eglin AFB aboard UH-72A Light MEDEVAC helicopter for medical item certification (Oct 2011).

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PMI Tests Flown in Support of the ACE Branch

JUH-60A	HH-60M	UH-72A
Skedco Tie-down Strap	Noise Immune Stethoscope	Noise Immune Stethoscope
Mobile IV System	Shock and Vibration Isolations System	Welch Allyn Model MIL5072 Fiber Optic Laryngoscope
Belmont Buddy Plus Fluid Warmer	Philips Medical Systems HeartStart MRx Defibrillator	Zoll Defibrillator
Impact Instrumentation 731 Ventilator	Impact Instrumentation 731 Ventilator	Zoll Blood Fluid Warmer
Science Powerheart G3 Pro AED	Science Powerheart G3 Pro AED	Impact Model 326M Suction Apparatus
Physio-Control Lifepak 1000 AED	Physio-Control Lifepak 1000 AED	Impact Model 754M Ventilator
OxLife Independent Model KXIN001 Oxygen Concentrator	OxLife Independent Model KXIN001 Oxygen Concentrator	Welch Allyn Propaq Model 206EL Vital Signs Monitor
Masimo Rainbow SET Radical-7 Pulse CO-Oximeter	Fixed Position Litter Loading	Nonin Model 9550 Oximeter Pulse
Masimo Rainbow SET Rad-57 Pulse CO-Oximeter		Carefusion Model 2865B Intravenous Infusion Pump
		SeQual SAROS Model Portable Oxygen Concentrator
		Thermal Angel Model TA-200 Intravenous (IV) Fluid Warmer
		Welch Allyn Model 01692-MC Thermometer Kit
		Thermal Gear Model 8000 ChillBuster Blanket

Safety

FSB pilots have continued USAARL’s phenomenal accident and incident free safety and performance record. To date, USAARL has never had a Class A, B, or C aviation accident since the inception of the branch in 1959. In the past, FSB has been presented with safety awards for 3500 hours, 1000 hours (2), but in FY11, FSB received the USAMRMC Commander’s Safety Award for Excellence for completing zero Class A, B, or C aviation accidents for over 36 months. Another flight safety milestone was reached this year when Research 69 surpassed the ‘6000’ Safe Flight Hour mark, distinguishing the aircraft as the highest single platform safety

milestone reached within USAARL's research fleet of aircraft.

Aircrew Standardization/Aircrew Training Program:

- Research pilots have maintained qualifications in all models of the Black Hawk; JUH-60A, HH-60L, HH-60M, and currency in all modes of flight; day, night, weather, and night-vision-goggle.
- All assigned pilots and aircrew members (flight surgeons and flight medics) successfully passed all oral, written, and hands-on flight evaluations. Additionally, all of the Aircrew Training Program (ATP) received and passed "no-notice" flight and/or written evaluations.
- All research pilots participated in the annual Aircrew Coordination Training (Enhanced) and scored 100% on all written and performance evaluations.
- The FSB team provided aircrew management training and records support for 11 Army flight surgeons, 2 active duty pilots, 1 Army flight medic, 2 Army civilian pilots, dozens of Flight Activity Categories (FAC), 3 staff aviators, dozens of non-crewmember Army civilians, and 4 contractor flight engineers.
- Both active duty officers completed the UH-60 Instructor Pilot's Course and regularly assist training UH-60 flight school students in support of 110th Aviation Training Brigade, 1-212th Aviation Training Regiment.
- All FSB personnel have completed Acquisition (ACQ) 101 training.

External Support

The FSB completed a very productive research support year completing several capstone projects. The effective utilization of our research assets and aviators provided support to all of the internal research divisions and an ever growing number of external organizations.

Support to MEDCOM

The FSB provides aviation standardization consultation to the OTSG on the following issues:

- Certification of the first roof-top hospital helipad efforts is on-going in support of San Antonio Military Medical Center (SAMMC), Fort Sam Houston, TX. The inaugural safety certification flights were conducted (October 2011).
- Developed the SAMMC Aviation standard operating procedure (SOP) and Aviation Procedures Guide establishing the policies and procedures to safely utilize the roof-top helipad.
- Initial roof-top helipad safety training of the SAMMC Emergency Department (ED) personnel and forthcoming this next quarter, certification safety training for all members of the ED, Safety Office, and Security department.
- Staffed and processed the 2011-2013 Assistive Technology Partnership (ATP) Waiver for AMEDD Center and School for aviators assigned to installations lacking aviation resources.

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Support to AMEDD

- Provided Aviation Center Logistics Command assistance in ferrying multiple UH-60 aircraft to and from maintenance facilities in Savannah, GA; Huntsville, AL; West Palm Beach, FL; and Fort Campbell, KY.
- In accordance with the USAACE, ACLC, and USAARL MOA provided pilot protocol, training, and ferry missions support in support of the USAACE mission.
- Attended several U.S. Army Aviation and Missile Command (AMCOM) Airworthiness Certification Coordination teleconferences.
- Member of the AMEDD Evacuation Integrated Concept Team (ICT).
- Supported USAMRMC by attending the AAAA and the Army Science Conference by providing TSAS demonstrations.
- Provided training support and standardization consultation to the MEDEVAC Proponency Office.
- Hosted the inaugural working group meeting of the Hoist Test and Evaluation program in support of Marine Enhancement Program, PM Utility, Army Engineering Directorate, and USAARL.
- Developed the U.S. Army very first Hoist Test and Evaluation charter. This charter establishes the roles and responsibilities of the key stakeholders involved in testing and fielding hoist devices utilized aboard MEDEVAC aircraft. This charter also established agreed upon test criteria and resource responsibilities.
- Authored a research protocol to evaluate a commercial pilot flight helmet cooling device which is utilized in the NASCAR industry. Testing of this device is pending funding.

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Technology Transfer

USAARL maintained an active technology transfer program in FY11 through distribution of its technical reports, publication in the open literature, presentations to military and civilian audiences, execution of Cooperative Research and Development Agreements (CRADAs) and Material Transfer Agreements (MTAs), and protection of intellectual property through invention disclosures and patenting.

USAARL is a member of the Federal Laboratory Consortium as well as an active community member and participant in technology transfer activities within the state of Alabama. Examples of USAARL's contributions to the locality include the loan of excess research equipment to regional universities under MTAs and donation of excess computers and/or research equipment under Education Partnership Agreements (EPAs) to the Dale County Board of Education, Rucker Boulevard Elementary School, and Enterprise State Community College

USAARL utilized the Oak Ridge Institute for Science and Education (ORISE) Internship Program, an EPA program, to place seven interns in research projects.

No patents were filed or issued in FY11. No new invention disclosures were filed.

Researchers addressed local civic organizations and conducted numerous USAARL tours. These tours began with a Laboratory overview followed by in-depth discussions of the research programs.

In FY11, one of USAARL's strategic goals was to influence Army combat and materiel developers. The objective was to promote USAARL's capability to positively impact and improve the products made by these developers. In order to achieve this, USAARL employed the strategy of teaming, through CRADAs, with materiel developers. USAARL partnered with industry to evaluate and enhance medical equipment for use on MEDEVAC platforms, to collaborate on visual performance issues, and to investigate the effect of helmet configuration on the injury incidence rate. The exchange of technical information and testing of materiel furthered the development of improved life support and personnel protective devices, systems and components for military medical purposes. Thirty-six CRADAs were fully executed between ACE and collaborators. The collaborators funded ACE for a total of \$111,455.00.

USAARL CRADA/MTA partners in FY11 were:

Applied Research Associates, Inc./Duke University/T.R.U.E. Research Foundation to develop a transfer function and numerical model which translates the helmet-mounted sensor response data to head-centered biomechanical responses in support of the DoD Congressionally Directed Medical Research Program's (CDMRP's) Psychological Health/Traumatic Brain Injury (PH/TBI) Research Program Award for the proposal PT075837, entitled "Helmet Sensor-Transfer Function and Model Development."

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

B. Braun Medical, Inc. for collaborative research, development, test, and evaluation of medical devices for use on U.S. military medical and casualty evacuation helicopters.

BAE Systems for collaboration on basic and applied research into optical, visual, acoustical, auditory, and biodynamic issues with head-borne systems.

Communications & Ear Protection, Inc. to provide a mechanism for scientists of the Laboratory and Communications & Ear Protection, Inc. to collaboratively evaluate hearing protective devices.

CareFusion (formerly Viasys Healthcare/Pulmonetic Systems) for collaborative research, development, test, and evaluation on medical devices for use on medical and casualty evacuation aircraft.

ClinVest/ T.R.U.E. Research Foundation (CRADA and 2 MTAs) to test the hypothesis that mild to moderate hypoxic hypoxia reversibly uncovers neurological deficits in individuals who have experienced mild traumatic brain injury and who appear asymptomatic when breathing air with normal sea level concentrations of oxygen in support of the DoD PH/TBI Research Program of the Office of the CDMRP, TBI Investigator-Initiated Research Award proposal PT075175 entitled “The Effects of Hypoxia on Cognitive Function in Aviators and Complex System Operators that have had a Mild Traumatic Brain Injury.”

Florida Institute for Human and Machine Cognition for exchange of data and technical expertise in a study of the use of human-centered novel display technologies in aviation.

Gentex Corporation for collaboration on research and development of testing techniques of aircraft safety equipment.

***Georgia Institute of Technology* to provide a mechanism for USAARL scientists to loan equipment and software which will facilitate their research into bone conduction communications and to mentor students involved in this research.

GlaxoSmithKline in support of a clinical research study entitled “Effects of Omega-3 EPA/DHA for Soldiers at Risk for Mood Disorders: A Combat Resilience Trial.”

***Innova Systems, Inc.* to provide to the Laboratory a ProVideo CCT Plus-Cone Contrast+ Vision Testing System for use in a color vision study.

Masimo Corporation for collaborative research, development, test, and evaluation on medical devices for use on medical and casualty evacuation aircraft.

Medical Education Technologies, Inc. for collaborative research, development, test, and evaluation on medical devices for use on medical and casualty evacuation aircraft.

Natus Medical, Inc. for loan of the Navigator Pro AEP software Version 7.0 to the USAARL for data collection.

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NavigSys Innovations, Inc for evaluation of the efficacy of the TSAS belt over moving targets.

Phillips Medical Systems, North America for collaborative research, development, test, and evaluation on medical devices for use on medical and casualty evacuation aircraft.

Physio-Control, Inc. for collaborative research, development, test, and evaluation on medical devices for use on medical and casualty evacuation aircraft.

Remote Diagnostic Technologies, LTD for collaborative research, development, test, and evaluation on medical devices for use on medical and casualty evacuation aircraft.

***Royal Australian Air Force Base Edinburgh (Aerospace Operational Support Group)* for the loan of the Tactile Situation Awareness System (TSAS) for the assessment of the TSAS for efficacy in the operation of aviation platforms in degraded visual environments.

Skedco, Inc. for evaluation of the Skedco Universal Litter Tie Down Strap and Patient Litter Strap for use on medical and casualty evacuation aircraft.

***Sound Innovations (CRADA and MTA)* for in-flight comparative testing of the ANR Communication Earplug (ACE™) with other talk-through, sound localization, and impulse suppression devices.

SUNY State College of Optometry for research to provide novel strategies for the treatment of traumatic brain injuries associated with visual dysfunction and methods to test visual dysfunction in the presence of cognitive impairment in both military and civilian populations.

SUNY State College of Optometry/T.R.U.E. Research Foundation in support of the USAMRMC Intramural War Supplemental Program (IWSP) Award for the proposal CWS_08_R2_290, “Determination of novel Strategies for Hastening Corneal Wound Healing and Reducing Tissue Inflammation.”

SUNY State College of Optometry/The Geneva Foundation in support of the USAMRMC IWSP Award for the proposal CWS_08_R2_290, “Determination of novel Strategies for Hastening Corneal Wound Healing and Reducing Tissue Inflammation.”

The Geneva Foundation in support of the CDMRP’s PH/TBI Research Program Award for the proposal PT075813, “Auditory, Vestibular, and Cognitive Effects Due to Repeated Blast Exposure on the Warfighter.”

The Geneva Foundation in support of the USAMRMC IWSP Award for the proposal CWS_08_R3_110, “Auditory, Vestibular, and Cognitive Effects from Repeated Blast.”

Thornhill Research, Inc. for cooperative research, development, test, and evaluation of medical devices for use on medical and casualty evacuation helicopters.

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T.R.U.E. Research Foundation in support of the CDMRP's PH/TBI Research Program Award for the proposal PT075813, "Auditory, Vestibular, and Cognitive Effects Due to Repeated Blast Exposure on the Warfighter."

T.R.U.E. Research Foundation in support of the USAMRMC IWSP Award for the proposal CWS_08_R3_110, "Auditory, Vestibular, and Cognitive Effects from Repeated Blast."

Twin Star Medical, Inc. for collaborative research, development, test, and evaluation on medical devices for use on medical and casualty evacuation aircraft.

United Kingdom Defence Medical Rehabilitation Center (DMRC) to loan a Vibrotactile Balance Rehabilitation Device to the DMRC which they will assess for efficacy in assisting injured service personnel to re-learn balance as part of their rehabilitation process.

Verathon Medical, Inc. for collaborative research, development, test, and evaluation on medical devices for use on medical and casualty evacuation aircraft.

Virginia Tech/T.R.U.E. Research Foundation in support of the USAMRMC IWSP Award for the proposal CWS_08_R3_130, entitled "Facial Fracture Injury Risk Functions for Assessing the Performance of Improved Face and Eye Protective Equipment."

Virginia Tech/The Geneva Foundation in support of the USAMRMC IWSP Award for the proposal CWS_08_R3_130, entitled "Facial Fracture Injury Risk Functions for Assessing the Performance of Improved Face and Eye Protective Equipment."

Wayne State University for loan by the USAARL to the College of Engineering a FOCUS head form.

Zoll Medical Corporation for collaborative research, development, test, and evaluation on medical devices for use on medical and casualty evacuation aircraft.

**CRADA/MTA includes loan of excess research equipment to these institutions.

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Science Information Center

The Science Information Center (SIC) library provided the information necessary to support the research performed at USAARL and disseminated scientific information to requestors worldwide. It also supported the staffs of Lyster Clinic, the U.S. Army Aeromedical Activity, and the U.S. Army School of Aviation Medicine including the Flight Surgeon Courses held at Fort Rucker throughout the year. The library holdings are believed to comprise the most comprehensive aviation medicine collection in this part of the country. Additionally, the SIC is a member of a national library consortium that, through interlibrary loans, exponentially expands each member's resources at minimal cost to each member.

The Office of the Writer-Editor contributed to the quantity and quality of publications to include USAARL technical reports, open literature publications, and public relations brochures and pamphlets created to describe and promote the research conducted by the USAARL scientists and engineers; served as grants administrator and contributed toward group efforts to secure several federal research grants; and consolidated and expanded a public relations program aimed at marketing USAARL's unique talents and assets.

The Office of the Research and Technology Applications (ORTA) administered USAARL's technology transfer program.

In FY11, the SIC developed and administered the Laboratory's inaugural GEMS program. The GEMS program encourages students of all ages to study STEM. Fifty-one 5th and 6th graders from the Fort Rucker area participated in the program held during FY11. The participants were led by six college-aged near-peer mentors and two resource teachers. After four days of completing a variety of age-appropriate science and mathematics experiments, the participants presented their work for family members and special guests at a showcase of experiments. The program concluded with an award ceremony recognizing the participants who completed the program. The USAARL GEMS program received numerous favorable accolades from leadership at USAMRMC and Fort Rucker and from the GEMS participants and their parents.

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Resources Management

Program funding for FY11/FY12 (dollars in thousands):

		FY11	FY12*
6.1	Basic Research	166	165
6.2	Applied Research	7,147	6,212
6.3	Advanced Technology Development	2,215	3,988
6.4	Demonstration and Validation	400	400
6.5	Engineering and Manufacture Development	912	554
	Other	5,648	2,214
<hr/>			
	TOTAL	\$16,488	\$13,533

*Estimated funding for FY12

Computer Information

Network Infrastructure Improvements

A new security system entailing all interior and exterior doors was installed on its own internal network with one server controlling the system.

The Information Management/Information Technology Branch continued replacing file servers for backing up the ever-increasing load of data.

Security Improvements and Upgrades

Credant encryption software was installed on all USAARL laptop and desktop personal computers whether they are connected to the AMEDD domain or not.

Wireless Communications

Twenty-two Blackberry™ devices were used by staff members; the devices provided phone, email, and internet access from one handheld device.

Sixteen Verizon Air Cards were used by staff members; the devices provided internet access from virtually any CONUS location.

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

Personnel

In addition to the work force described below, USAARL had a monthly average of 22 over-hires, 11 terms, and 35 non-Table of Distribution and Allowance (TDA) personnel during FY11. Non-TDA personnel include Student Temporary Employment Program (STEP) personnel, on-site research and research support contractor personnel, exchange officers, and casual officers.

Required strength was 27 officers, 1 warrant officer, 33 enlisted, and 72 civilians for a total of 139 requirements. Authorized were 16 officers, 1 warrant officer, 27 enlisted, and 46 civilians for a total authorized strength of 96. The average assigned strength was 11 officers, 1 warrant officer, 21 enlisted, and 74 civilians for an average assigned strength of 107.

USAARL employs a highly skilled and trained work force with 73% of assigned employees possessing higher education degrees. The types of degrees held by Laboratory employees as of 30 September 2011 were: 8 M.D., 18 Ph.D., 1 Au.D., 18 Masters, 37 Bachelors, and 10 Associate degrees.

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

Equal Employment Opportunity Program

The USAARL Equal Employment Opportunity (EEO) coordinator completed quarterly EEO reports for the USAARL Commander for submission to the Commander, U.S. Army Garrison, Fort Rucker (USAGFR), Fort Rucker, AL, through the USAGFR EEO office. These reports identified the USAARL's EEO objectives, actions to be taken to meet objectives, and accomplishments in meeting the objectives through hiring actions, promotions, details or temporary promotions, awards, training, and supervisors' support of the EEO program.

All Department of Army (DA) civilian employees and supervisors of DA civilian employees who required training in FY11, completed the Department of Army's POSH and No Fear Act training courses or New Employee Orientation (NEO) training. Supervisors of Department of Army civilian employees, who required training in FY11, completed the PDP Training for Managers/Supervisors (MRMC-approved substitute for the Basic Supervisory Development Course). Reports were submitted to the USAGFR EEO office.

The USAARL EEO coordinator served on the 2011 USAGFR, Dr. Martin Luther King, Jr. Commemorative Program planning committee. The USAARL EEO coordinator and several Soldiers provided support to an Armed Services Blood Program (ASBP) blood drive, sponsored by Lyster Army Health Clinic and the 1-13th AVN RGT.

A USAARL civilian employee is a Department of Army certified EEO counselor and serves the USAGFR EEO office.

African-American or black Civilian Employees: As of 30 September 2011, USAARL employed 8 African-American or black civilian employees (5 females and 3 males), for a representation of 12% of civilian employees. One African-American or black employee received an "A" performance evaluation with a pay for performance award and 7 received a "B" performance evaluation with a pay for performance award.

Hispanic Civilian Employees: USAARL employed 2 Hispanic employees (0 females and 2 males), a representation of 3% of civilian employees, during FY11. Two (2) Hispanic employees received a "B" performance evaluation with a pay for performance award.

Female Civilian Employees: During FY11, USAARL employed 26 female employees, a representation of 39% of civilian employees. Thirteen (13) female employees received an "A" performance evaluation with a pay for performance award and 13 female employees received a "B" performance evaluation with a pay for performance award.

Handicapped Civilian Employees: USAARL employed 0 handicapped employees in FY11.

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

Personnel Achievements

Civilian Awards: The following are civilian awards presented during FY11 at USAARL:

26 Pay for Performance As
40 Pay for Performance Bs
0 Invention Award
6 Time-Off Awards (TOA)
1 On-The-Spot Cash Awards
2 Special Act/Service Awards
11 Certificates of Appreciation
6 Certificates of Achievement
2 Achievement Medals for Civilian Service
8 Commander's Awards for Civilian Service
3 Superior Civilian Service Awards
1 Meritorious Civilian Service Award
9 Length of Service Awards

115 Total Civilian Awards

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

Key Committee/Organization Participation

Acoustical Society of America	Fellow	Dr. W. A. Ahroon
Aerospace Medical Association Scientific Program Committee	Fellow Member Member	Dr. J. S. Crowley Dr. J. S. Crowley Dr. L. A. Temme
American Academy of Audiology	Fellow	LTC K. L. Casto
American Academy of Family Physician	Fellow	COL D. K. Renta
American Academy of Optometry	Fellow Member	LTC J. E. CapoAponte Dr. M. R. Lattimore
American Board of Preventive Medicine (ABPM) Aerospace Medicine Examination Subcommittee of the ABPM	Vice Chair, Aerospace Medicine Chairman	Dr. J. S. Crowley Dr. J. S. Crowley
American College of Emergency Physicians	Member	LTC S. J. Gaydos
American National Standards Institute Accredited Standards Committee S3 Bioacoustics	Representative	Dr. W. A. Ahroon
Accredited Standards Committee S3/CS 1 Animal Bioacoustics	Representative	Dr. W. A. Ahroon
Accredited Standards Committee S12 Noise	Representative	Dr. W. A. Ahroon
Z90.1 Helmet Committee	Member	Mr. B. J. McEntire
S12 Hearing Protection Attenuation and Performance, Working Group 11	Member	Dr. W. A. Ahroon
S12 Measurement of the Noise Attenuation of Active and/or Passive Level Dependent Hearing Protection Devices, Working Group 39	Member	Dr. W. A. Ahroon
S12.7 Methods for Measurement of Impulse Noise, Working Group 32	Chair	Dr. W. A. Ahroon

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

American Optometric Association	Member	LTC J. E. CapoAponte
American Society for Testing and Materials F30-01, EMS Equipment	Member Member (Non-Voting)	Dr. K. W. Barazanji Mr. R. Eshelman
Army Aviation Medicine Association	Member Member	COL J. F. McKeon Dr. J. S. Crowley
Association for Aviation Psychology	Member	Ms. C. M. Webb
Association for Psychological Science	Member Member	Dr. A. M. Kelley CPT M. N. Dretsch
Association for Research in Vision and Ophthalmology (ARVO)	Member Member	LTC J. E. CapoAponte Dr. M. R. Lattimore
Auburn University Warrior Research Center Research Advisory Board, Academic Affairs Committee	Assoc Res Prof Vice Chair	CPT M. N. Dretsch Dr. L. P. St. Onge
Brain Injury Association	Member	CPT M. N. Dretsch
Brain Injury Association of Wisconsin	Member	CPT M. N. Dretsch
Cognitive Neuroscience Society	Member	CPT M. N. Dretsch
Cognitive Science Society	Member	Dr. A. M. Kelley
Department of the Army Advanced Night Vision Goggle (ANVG) Program	Member	Dr. W. E. McLean
Air Warrior System Safety Working Group	Assoc. Member Assoc. Member	Mr. B. J. McEntire Dr. J. S. Crowley
Joint Aircrew Executive Steering Council	Member	Mr. B. J. McEntire
Military Eye Protection System (MEPS)	Member	Dr. W. E. McLean
Explosion Ordnance Disposal Working Group	Member (Non-Voting)	Dr. W. E. McLean

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

Department of Defense

Armed Forces Optometric Society	Member	LTC J. E. CapoAponte
	Member	Dr. W. E. McLean
Auditory Research Working Group	Member	Dr. W. A. Ahroon
	Member	Dr. E. R. Reeves
	Member	Ms. E. Gordon
	Member	Mr. R. Williams
	Member	LTC K. L. Casto
Defense Medical Standardization Board, Test, Evaluation, and Standards Working Group	Member	Dr. K. W. Barazanji
	Member	Mr. R. Eshelman
	Member	Mr. B. Bowers
Global Patient Movement Joint Advisory Board (PMJAB)	Member	Dr. K. W. Barazanji
	Member	Mr. B. Bowers
Hearing Center of Excellence Fitness-for-Duty Working Group	Member	LTC K. L. Casto
Hearing Conservation Working Group	Member	Dr. W. A. Ahroon
Joint Cockpit Airbag System Working Group	Member	Mr. B. J. McEntire
Joint Service Aviation Mask (JSAM)	Member (Non-Voting)	Dr. W. E. McLean
Joint Service General Purpose Mask Working Group	Member (Non-Voting)	Dr. W. E. McLean
MRMC Institutional Review Board	Member	CPT M. N. Dretsch
Navy Marine Corps Hearing Advisory Group	Member	Dr. W. A. Ahroon
Oxygen Standardization Coordinating Group (OSCG)	Member	Dr. K. W. Barazanji
	Member	Mr. B. Bowers
Research Steering Committee (TA Q1), MOMRP	Member	CPT M. N. Dretsch
Triservice Aviator Helmet Standardization Working Group	Member	Mr. B. J. McEntire
Triservice Biodynamics Working Group	Chairman	Mr. B. J. McEntire

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

Federal Laboratory Consortium	Member	Ms. D. L. Hemphill
Human Factors Society Perception and Performance Technical Group	Member	Dr. L. A. Temme
Human Factors and Ergonomics Society	Member Member	LTC K. L. Casto Dr. B. D. Lawson
Kansas State University, Human Metabolism Department	Adjunct Professor	CPT M. Dretsch
Military Audiology Association	Member	LTC K. L. Casto
National Academy of Practice in Optometry	Distinguished Scholar	LTC J. E. CapoAponte
National Board of Examiners in Optometry	Examiner	LTC J. E. CapoAponte
National Hearing Conservation Association	Director of Education	LTC K. L. Casto
National Security Science and Engineering Faculty Fellowship Program	Technical Review Panel Member	Dr. M. R. Lattimore
National Neurotrauma Society	Member	CPT M. N. Dretsch
Office of the Secretary of Defense, Phase 2, Small Business Innovation Research Proposals SD09-H22, Treatment of mTBI Balance Dysfunction via Multimodal Biofeedback	Contracting Officer Representative	Dr. B. D. Lawson
Society for Judgment and Decision Making	Member	Dr. A. M. Kelley
Society for Neuroscience	Member	CPT M. N. Dretsch
Society for Psychophysiological Research	Member	CPT M. N. Dretsch
Society of U.S. Army Flight Surgeons	Member Member Member	COL J. F. McKeon Dr. J. S. Crowley LTC S. J. Gaydos

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

State University of New York (SUNY), State College of Optometry	Adjunct Professor	LTC J. E. CapoAponte
Troy University	Adjunct Professor	Dr. A. M. Kelley
United States Air Force Aerospace Medicine Residency Advisory Committee	Member	COL J. F. McKeon
University of Texas Medical Branch, Galveston	Adjunct Faculty	COL J. F. McKeon
U.S. Army Medical Research and Materiel Command		
System Biology Integrated Product Team	Member	CPT M. Dretsch
Human Subjects Research Protection	Member Member	Dr. J. S. Crowley Dr. B. D. Lawson
U.S. Army Aviation Warfighting Center		
Fort Rucker Emergency Management Working Group	Member	Mr. J. Miller
Fort Rucker Environmental Management Committee	Member Member	Mr. J. Miller Mr. A. Roddy
Fort Rucker Ergonomics Committee	Member	Mr. J. Miller
Fort Rucker Safety and Occupational Health Committee	Member	Mr. J. Miller
Night Vision Goggle Working Group	Member	Dr. W. E. McLean
U.S. Army Aeromedical Consultant Advisory Panel, USAAMC	Member Member	COL J. F. McKeon Dr. J. S. Crowley
U.S. Army Garrison, Fort Rucker		
Equal Employment Opportunity (EEO)	Counselor	Ms. E. Gordon
U.S. Army Optometry Residency Selection Board	Member	LTC J. E. CapoAponte
U.S. Army/Navy Aerospace Medicine Residency Program		
Residency Advisory Committee	Member Member	COL J. F. McKeon Dr. J. S. Crowley

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

University of Pittsburgh

Data Safety and Monitoring Board	Member	CPT M. N. Dretsch
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Women in Cognitive Science	Member	Dr. A. M. Kelley
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International Committees

Air and Space Interoperability Council	Army Rep.	Dr. J. S. Crowley
Agile Combat Support Working Group	Army Rep.	Dr. K. W. Barazanji

International Academy of Aviation and Space Medicine	Academician	Dr. J. S. Crowley
Science Review Committee	Member	Dr. J. S. Crowley

International Brain Injury Association	Member	CPT M. N. Dretsch
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International Symposium on Visual Safety Scientific Committee	Member	Dr. B. D. Lawson
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International Virtual Reality Conference	Program Committee Member	Dr. B. D. Lawson
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North Atlantic Treaty Organization Research and Technology Organization

AVT-097, Equipment for Personal Protection Technical Team	Member	Dr. J. S. Crowley
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HFM-084, Unmanned Aerial Vehicle (UAV) MEDEVAC Operations	Member	Mr. J. G. Ramiccio
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HFM-157, Medical Challenges in the Evacuation Chain	Member	Dr. K. W. Barazanji
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HFM-164, Psychological Aspects of Health Behaviors on Deployed Military Operations	Member	Dr. A. M. Kelley
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HFM-171, Psychological and Physical Selection of Military Special Units	Member	Dr. J. S. Crowley
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HFM-180, Strategies to Address Recruiting and Retention Issues in the Military	Member	Dr. M. R. Lattimore
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U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

HFM-181, Human Performance Enhancement for NATO Military Operations	Member	Dr. J. S. Crowley
HFM-184, Safe-Ride Standards for UAS-Casualty Evacuation	Member	Dr. K. W. Barazanji
	Member	Mr. J. G. Ramiccio
HFM-190, Oxygen Solutions for Unpressurized Aircraft Operating below 18,000 feet (Hypoxia prevention).	Member	Mr. J. G. Ramiccio
HFM-ET-086, Database of Biomechanical Analyses	Member	Mr. F. T. Brozoski
HFM-ET-082, Requirements for Oxygen Systems for Rotary Wing Aircraft	Member	Mr. J. G. Ramiccio
The Technical Cooperation Program		
HUM Subgroup, Technical Panel 7, Human Factors in Aircraft Environments	Army Rep. U.S. National Leader	Dr. J. S. Crowley

U.S. Army Aeromedical Research Laboratory — Fiscal Year 2011

Miscellaneous Committees

Journal Review Board

Aviation, Space, and Environmental Medicine	Reviewer	Dr. J. S. Crowley
	Reviewer	LTC S. J. Gaydos
	Reviewer	Dr. M. R. Lattimore
	Reviewer	Dr. B. D. Lawson
	Reviewer	Dr. W. E. McLean
	Reviewer	Dr. L. A. Temme
	Editorial Board Member	Dr. J. S. Crowley
Brain Injury	Reviewer	CPT M. N. Dretsch
British Medical Journal Online	Reviewer	Dr. B. D. Lawson
Human Factors Journal	Reviewer	LTC K. L. Casto
International Journal of Human-Computer Interaction	Editorial Review Board Member	Dr. B. D. Lawson
Journal of Audiology and Neurotology	Reviewer	Dr. B. D. Lawson
Journal of Experimental Brain Research	Reviewer	Dr. B. D. Lawson
Journal of Vestibular Research	Reviewer	Dr. B. D. Lawson
Medical Research and Materiel Command	Grant reviewer	Dr. W. A. Ahroon
Military Medicine	Reviewer	Dr. J. S. Crowley
	Reviewer	Dr. M. R. Lattimore
Noise Control Engineering Journal	Reviewer	Dr. W. A. Ahroon
Optometry & Vision Science	Reviewer	Dr. M. L. Lattimore
Personality and Individual Differences	Reviewer	CPT M. N. Dretsch
Traumatology	Reviewer	CPT M. N. Dretsch



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U.S. Army Medical Research and Materiel Command