



USAMRMC STRATEGIC COMMUNICATION PLAN

U.S. ARMY AEROMEDICAL RESEARCH LABORATORY (USAARL)

MISSION

The U.S. Army Aeromedical Research Laboratory's mission is to develop, test and evaluate performance solutions within the military operational environment to preserve the health, safety and performance of air and ground warriors.

BACKGROUND

The USAARL, located at Fort Rucker, Alabama, is a nationally recognized laboratory for research into safety, survival, impact tolerance, sustainability and performance effectiveness for aviators and Soldiers. The USAARL conducts research in five main areas: aircrew health and performance; blunt, blast and accelerative injury and protection; crew survival in military helicopters and combat vehicles; enroute care environment and sensory performance, injury and protection.

Laboratory personnel seek to improve force effectiveness by preventing or minimizing health hazards created by military systems, doctrine and tactics. Specifically, they identify, investigate and solve medical- and health-related problems that deter Soldiers/ aviators from performing their missions, or compromise their safety. Additionally, the USAARL provides military developers with information and expertise to enhance the performance and safety of future Army systems.

The USAARL conducts helmet impact testing, retention testing and measurement of mass distribution properties of protective helmets—critical topics that affect Soldier protection against

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occupational and combat injury. For many years, the USAARL has evaluated the ophthalmic characteristics of eye protection and provided recommendations to industry and project managers to ensure that the eye protection worn by Soldiers meets military requirements and successfully protects from eye injury threats.

The laboratory assesses protective equipment involved in the DOD, U.S. Coast Guard and other federal government rotary-wing accidents to determine if the equipment functioned as designed and intended. The USAARL also maintains an extensive database of equipment performance as assessed by equipment retrieved from these accidents (1976 until present). Data is used to justify or recommend advancements in protection requirements for future aviation systems. This proven methodology is also employed in ground accident investigations to improve protection of military vehicle occupants as well as dismounted Soldiers.

The recent surge in under-body vehicle blast injuries has spurred a major USAARL-led research effort to develop a new injury assessment method that will be able to assess the effectiveness of vehicle blast countermeasures.

Exposure to intense noise and blasts in the military environment can cause damage to the peripheral auditory system and lead to tinnitus, dizziness and central auditory processing disorders. Soldiers' combat effectiveness and day-to-day functioning may be impaired because of these injuries. The USAARL research focuses on preventing the auditory effects of intense continuous and impulse noise and on addressing the concerns related to immediate return-to-duty.

The USAARL is the leader in testing and evaluating the efficacy of medical systems used in the U.S. military medical evacuation and ground transport environments, ensuring the safe interaction among the vehicle, medical systems, care providers and patients. Medical systems that meet military and industry fixed- and rotary-wing aircraft standards are eligible for an airworthiness release and may be safely operated onboard all U.S. Army aircrafts.

Since 1959, the USAARL has served the aviation community by providing excellent aeromedical research aboard our JUH-60A Black Hawk helicopter and inside our NUH-60FS Black Hawk flight simulator. Both devices are capable of collecting pilot flight performance and pilot physiological/psychological data.

KEY THEMES AND MESSAGES

The USAARL research programs aim to prevent or mitigate injury and health hazards in the military operations environment and sustain aviator/Warfighter performance. The USAARL applies its medical, psychological and physiological knowledge and skills to optimize systems for the end user — the U.S. Army Soldier.

The USAARL's medical research includes developing return-to-duty standards for Soldiers suffering from neurosensory injuries, mild traumatic brain injuries, determining the effectiveness of life support equipment, and preventing and mitigating ground crew and aircrew biomechanical injuries.

The USAARL tests and evaluates the efficacy of medical systems used in the U.S. military medical evacuation and ground transport environments.



The USAARL's Science Information Center Library specializes in the field of aviation medicine. The library houses a large selection of aviation medicine, scientific and engineering publications. These include books, periodicals, technical reports and electronic materials.

The USAARL plays an active role in science, technology, engineering and mathematics education outreach. Each summer, the USAARL leads the Gains in the Education of Mathematics and Science program at Fort Rucker. The GEMS program is a U.S. Army Educational Outreach Program that emphasizes educating students in the areas of STEM and is structured to increase students' interest in these areas by engaging them in experiments. College-aged mentors teach GEMS participants fun, hands-on experiments. In addition, the USAARL researchers open their laboratories to tour groups from area schools.

QUESTIONS & ANSWERS

Q *How does the USAARL impact Soldiers' return-to-duty?*

A The USAARL's return-to-duty research program focuses on assessing the impact of injuries to neurosensory systems: vision, hearing, balance and the central nervous system. The goal of this research program is to establish valid, evidence-based, operationally specific return-to-duty criteria to determine the level of operational competence and performance of a Soldier after cognitive and neurosensory injury, including those resulting from blast, blunt and ballistic threats. Because of this research, the USAARL acquired a Technical Transition Agreement with both the Defense and Veterans Brain Injury Center and the Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury to provide a Return-to-Duty Toolkit following neurosensory injuries. Our research in the return-to-duty program will result in better-informed decisions concerning the retention and possible reclassification of Wounded Warriors, and a more capable fighting force.

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Q *Who funds USAARL research?*

A The USAARL receives core funding from the U.S. Army Medical Research and Materiel Command Military Operational Medicine Research Program. Researchers also compete for and, if selected, are awarded funding through the Defense Health Program. Other sources of funding include research partnerships with academic institutions and agreements with industry.

Q *Who are USAARL's research collaborators?*

A The USAARL collaborates with universities and industry, VA and military hospitals and other military laboratories.

Q *What educational employment opportunities are available at the USAARL?*

A The USAARL offers internships through the Oak Ridge Institute for Science and Education program and Gains in the Education of Mathematics and Science summer program.

- The **ORISE program** offers college students and recent graduates with experience in their field of study.
- The **GEMS program** allows college students to teach to school-age students hands-on science, technology, engineering and math experiments.

Q *What are some of the USAARL's unique research capabilities?*

A USAARL maintains the following research capabilities:

- **Acoustics Research Facility** includes anechoic and reverberation chambers, an audiometric research facility with a real-ear attenuation measurement room (in compliance with the ANSI standards), and a mobile field laboratory.
- **Aeromedical Equipment Test & Evaluation Facility** consists of an electromagnetic interference chamber, an altitude chamber, four environmental chambers (heat, cold, dry, wet) and a vibration table.
- **Aviation Life Support Equipment Retrieval Program and Joint Trauma Analysis and Prevention of Injury in Combat Program** aims to improve the protection of military aircrew via aviation and vehicle mishap investigations and system analysis.
- **Biodynamics Research Facility** houses a vertical acceleration tower, a shock tube and two projectile launchers, as well as dedicated workspaces supporting biodynamic instrumentation, biological specimens and test dummies for research focused in occupant survivability injury mitigation and protection criteria.
- **Biodynamics Resource** is a data repository consisting of impact acceleration exposures, which resulted in volumes of kinematic and physiological data that serve as a foundation for historic and future injury biomechanics research, model validation, and biofidelity requirements.



- **Engagement Skills Trainer** is a simulated small arms range used to conduct research on Soldier performance in static and dynamic marksmanship. It applies a unique in-house software program that transforms the data into more research applications allowing for the critical analysis of return-to-duty assessments and performance of Service Members under operational stressors. This is an Olympic-quality, multi-lane, precision air rifle range used for high-resolution visual performance research.
- **Helmet Impact and Retention Testing Facility** includes a monorail impact tower, a free-fall impact tower, a mass properties instrument, a high-speed camera system, a dynamic mini-sled system, a Tinius Olsen quasi-static test machine and an Instron quasi-static materials tester.
- **JUH-60A Black Hawk Helicopter** is instrumented with in-flight measurement systems to monitor and record aviator physiological and cognitive status, flight performance and aircraft performance in real time.
- **Man-Rated Multi-Axis Ride Simulator** reproduces the ride of virtually any tracked/wheeled vehicle or aircraft.
- **NUH-60FS Black Hawk Flight Simulator** is an environmentally-controlled, full-motion, full-visual aeromedical research flight simulator. The system reproduces a wide range of environmental conditions of flight within the NUH-60 and records aircrew flight performance.
- **Vision Research Facility** is used for basic and applied research on the visual/optical physiology of the eye. The facility includes a laser ophthalmoscope, a corneal topography, an optical distortion measurement system, a visual display, a visual psychophysics facility and an optical fabrication laboratory.

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Q *How does the civilian sector benefit from research conducted by the USAARL?*

A The results of the USAARL's research apply to the civilian sector in several areas.

- Results from research using the Facial and Ocular Countermeasure for Safety Headform can be used to develop biomedically validated standards for facial, eye, head and neck protection and to design safer consumer products and sports protective equipment, like eyewear.
- Testing and evaluation of the blunt impact protection of helmets is conducted by the USAARL. Results contribute to the development of safer helmet designs and standards for the sporting and civilian air medical transport industries.
- **Small business research** efforts created and managed by the USAARL have resulted in improved data collection systems for use by the automotive and aviation industries to assess vehicle occupant crash safety.
- Testing and evaluation of medical systems intended for use on-board medical evacuation aircraft is conducted by the USAARL. Medical systems that meet military and industry standards are eligible for an airworthiness release, meaning the systems can be safely operated on-board U.S. Army fixed- and rotary-wing aircraft. These medical systems are developed by civilian companies.
- The Noise Immune Stethoscope will provide medical care providers with the ability to detect heart sounds in noisy environments, where traditional stethoscopes are not effective.
- USAARL researchers are developing a tool that quantifies balance performance and provides sway feedback to improve balance. This device will be an effective tool for the rehabilitation of individuals with balance deficits due to injury (e.g., stroke, brain injury).

Q *What USAARL products have transitioned to the civilian sector?*

A Products include:

- **Facial and Ocular Countermeasure for Safety Headform:** A research headform that is used to test and evaluate the performance of face and eye protective equipment by predicting the degree of eye injury and facial fracture sustained in blunt impact and blast environments.
- **Helmet-Mounted Displays (HMD) Books:** Two comprehensive texts on HMDs — the first book summarizes engineering issues pertaining to HMDs whereas the second book discusses the effects of HMDs on users' sensation, perception and cognition of visual and auditory displays.
- **SLICE PRO and SLICE PRO Mini:** High speed, shock-hardened data collection systems developed through a small business innovation research agreement with Diversified Technical Systems, Inc.