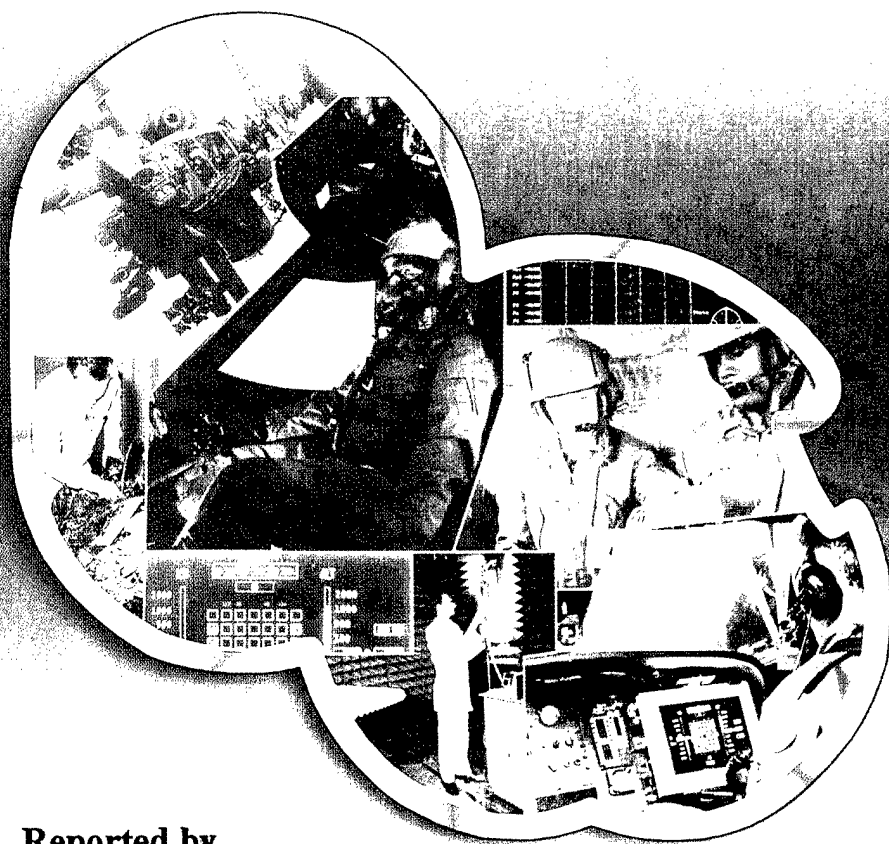


U.S. Army Aeromedical Research Laboratory

Annual Progress Report

Calendar Year 2000



Reported by

John A. Powell, Colonel, MC, MFS

March 2001

Approved for public release, distribution unlimited.

**U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012**

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**U.S. Army
Aeromedical Research
Laboratory**

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BACKGROUND

The U.S. Army Aeromedical Research Laboratory (USAARL) was established in 1962 to accomplish research in support of Army aviation and airborne activities, and to provide a central aeromedical research and reference library. In 1974, medical research programs in acoustics and vision were added to the Laboratory's mission. USAARL's mission was further expanded in 1977 to include the assessment of health hazards and research in support of both air and ground vehicles and weapons systems. In spite of this mission expansion, USAARL's primary mission remains medical research support of Army aviation.

Scientists and engineers assigned to USAARL seek to enhance 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 which deter soldiers/aviators from performing their mission or compromise their safety. Co-location with the U.S. Army Aviation Center allows USAARL's unique mix of scientific personnel to successfully conduct critical research for solving operational medicine problems for our aviators. Additionally, USAARL provides military developers with information and expertise to enhance the performance and safety of future Army systems.

USAARL maintains close coordination with other services and the international allied medical research community as a member of the North Atlantic Treaty Organization (NATO) Research and Technology Organization (RTO); the Air Standardization Coordinating Committee, Aerospace Medical and Life Support Systems; and the Triservice Aeromedical Research Panel (TARP).

This report presents an overview of USAARL activities during calendar year 2000 (CY00), identifies current areas of research, and gives a brief description of the research programs being conducted.

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MISSION

USAARL conducts research and development on health hazards of Army aviation, tactical combat vehicles, selected weapons systems, and airborne operations. Assesses the health hazards from noise, acceleration, impact, and visual demands of such systems and defines measures to offset hazards. Assesses stress and fatigue in personnel operating these systems and develops countermeasures. Assists in development of criteria upon which to base standards for entry and retention in Army aviation specialties. Assists other U.S. Army Medical Research and Materiel Command (USAMRMC) laboratories and institutes research on the impact of continuous operations on individual and crew performance and development of improved means of patient evacuation. Assesses current life support equipment to identify causes of failure and devises improved design. Assists the combat developers and materiel developers of new Army aviation and tactical combat vehicle systems to recognize and eliminate health hazards as early as possible in the developmental cycle. Conducts collaborative research with other Department of Defense and federal agencies on medical research and development issues of common concern.

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FROM THE COMMANDER

The U. S. Army Aeromedical Research Laboratory (USAARL) is proud to present this summary of achievements for calendar year 2000. Our personnel made significant contributions to Army readiness this year through the continued accomplishment of our research mission.

USAARL is concerned that the inevitable increase in weight of head-supported devices may pose a risk to the Army aviator and ground soldier who use them. To minimize this risk, our researchers are developing guidelines for equipment designers and Army leaders that will allow the safe use of these important devices.

During this past year, we completed projects related to the maintenance of aviator performance during continuous and sustained operations. These studies have resulted in USAARL giving instructional courses on fatigue management, providing expert advice on the impact of fatigue, and assisting Army, Air Force, and civilian communities in implementing fatigue management strategies.

Health hazards encountered in Army systems include whole-body acceleration and blunt impacts that can produce skeletal and internal soft tissue injuries. One way USAARL assesses these hazards is by using crash manikins and anthropomorphic test devices that faithfully reproduce the human biodynamic response to impact. These devices are subjected to impact tests, and the data gathered are processed and evaluated to estimate the risk of injury to the exposed soldier.

Mission-driven changes in work schedules and rapid deployment can produce stress, fatigue, and sleep deprivation that lessen aircrew performance and impede the accomplishment of Army aviation missions. USAARL has developed countermeasures to maintain aviator performance.

Considerable effort was expended during 2000 on the UH-60 and OH-58D cockpit air bag systems. Several studies were conducted to assess the risk, either to aircrew and/or aircraft, associated with deployments of prototype and production air bags.

In an effort to reduce the incidence of spatial disorientation (SD) in Army aviation, USAARL has updated training methods, created an SD video, and prepared instructions for demonstrating instances of SD to include TH-67, UH-1, and UH-60 aircraft.

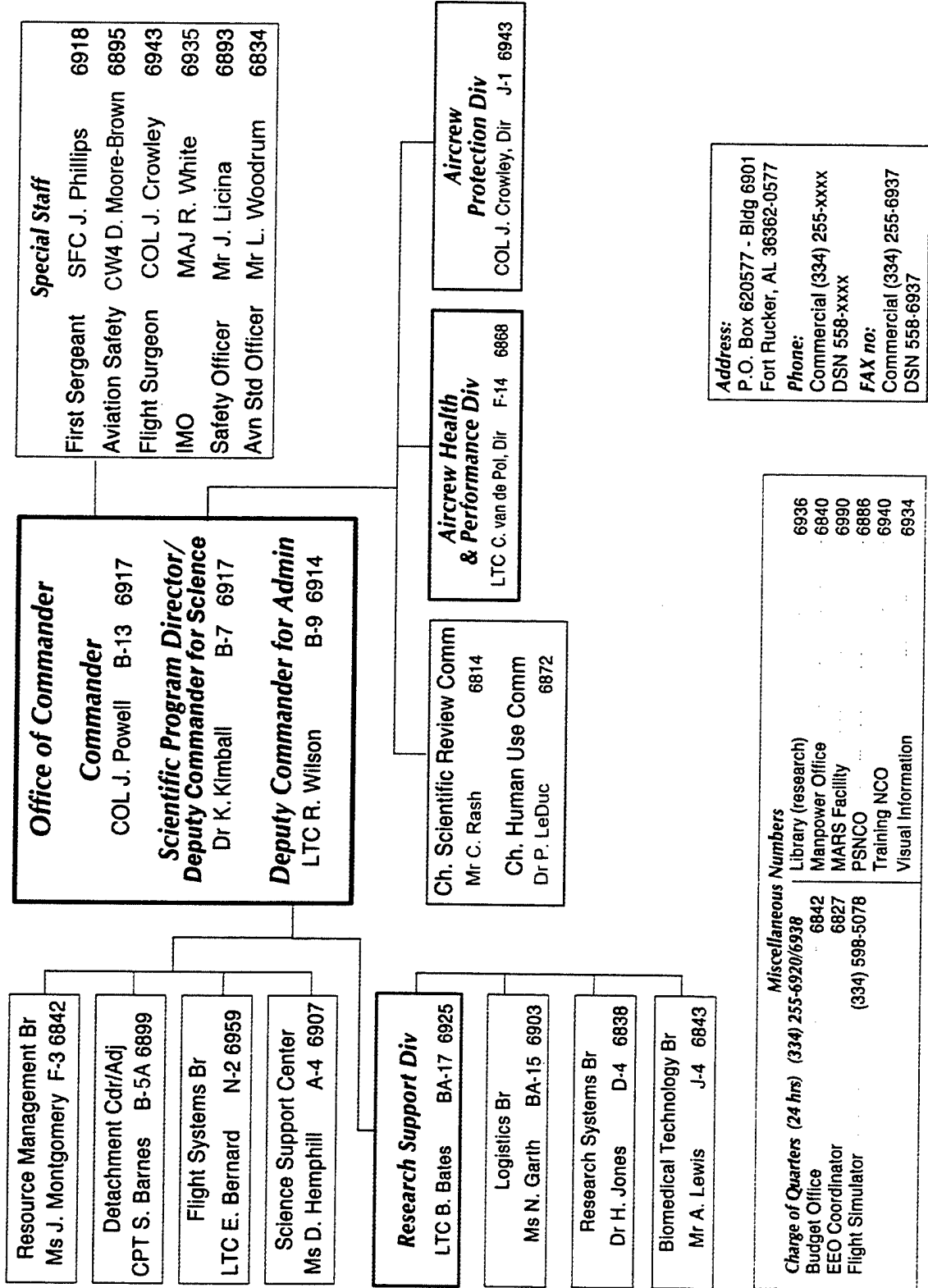
A study was conducted to determine the variability of eye positions relative to the faceplate of laser protective eyewear. This information is critical in determining the effectiveness of various laser protection designs.

USAARL remains dedicated to the support of our customer, the combat soldier aviator. We are proud of the singular work we have accomplished on his/her behalf and dedicate ourselves to this continuing mission.



John A. Powell
JOHN A. POWELL
Colonel, MC, MFS
Commanding

**United States Army Aeromedical Research Laboratory
Fort Rucker, Alabama 36362-0577**



PERSONNEL

As with the majority of organizations, USAARL continues to be impacted by downsizing within the Government. Loss of manpower authorizations and requirements, both military and civilian, deletes critical scientific skills and intensifies the disparity between required and authorized strength levels. In order to meet continuing mission demands in light of these staffing limitations, in addition to the work force described below, USAARL had 6 overhires, 5 terms, and a monthly average of 15 non-TDA personnel during CY00. Non-TDA personnel include Army student contractors, Army Research Office personnel present under the Summer Faculty and High School Math and Science Teachers Programs, and other on-site research and research support contractor personnel, exchange officers and casual officers.

Required strength was 31 officers, 2 warrant officers, 39 enlisted, and 78 civilians, for total requirements of 150. Authorized were 18 officers, 2 warrant officers, 31 enlisted, and 37 civilians for a total authorized strength of 88. The average assigned strength was 15 officers, 2 warrant officers, 29 enlisted, and 41 civilians, for a total average assigned strength of 87.

USAARL employs a highly skilled and trained work force with 68 percent of assigned employees possessing degrees. The types of degrees held by Laboratory employees as of 31 December 2000 were: 3 M.D.s, 11 Ph.D.s, 2 O.D., 17 Masters, 20 Bachelors and 7 Associate degrees.

Equal Employment Opportunity (EEO) Program:

Black Employment Program: USAARL provides a primary and alternate representative to the Fort Rucker Black Employment Program Committee (BEPC). This committee provides a forum to consider employment issues affecting blacks in the work force. The committee also works to develop and propose methods to overcome any identified barriers to employment, promotion, training, status, and recognition. This year the BEPC planned and sponsored two seminars for the Fort Rucker workforce. BEPC sponsored and assisted with the American Red Cross blood drive, adopted an elderly Enterprise citizen, and provided donations of items for the Army Community Service Food Closet.

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Black Civilian Employees: Four black females received an "A" performance evaluation with a pay for performance. One black female was promoted to Secretary (OA), GS-5. One black female received the Commander's Award for Civilian Service and a Time Off Award. Two training classes were attended (TDY) as compared to one training course in CY99. As of 31 December 2000, there were 48 civilian employees--4 black, for a representation of 8 percent.

Hispanic Civilian Employees: USAARL has one Hispanic employee.

Handicapped Civilian Employees: USAARL has no handicapped employees at this time.

Women Civilian Employees: As of 31 December 2000, there were 23 female employees out of 37 permanent civilians, 6 overhires, and 5 term employees, for 48 percent of the 48 total employees.

Of the 21 female employees rated, 14 received an "A" evaluation and 7 received a "B" evaluation.

Federal Women's Program. USAARL provides a primary representative to the Federal Women's Program Committee (FWPC).

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Personnel Achievements:

Promotions: The military staff earned 12 promotions in CY00 ranging from E-4 to colonel. The civilian staff had two promotions; a black female was promoted to Secretary (OA), GS-05, and a white female was promoted to Management Analyst, GS-11.

Awards: USAARL's highly motivated, productive staff was recognized for performance in CY00 with:

Military awards:

Order of Military Medical Merit	2
Army Good Conduct Medal	1
Army Commendation Medal	10
Army Achievement Medal	6
Legion of Merit	1
Meritorious Service Medal	5
Total	25

Civilian Awards: USAARL had an active awards program in CY98 with:

- 32 Pay for Performance A's
- 14 Pay for Performance B's
- 15 Time Off Awards (TOAs)
- 8 Commander's Award for Civilian Service
- 5 Achievement Medals
- 4 Civilian of the Quarter Awards with TOAs
- 1 Civilian of the Year Award with TOA

Computer Information

To improve user quality of service by increasing network and server uptime and reliability, USAARL replaced an aging Alpha server with a new Dell Poweredge 6300 server, with dual Xeon 500 MHz processors. The network operating system was also converted to the more widely supported, Windows NT. The migration went very smoothly, with very little user-service interruption.

USAARL adopted a standardized workstation specification. This specification was developed to be dynamic, not a snapshot of current technology. It was designed to be flexible, based on unique user and application needs. As a result of the base specification, new PC procurements are streamlined, as less research time is required to research the spectrum of PC products that are available. Additionally, technical support also has improved because technicians more quickly attain proficiency with one vendor's operating schema.

USAARL underwent an Information Management/ Information Technology Assistance Visit from its headquarters. The inspection focused on AR 25-1 subject areas, but delved extensively into AR 380-19 information security issues as well. The team spent three days with us inspecting, and more importantly, assisting us with improving the subject areas. A complete report was provided to help us to document management controls, and to also to give us a guide for improvement.

USAARL has entered into the initial phases of Windows 2000 migration. We have successfully converted five workstations to the new desktop operating system. By all indications, the application environment is proving to be stable and much more robust than the former Windows 9X operating system. The key improvement, however, is security. Legacy application conversion and modification will continue, and we project a complete migration in 2001.

To improve customer support, USAARL has launched a new help-desk support software system called Track-It. The application has several key modules. One critical piece is its ability to remotely inventory hardware and software components of all PCs connected to the network. This process was painstakingly performed manually in the past, and due to the voluminous amount of data collected, was difficult to maintain. More modules like remote troubleshooting and user-initiated work requests will be launched in 2001.

SCIENTIFIC PROGRAMS

USAARL scientific research encompasses three of USAMRMC's major research areas. They are systems health hazards, hazards of mechanical forces, and combat crew effectiveness. Under each of these research areas, USAARL has established scientific programs which are directed at fulfilling either an Army Science and Technology Objective (STO) or a USAMRMC Science and Technology Execution Plan (STEP).

Titles, the DA Form 1498 accession number, and the USAARL division with the responsibility for these projects are listed below.

TITLE	DA ACCESSION NUMBER	DIVISION
Aeromedical Research of Operationally Significant Problems in the Army Aviation Environment	DA0G0151	Aircrew Health and Performance
Coping Strategies for Helicopter Pilots and Crews Involved in Night Operations	DA335655	Aircrew Health and Performance
Enhancement of Aviator Sleep and Performance Through Chemical Intervention	DA336185	Aircrew Health and Performance
The Investigation of Spatial Disorientation and Related Topics	DA336186	Aircrew Health and Performance
Research Countermeasures for Significant Medical Hazards in Military Systems	DA0G0165	Aircrew Health and Performance
Military Visual Performance	DA361539	Aircrew Health and Performance
Military Visual Problems: Assessment, Mechanisms, and Protection	DA0B6893	Aircrew Health and Performance
Visual Performance Issues of Flat Panel Technologies	DA336445	Aircrew Health and Performance

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Methodologies for Assessing Retinal and Visual Functions	DA336446	Aircrew Health and Performance
Mechanism of Melatonin Action on Military Performance	DA360560	Aircrew Health and Performance
Aviator Status Monitoring	DA361534	Aircrew Health and Performance
Evaluation of Refractive Error Correction Methodologies and Military Implications	DA306074	Aircrew Health and Performance
Crashworthiness of Aviation Life Support Equipment	DA302870	Aircrew Protection
Operational Studies of Aviation Life Support Equipment	DA0G0167	Aircrew Protection
Repeated Impact Tolerance Criteria for U.S. Army Ground Vehicles	DA336192	Aircrew Protection
Develop Criteria, Models and Evaluation Methodologies to Improve Aviator Communication Performance and Hearing Protection	DA360347	Aircrew Protection
Medical Equipment Airworthiness Certification Evaluations	DA361537	Aircrew Protection
Soldier Performance and Injury Based Design Criteria for Mass Properties of Head Supported Devices	DA361535	Aircrew Protection
Conventional Restraint Systems	DA366716	Aircrew Protection
Enhanced Head Protection of Paratroopers	DA366715	Aircrew Protection
Inflatable Restraints	DA366714	Aircrew Protection
Aviation Life Support Equipment Retrieval Program (ALSERP)	DA366713	Aircrew Protection

MANAGEMENT ACTIVITIES

Technology Transfer:

USAARL maintained an active technology transfer program in CY00 through distribution of its technical reports, publication in the open literature, presentations to military and civilian audiences, execution of Cooperative Research and Development Agreements (CRDAs), and membership in federal, regional, and state technology transfer organizations.

Invention disclosures were filed for MFDTTool, a software aid for the design of multifunction displays, and a Field-ready Monocular Helmet-Mounted Display Imagery Evaluation System. The Invention Evaluation Committee has approved both inventions for patent applications. MFDTTool is a product of a CRDA with Purdue University.

USAARL CRDA partners in CY00 are:

BCI International - for collaborative research, development, test and evaluation on BCI International pulse oximeters.

Bethel College - for collaborative development of a high performance liquid chromatographic method for determination of normal and elevated levels of melatonin in saliva.

Communications and Ear Protection, Inc. - for collaboration in research, development, test and evaluation of hearing protective devices.

H. Koch & Sons - for collaborative research on advanced aircrew restraint systems.

Heartstream - for collaborative research, development, and test and evaluation on aeromedical equipment.

Honeywell - for collaboration in visual testing of image intensifier components and systems.

ITT Defense - for collaborative research in visual testing of image intensifier components and systems.

L-3 Communications Corporation - for collaboration on software support for simulation devices.

Medical University of South Carolina Department of Ophthalmology - for research and development on visual performance issues in aviation.

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- Oregon Aero Corporation – for research on aeromedical safety equipment.
- PhysioControl Corporation - for collaborative research, development, and test and evaluation of the LifePak 10.
- Purdue University - for collaborative research in hierarchically ordered information in intelligent multifunction displays.
- Rush Sport Medical - for development of advanced helmet technologies.
- Simula Technologies, Inc. - for research in advanced aircrew protection systems.
- SpaceLabs Medical Corporation - for collaborative research, development, and test and evaluation on aeromedical equipment.
- Troy State University – for loan of excess scientific equipment for use by chemistry and biology classes.

Science Support Center:

The Science Support Center (SSC) library provided the information necessary to support the aeromedical research performed at USAARL, supported three Flight Surgeon Courses and one Aviation Psychology Course, and disseminated scientific information to requesters worldwide. The library holdings are believed to comprise the most comprehensive aviation medicine collection in this part of the country.

Audiovisual and editorial services contributed to the publication of USAARL technical reports and open literature publications. These services also produced video documentaries, brochures and pamphlets describing research conducted by USAARL scientists and engineers.

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Resources Management:

Program funding for FY00/01 (dollars in thousands):

	FY00	FY01
6.1 Basic Research	789	250
6.2 Exploratory Development	5,137	5,727
6.3 Advanced Technology Development	159	316
6.5 Engineering and Manufacturing Development	38	0
Other	268	156
	-----	-----
TOTAL	6,391	6,449

Flight Activities:

Aviation research/research support was provided by six active duty Medical Service Corps (MSC) aviators, a Chief Warrant Officer Four (CW4), and two Department of the Army Civilian (DAC) research pilots/instructors. The majority of the aviators fly at least two of USAARL's aircraft for research support.

Assigned aircraft in CY00 were:

JUH-1H - 71-20033
JUH-60A - 88-26069
NUH-60FS - Simulator

Flight hours in USAARL aircraft in CY00 were:

Total rotary-wing flight hours – 449.9
JUH-1H hours: 108.7

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JUH-60A hours: 341.2

Total NUH-60FS simulator flight hours – 806

Simulator and peripherals utilization other than flight – 1,848 hours

Flight Systems Branch man-hour totals for CY00:

Research man-hours	6,772.4
Productive man-hours	13,341.5

During CY00, USAARL aviation assets were used for the following research studies:

JUH-1H - Telemetry, Joint Aviator Laser Visor Eye Protection (JALEP), and Assessment of the Latest Laser Eye Protection Spectacles.

JUH-60A - Telemetry, Feasibility of Using the AN/PVS-14 Monocular Night Vision Device for Pilotage, Spatial Disorientation Demonstration Flight/Video, Certification of Life Support for Trauma and Transport (LSTAT), and Airworthiness Certification and Evaluation (ACE).

NUH-60FS - Modafinil, Heads-up Display, Temazepam, 100° Panoramic Night Vision Goggle Assessment, Power Management Training Scenarios, Cockpit Airbag System (CABS), and Spatial Disorientation Scenarios.

USAARL executed the Airworthiness Certification and Evaluation Program and assigned accountabilities and responsibilities. This validation process included the In-Flight Test Operation (ITOP) for Aeromedical Equipment Suitability Test and the flight test profile being written. As a result of the ACE Program, several significant events have occurred. First, the U.S. Army Aviation and Missile Command (USAMCOM), on 20 July 2000, granted the first fleet-wide airworthiness release (AWR) for the LifePak 10-59/62 defibrillator to be used as part of the medical carry-on equipment aboard UH-60A MEDEVAC aircraft. Second, on 19 December 2000, USAMCOM granted the second fleet-wide AWR for the Alaris MS III 2863B/2865B infusion pumps. Additionally, ground and flight-testing were completed for the BCI 3303 pulse oximeter, Impact 754 ventilator and the Impact 325/326 suction pumps. A fleet-wide certification request is currently pending release from USAMCOM. This third fleet-wide approval is expected by mid-February 2001. Currently, the Propaq 206EL vital signs monitor is undergoing ground- and flight-testing for fleet-wide certification. Finally, LSTAT has undergone initial flight testing. This will complete all current Patient Movement Items (PMIs).

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During CY00, many distinguished visitors, from general officers to foreign officials, were given demonstrations of the USAARL-developed simulator spatial disorientation scenarios; thus enhancing their awareness of what the aviator may experience when exposed to a spatially disorienting situation.

There were several significant events that affected USAARL flight activities in CY00. The JUH-60 had a scheduled maintenance phase inspection and installation of mandatory maintenance modifications on the fuel cells, auxiliary power unit and fire bottles. These modifications kept the JUH-60 down for 3 months (June through August). The JUH-60 was also down for 1 month to replace the left forward external support bracket in Troy, Alabama, in October. The JUH-1H had a scheduled maintenance phase inspection, tail boom replacement, engine deck and firewall replacement, three engine changes and a mast replacement due to three safety of flight restrictions, which kept the aircraft down for maintenance for a total of 4 months during 2000.

Standardization/Aircrew Training Program: Seven aviator personnel turnovers occurred this year. The replacements were all experienced aviators. However, three were in nonflying assignments and one was in a simulator-only assignment prior to reporting to USAARL, which increased the training workload significantly. The Flight Systems Branch was also tasked to train a new IMA officer, which required refresher training in the JUH-1H. Three aviators went through UH-1H refresher training and four aviators required UH-60 refresher training. Twenty-six instrument and contact flight evaluations were administered, in addition to 19 no-notice, pilot, pilot-in-command, and instructor pilot evaluations.

Flight Systems continued its role of consulting and coordination with USAARL research divisions in developing and supporting flight and simulator research protocols. Consultations were provided for the following projects:

Bifocal Contact Lens, Joint Shipboard Helicopter Integration Process (JSHIP) Project, Spatial Disorientation Awareness Scenarios, Spatial Disorientation Demonstration Flight lesson plans and video production, Power Management Training Scenarios, AH-64 Apache Pilot Survey, VolksSim 2000 Simulator Development, Air Sickness Prevention, Cockpit Airbag System, Review of Field Manual 1-564 (Shipboard Operations), LSTAT, Night Vision Goggle Focus Research Study, Aviator Fatigue Survey, Heads-up Display Survey, Spatial Disorientation Awareness Training Survey, and Aircraft Certification and Evaluation.

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Flight Systems also was involved in external commitments and consultations, with personnel attending or tasked to support the following:

Army-wide Simulation, Training and Instrumentation Command (STRICOM) Synthetic Flight Training Systems (SFTS) Conference
Medical Command (MEDCOM) Aviation Safety and Standardization Council
U.S. Army Aviation Center (USAAVNC) Safety and Standardization Council
Aircraft Logistics Management Division (ALMD) support missions
U.S. Army Aviation and Missile Command Airworthiness Certification coordination meetings
Army Medical Department (AMEDD) Evacuation Integrated Concept Team (ICT)
UH-60 Users Conference (USAMCOM)
Spatial Disorientation Research Conference, San Antonio, Texas
U.S. Army Aviation Technical Test Center (USATTC)
U.S. Army Safety Center (USASC)

Training:

USAARL's training program for CY00 included 39 training experiences. Training encompassed supervisory development training, software training, training required by Equal Employment Opportunity mandates, and training to assist employees to perform more effectively in their current positions.

RESEARCH ACTIVITIES

Aircrew Health and Performance Division:

Aeromedical Factors Branch:

Aircrew Endurance and Sustainment

During 2000, the Sustained Operations Team completed several projects related to the maintenance of aviator performance during continuous and sustained operations. A study was completed to investigate the feasibility of collecting real-time, telemetered electroencephalograph (EEG) and performance data in flight from fatigued aviators. The study also included mood evaluations, resting laboratory EEG measurements and objective cognitive performance data. The results demonstrated that our specially designed in-flight equipment is capable of reliably measuring actual pilot performance and alertness, and that decrements in these measures due to sleep deprivation mirror those that we have demonstrated previously in the Laboratory. Another major effort was a meta-analysis of several years of research in this Laboratory examining the effects of Dexedrine on pilot performance, both in flight and in the simulator, as well as EEG power, mood ratings, and cognitive test performance. These results demonstrated a consistent effect of Dexedrine in enhancing performance in fatigued pilots, and lent considerable statistical power to the claim of beneficial effects of the drug. A third effort involved another meta-analysis using placebo-condition flight and EEG data collected in five stimulant studies, with the objective of finding a regression equation that described the relationship between diminishing flight performance and changing EEG power over the course of sleep deprivation (without reference to drug effects). Finally, a comprehensive survey relating to aviator fatigue was designed and distributed to over 300 Army aviators. Their responses were tabulated and analyzed, yielding a massive amount of data regarding pilot sleep, rest habits, and attitudes.

The products stemming from these projects and other work in USAARL's sustained operations research program include a variety of papers and presentations. Presentations were given on the overall efficacy of dexedrine (meta-analysis) at the Army Science Conference, on the comparison of dextroamphetamine and modafinil at the meeting of the Associated Professional Sleep Societies, and on the efficacy of stimulants in sustaining performance at the 4th International Conference on Fatigue in Transportation, among others.

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Instructional courses on fatigue management were given at the Aviation Precommand Course, Flight Surgeon's Course, and elsewhere.

Technical reports, scientific papers, and articles have been prepared, published, or accepted for publication on the feasibility of telemetered EEG and flight performance in sleep-deprived aviators, the efficacy of modafinil in sustaining performance, the results of the aviator fatigue survey, facts and advice on fatigue management, the differential performance sensitivity of aircraft versus simulators, and the effects of body posture on EEG recordings in sleep-deprived aviators.

In addition, expert consultations on the impact of fatigue and the implementation of fatigue management strategies have been provided for Army, Air Force, and civilian communities.

Coping Strategies for Shiftlag/Jetlag

Mission-driven changes in work schedules and rapid deployment can produce stress, fatigue, and sleep deprivation that limit aircrew performance and impede the accomplishment of Army aviation missions. The Aviation Shift-Lag Team develops countermeasures to maintain aviator performance which are implemented and tested in both laboratory and field environments. This team, when required, may consult with aviation units in the field, study work schedules and environmental conditions, evaluate crew rest plans, and educate commanders in new strategies which can be used for future operational and training deployments.

Several projects were designed to investigate problems with working night shift and possible countermeasures to address these problems. A questionnaire was completed in which three units from three U.S. Army posts were surveyed to document how these aviation units work night shift. Based on the results of this survey, countermeasures will be formulated to help soldiers cope with working nights. Data collection has been completed for a study that investigated the ability of temazepam to improve daytime sleep and lead to improved alertness and performance of aviators working night shift for 3 consecutive nights. Another study is planned in which the problems associated with an early morning shift will be addressed. In addition, field studies are planned to document work/rest cycles of units who train and work night shift. A brochure also has been developed to teach aviators how to sleep during the day and stay alert at night. A workshop has been organized for the Aviation Psychology Conference in March 2001, in

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which aviation personnel will be taught to recognize the problems and to implement countermeasures associated with fatigue and circadian rhythm disruption. The Precommand Course, the Flight Surgeon Course, and the Aviation Psychology Course include these topics as well.

Crew Coordination

Over 70 percent of rotary-wing accidents can be attributed, at least in part, to human error. Over half of these accidents involve at least one crew coordination failure. These failures typically involve poor coordination of actions due to miscommunication or no communication among the aircrews. Unfortunately, these mishaps continue to plague the military community, even during routine training missions.

In 2000, the Laboratory purchased the Duo-WOMBAT. The Duo-WOMBAT-CS is a computerized test that measures situational awareness, stress tolerance, attention management abilities of complex-system operators, and crew resource management in a team environment. This test is a derivative of the Wombat-CS, which is designed to measure a single operator's performance. In the Duo-WOMBAT-CS, various tasks will be shared between teammates with the emphasis placed on cooperation, not competition. A participant's ability to manage a complex system is measured by presenting situations and evaluating the reaction to those situations. The situations presented enable the researcher to evaluate performance in the following areas: attention to multiple information sources, evaluation of alternatives, establishment of priorities, estimation of probable outcomes for different courses of action, attention to the highest moment urgency without disregard for the routine tasks, reestablishment of priorities as situations deteriorate or improve, and decisive action in the face of indecision of others. A protocol to gather baseline data from rated and nonrated aviators using Duo-WOMBAT is targeted to begin in early 2001.

Miscellaneous Aeromedical Human Factors

Aeromedical human factors include a vast number of practical issues of importance to Army aviation units and personnel for preventing aircraft accidents and for achieving maximum performance during physically- and psychologically-demanding mission scenarios. Motion sickness is an example of a physiological response that can adversely affect aviator and crewmember endurance and flight performance. In support of the

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Special Operations Command, a research study using USAARL's UH-60 was proposed. This study will examine the effects of airsickness on reaction time, postural stability, and cognition in relation to symptom severity. Additionally, various airsickness remedies for alleviating airsickness symptoms and ameliorating performance declines will be examined.

Visual Sciences Branch:

Mechanism Assessment of Military Visual Problems

The variability of eye positions relative to the faceplate of laser protective eyewear was unknown for U.S. Army personnel. This information was critical in determining the effectiveness of various laser protection designs. A study was conducted to determine this variability using USAARL personnel wearing an advanced sun, wind, and dust goggle. The U.S. Army Aviation Research, Development, and Engineering Center, in coordination with the U.S. Army Aviation Technical Test Center, requested USAARL evaluate theoretical and actual multifunction colored displays in UH-60L and CH-47SD aircraft for night vision imaging system (NVIS) compatibility according to Military Specification MIL-L-85762A and TECOM Test Operations Procedure (TOP) 7-2-513. A laboratory and flight assessment of the feasibility of using a monocular AN/PVS-14 night vision device (NVD) was conducted using UH-60 and AH-64 helicopters. A paper covering a literature review and laboratory and flight assessments on the effects of yellow visors was presented at the Annual SAFE Conference. At the request of PM Night Vision, and in coordination with the Aviation Training Brigade, USAARL conducted ground, flight, and maintenance assessments of two different advanced objective lenses for the aviator's night vision imaging system (ANVIS). At the request of Night Vision Electronic Sensors Directorate, in coordination with the Aviation Training Brigade, USAARL evaluated advanced 100-degree horizontal field-of-view panoramic night vision goggles (PNVGs) during routine NVG training missions, in the Laboratory, and in the UH-60 flight simulator. Modifications to the NVD Test Set (TS-3895A/UV) were developed at USAARL to provide collimation assessments for the monocular AN/PVS-14 and the PNVG.

Spatial Disorientation

Spatial disorientation (SD) is a contributing factor in as much as 30 percent of all Army helicopter accidents. USAARL's SD team directs its efforts at reducing the incidence of SD in Army aviation, thereby enhancing flight safety and operational effectiveness. The SD research approach has always been comprised of three components: (1) analysis of aviation accident data to determine pilot, cockpit, mission, and environmental factors associated with SD; (2) evaluation of aids to prevent or help overcome SD in flight; and (3) development of new training and instructional methods to enhance pilot and command understanding and awareness of SD.

As part of the continuing evaluation of factors associated with SD, the effects of sleep deprivation on spatial disorientation were examined. Nearly all measures of performance, to include mood, alertness, cognition, spatial orientation, postural stability, flight accuracy, and recovery from in-flight disorientation, were detrimentally impacted by fatigue. A final report was published as USAARL Report 2000-9. Updates to training methods used to enhance pilot awareness of SD were also accomplished. Instructions for demonstrating instances of in-flight disorientation were prepared for the TH-67, UH-1 and UH-60. These instructions were published as USAARL Report 2000-11. In addition to the written instructions for conducting in-flight disorientation maneuvers, a video was created to provide instructor pilots with the physiological changes which produce disorientation phenomena. This video is being distributed as USAARL Nonprint Product 2000-15.

Refractive Error Correction Methodologies and Military Implications

As pilots age, there are greater requirements to correct vision for nearsightedness. A technical report was completed in 2000 that is geared towards clinicians that prescribe bifocal spectacles for Army aviators. This guide provides the clinician with more information about the expected near-working distances in specific Army aircraft. A description of each aircraft, a diagram of the cockpit layout, distances to each of the control panels and the Snellen equivalent letter size of instrumentation is detailed. The final part of the paper uses an example to aid in determination of the operationally-optimal bifocal add power and segment height. A study is in development to assess the new generation bifocal contact lenses as an alternative to spectacle correction for presbyopic aviators.

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Advanced technologies have now been applied to the refractive error and spectacle incompatibility problem of modern visionic and electro-optics systems. While incisional refractive error correction methods (i.e., radial keratotomy (RK)) have proven to have major problems in the military setting, no such problems have yet been documented by laser techniques (i.e., photorefractive keratectomy (PRK) and laser in-situ keratomileusis (LASIK)). Changes in the quality of vision after laser refractive surgery have been documented, however. Given the FDA approval of PRK and LASIK, individuals having received this treatment prior to military service are entering service in ever-greater numbers. The aviation environment is very visually demanding and efforts are underway to verify the compatibility of refractive surgery with the operational requirements in Army Aviation through the conduct of a large study of Army aviation recruits who have had PRK or LASIK.

Diagnostic techniques to determine the quality of vision after any ocular surgery are also important. A study was conducted on the accuracy of corneal topographers and their potential use in corneal optics research and as screening devices for refractive surgery patients among aviator recruits. Several scientific presentations, technical reports and open literature manuscripts on visual performance and ocular parameters after refractive surgery were completed.

Military Visual Tests and Retinal Function

Selection and retention of aviation personnel is based on acceptable performance on a number of vision tests. While visual acuity remains the cornerstone of vision assessment, subtle visual loss can escape detection with standard measures of acuity. USAARL scientists have continued development of the Small Letter Contrast Test for use in studies of visual function. The test has been used by all three services for assessment of refractive surgery outcomes.

Visual Performance with Electro-Optical Displays

In 2000, visual performance researchers advanced the development of a field portable, image quality tester for the Apache helmet mounted display. The second generation of the laser based virtual retinal display being developed by Microvision, Inc. was evaluated

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for optical and visual performance. Work was completed on the development of two international standards for integrated helmet-mounted-display and flat-panel-display design criteria.

A web-based survey of visual issues with the AH-64 Apache's helmet-mounted display was conducted. A total of 214 surveys were received. Analysis of these data and a comparison to the original 1990 study has begun.

Aircrew Protection Division:

USAARL's Aircrew Protection Division (APD) comprises a team of engineers, aviators, and health care professionals. The team studies the effects of exposure to physical forces (e.g., impact decelerations, repeated impact, jolt and noise) on the health and performance of Army air and ground warfighters. It studies communication performance and causes of injury and attrition. These efforts are accomplished through epidemiological research, computer modeling, laboratory simulation, use of crash manikins and human volunteers, investigation of mishaps, and study of combat crew life support equipment. Team members recommend injury prevention strategies to equipment developers and major commands.

Effects of Head-Supported Weight on Army Warfighters

Army aviation and ground soldiers use head-supported devices (HSDs) in a wide variety of training and combat scenarios. There is a risk, however, that the inevitable increase in head-supported weight could cause injury (acute and chronic) or performance degradation. APD researchers have received funding for a 5-year program to develop guidelines for equipment designers and Army leaders that will allow the safe use of these important devices. In 1999, a USAARL study identified a safe range of weight and centers-of-mass of HSDs that can be tolerated by female aviators without affecting their health or degrading their performance. The study involved 12 subjects who were exposed to whole-body vibration (WBV) while wearing HSDs with various mass properties. In 2000, epidemiological studies were initiated to determine the incidence of neck pain due to night vision goggle use in Army aviation, and neck injury in helicopter mishaps.

Development of ALSE and Crashworthiness Design Standards

Supporting the developers of Army aircraft systems and personal protection devices is an on-going consultation and testing effort at USAARL. Protective systems and devices include crashworthy seats, air bag restraints, conventional restraint harnesses, inertia reels, and protective headgear. Through reconstruction of crashes, static and dynamic testing of systems and devices, and the use of manikins and human volunteers, experts derive protection standards and propose product improvements to developers.

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In 2000, USAARL researchers provided extensive consultation to the Army's Air Warrior Program—the next generation life support and survival equipment for the Army aviator. The multidisciplinary APD team fielded questions ranging from the crash safety of vest components to the necessity of an emergency oxygen bottle.

Acceleration Injury Assessment: Crash Manikin

Health hazards encountered in Army systems include whole-body acceleration and blunt impacts that can produce skeletal and internal soft tissue injuries. One way that USAARL assesses these hazards is by using crash manikins and anthropomorphic test devices that faithfully reproduce the human biodynamic response to impact. When subjected to impact tests, data from these devices are processed and evaluated to estimate the risk of injury to the exposed soldier. USAARL has developed a manikin with internal data acquisition system (MIDAS) to assess spinal vertical response. In 1999, USAARL participated in a full-scale drop test of a composite UH-60 fuselage at NASA Langley Research Center (LRC). In addition to fostering cooperative research with NASA LRC researchers, USAARL's goal was to subject MIDAS to realistic crash conditions to evaluate its performance as a test device. Data recorded from the test were sent back to NASA for analysis and comparison to other recorded data from the drop test. In 2000, a 5th percentile female manikin and instrumented arm were acquired, and plans call for additional state-of-the-art instrumentation acquisitions in 2001.

Cockpit Air Bag System (CABS) Research Program

In support of the Program Manager, Aircrew Integrated Systems, considerable effort was expended during 2000 on the UH-60 and OH-58D Cockpit Air Bag Systems (CABS). Several studies were conducted to assess the risk, either to aircrew or aircraft, associated with deployments of prototype and production air bags.

Previous USAARL studies have identified a significant risk of arm fracture with air bag deployment. In 2000, the redesigned lateral air bag was studied to quantify the residual risk of arm injury. In these tests, USAARL's midsize crash manikin and an instrumented arm (attached to an Air Force small female manikin) were used as human surrogates. Data from these tests indicated a dramatically reduced risk of upper extremity injury compared to the prototype bag, but a small residual risk of arm injury for small occupants remained.

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Aviators and ground soldiers who are wearing NVGs or other head-mounted systems during vehicle crashes are at particular risk for eye and face injury. APD engineers are collaborating with academic institutions around the world to better define this risk and devise countermeasures.

One series of studies assessed the aviator's ability to maintain flight control in the event of an in-flight activation of the prototype and alternate UH-60 CABS. Inadvertent CABS deployments were simulated in USAARL's NUH-60 research flight simulator. Twenty-four current and qualified UH-60 aviators flew 1-hour simulator missions during which simulated inadvertent deployments were introduced. Aircraft flight parameters and subjects' recovery times after each deployment were among the data gathered. Test results suggested a high probability of crashing if the prototype CABS were to activate during high speed, low altitude flight. The risk of crashing was dramatically less with the alternate air bag configuration.

Standard for Health Hazard Assessment of Repeated Jolt in Army Vehicles

In 1997, USAARL concluded a 5-year research program that documented human whole-body response to repeated jolt. The research, which was done under contract with British Columbia Research Inc., established safe tolerance thresholds that would be considered hazardous by current standards. The effort also resulted in a new model for health hazard assessment (HHA) that is designed to replace the current ISO standard for repeated jolt. While the new model requires additional field-testing before it gains users' acceptance, there is little doubt that the USAARL-produced data have raised the bar well above current conservative limits. The impact of this program is likely to affect how the Army evaluates whole-body vibration; particularly when the vibration signature contains high levels of repeated jolts. In 1998, an ANSI workgroup (WG 87, Human Response to Repetitive Mechanical Shock) was formed under the S3 committee (Bioacoustics) to deliberate, refine and establish a new standard that is relevant to Army tactical vehicles. By pushing the envelope of known human tolerance and developing modern methods to assess the health hazard of repeated jolt, USAARL is serving the developer of Army ground vehicles while protecting the health and safety of the soldier.

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Acoustics

A new team of acoustics researchers is continuing the tradition of excellence set by the recently retired principal investigator and his staff. While continuing a line of research supporting the very popular USAARL-developed Communications Ear Plug (CEP), a new program has been initiated to investigate the use of three-dimensional auditory displays and auditory icons in aviation.

The CEP has been particularly successful with hearing-impaired aviators, as it delivers communication input directly into the external ear canal, behind the ear plug. A study has been underway for the past year to assess the effect of CEP use on flight safety and hearing test performance in hearing-impaired aviators. The results of this study should be published in the 3rd quarter FY01.

A research effort has begun to develop techniques to allow medical personnel to hear heart and breath sounds inside an operating helicopter. Certain "electronic" sensors appear to hold promise for sensing faint biological sounds while resisting contamination from outside noise sources (e.g., aircraft, truck). These devices will be tested in the extensive acoustic research facilities at USAARL, and then on our specially configured UH-60 research helicopter.

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Contracts:

Through sponsorship by the U.S. Army Medical Research and Materiel Command, USAARL maintains an extramural research program in support of its in-house research. These research contractors perform at their own facilities and, in some cases, onsite at USAARL, where unique research tools and facilities can be provided at lower cost to the Army.

Present contract efforts include:

- High-impedance, Dry Physiological Recording Optrode, Phases I and II; SRICO, Inc. Principal investigator – Dr. S. A. Kingsley.
- Contributive Research in Aviation Medicine, Bioengineering, Human Performance, Analytic and Modeling Systems and Data Management, Universal Energy Systems, Inc. Principal investigator - Dr. Thomas Harding.
- Low Cost Virtual Reality System for Monitoring Pilot Performance During Simulated Helicopter Flight, Phase I, Systran Federal Corporation - Mr. G. Valentino.
- Solid State Compact and Rugged Personal Environmental Recording System Employing Inertial Sensors and Electromyographic Monitoring. Physical Optics Corporation – Dr. Stephen Kupiec.

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Publications:

Open literature publications

- Bancroft, D., Lattimore, Morris R. 2000. Initial 67th Combat Support Hospital (CSH) optometry service at Taszar, Hungary on Operation Joint Endeavor. Military Medicine. (In press.)
- Caldwell, John A., Smythe, Nicholas K., Leduc, Patricia A., Caldwell, J L. 2000. Efficacy of Dexedrine for maintaining aviator performance during 64 hours of sustained wakefulness: A simulator study. Aviation, Space, and Environmental Medicine. 71 (1): 7-18.
- Caldwell, John A. 2000. Sleepiness in the cockpit. United Airlines, Safetyliner. 10 (3): 2-4.
- Caldwell, John A., Smythe, Nicholas K., LeDuc, Pat A., Caldwell, Jo L. 2000. Efficacy of dextroamphetamine for the maintenance of aviator performance during 64 hours of sustained wakefulness. Aviation, Space, and Environmental Medicine. 71 (1): 7-18.
- Caldwell, John A., Smythe, Nicholas K., Caldwell, J L. 2000. Efficacy of 600 mg modafinil for the sustainment of aviator performance throughout 40 hours of continuous wakefulness. Sleep. 23 (S#2): A245. (Published Abstract)
- Caldwell, John A., Prazinko, Brian F., Hall, Kecia K. 2000. The effects of body posture on resting electroencephalographic activity in sleep-deprived subjects. Clinical Neurophysiology. 111 (April): 464-470.
- Caldwell, John A. 2000. Sleepiness in the cockpit (reprint). Airline Pilots Association--Centerline. Spr (May): 20-24. (Rprnt Sftylinr Paper)
- Caldwell, John A. 2000. Recognizing the problem of fatigue in Army aviation. Army Aviation. 49 (6): 22-27.
- Caldwell, John A., Caldwell, J L., Smythe, Nicholas K., Hall, Kecia K. 2000. A double-blind, placebo-controlled investigation of the efficacy of modafinil for sustaining the alertness and performance of aviators: a helicopter simulator study. Psychopharmacology. 150 (August): 272-282.

U.S. Army Aeromedical Research Laboratory--Calendar Year 2000

- Caldwell, John A. 2000. This is your wake-up call: How to reduce sleepiness on the job. Flightfax. 28 (9): 1-5.
- Caldwell, John A., Roberts, Kristi A. 2000. Differential sensitivity of using simulators versus actual aircraft to evaluate the effects of a stimulant medication on aviator performance. Military Psychology. 12 (4): 277-291.
- Caldwell, J. Lynn, Gilreath, Steven R. 2000. A survey of subjective sleep length of shiftworkers based on time of day of sleep onset. Sleep. 23 (S2): A388. (Abstract)
- Caldwell, J. Lynn. 2000. The use of Melatonin: An information paper. Aviation, Space, and Environmental Medicine. 71 (3): 238-244.
- Jones, Anthony BG, Powell, John. 2000. Spatial disorientation in Army aviation. Army Aviation. Aug (2000): 6-8.
- Lattimore, Morris R., Schallhorn, S., Kaupp, S., Lewis, R. 2000. Bandage soft contact lens barrier function.. Contact Lens & Anterior Eye. (In Review)
- Lattimore, Morris R. 2000. Contact lenses in the U.S. Army attack helicopter environment: The final report. Journal of the American Optometric Association. (In Revision)
- Lippert, Thomas M., Rash, Clarence E., Hauser, James J. 2000. "A helmet-mounted laser display" in Information Display. Society of Information Displays. 16 (1): 12-16.
- Rash, Clarence E., van de Pol, Corina. 2000. Apache pilots view the world differently. FlightFax. 28 (8): 14.

U.S. Army Aeromedical Research Laboratory--Calendar Year 2000

Technical reports

- 2000-10. **Prescribing Bifocal Spectacles for U.S. Army Aviators.** (Reprint) February 2000, (ADA373632)
By Corina van de Pol, Stephen E. Morse, Brian Brown, Gordon C. Hendricks, Deborah R. Towns, Steven R. Gilreath, Nina s. Jones, and Morris R. Lattimore, Jr.
- 2000-11. **Spatial Disorientation Demonstration Flight for U.S. Army Aviators in the TH-67, UH-1 and UH-60 Helicopters.** January 2000. (ADA373633)
By Arthur Estrada, Malcolm G. Braithwaite, Siobhan M. Hoffman, and Patricia A. LeDuc
- 2000-12. **The Effects of Exercise Versus Napping on Alertness and Mood in Sleep-Deprived Aviators.** (Reprint) February 2000. (ADA375186)
By Patricia A. LeDuc, John A. Caldwell and Peggy S. Ruyak
- 2000-13. **ORBSCAN Accuracy in Measuring Corneal Surface Elevation.** May 2000. (ADA378677)
By Thomas O. Salmon, Corina van de Pol, and Nina S. Jones
- 2000-14. **The UH-60 Cockpit Airbag System: A Preliminary Anthropometric Analysis.** May 2000. (DTIC number being assigned)
By Frederick T. Brozoski, John S. Crowley, B. Joseph McEntire, Philip A. Johnson, Victor J. Cruz, and Clifton L. Dalgard
- 2000-15. **Effects of Inadvertent UH-60 Cockpit Airbag System Deployment on Flight Control.** May 2000. (ADA378682)
By Frederick T. Brozoski, Philip A. Johnson, John S. Crowley, and B. Joseph McEntire
- 2000-16. **Effect of Head-Supported Devices on Female Aviators During Simulated Helicopter Rides. Part I: Biomechanical Response.** June 2000. (DTIC number being assigned)
By Khalid W. Barazanji and Nabih M. Alem
- 2000-17. **Variability of Eye Positions with EPS-21 Sun, Wind, and Dust Goggle.** June 2000. (ADA379756)
By William E. McLean

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- 2000-18. **Feasibility of Using the AN/PVS-14 Monocular Night Vision Device for Pilotage.** June 2000. (ADA379764)
By William E. McLean and Arthur Estrada
- 2000-19. **Noise Levels in the USAARL NUH-60 (Black Hawk) Aeromed Flight Simulator.** August 2000. (ADA383436)
By Elmaree Gordon and William A. Ahroon
- 2000-20. **High Contrast Filters and Their Use in the Aviation Environment.** (Reprint) July 2000. (ADA382912)
By William E. McLean, Clarence E. Rash, and Elmar T. Schmeisser
- 2000-21. **Proceedings of the Technical Cooperative Program Workshop: Inflatable Restraints in Aviation.** August 2000. (ADA384324)
Edited by John S. Crowley and Clifton L. Dalgard
- 2000-22. **Closed Cockpit Flight in the U.S. Army: The AH-64 Experience.** (Reprint) September 2000. (ADA383970)
By Morris R. Lattimore, Jr. and John S. Crowley
- 2000-23. **Dose Uniformity of Over-the-Counter Melatonin as Determined by High-Pressure Liquid Chromatography.** August 2000. (ADA383246)
By Brian F. Prazinko, Joseph A. Sam, J. Lynn Caldwell, and Alfred T. Townsend
- 2000-24. **Impulse Noise Levels of the UH-60A/L Helicopter Cockpit Airbag System.** August 2000. (ADA384583)
By Elmaree Gordon and Barbara Murphy
- 2000-25. **Spatial Disorientation Demonstration Flight (Video).** August 2000. (DTIC number being assigned)
By Patricia A. LeDuc
- 2000-26. **Design of Interface and Algorithms for an Image Quality Tester.** August 2000. (ADA383159)
By Sheng-Jen Hsieh, Clarence E. Rash, John C. Mora, Thomas H. Harding, Howard H. Beasley, and John S. Martin

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2000-27. Communications Effectiveness When Using the Communications Earplug or Expandable-Foam Earplug With the HGU-56/P Aviator Helmet. August 2000.

(ADA384639)

By William A. Ahroon, Elmaree Gordon, Ben T. Mozo, and Lawrence C. Katz

2000-28. Test and Evaluation Report of the Physio-Control Lifepak 10-59 Defibrillator/Monitor/Pacemaker, Part A: Laboratory Testing. September 2000. (DTIC number being assigned)

By Joseph R. Licina, Khalid Barazanji, Bruce Hall, Jeaneen Lesniak, and Blake Murphree

2001-01-NP. USAARL Research Series: Spatial Disorientation 1968 – 2000. (CD) November 2000. (ADM001187)

By Patricia A. LeDuc

2001-02. The Sensitivity of Real-Time, Telemetered Electroencephalographic Data and Actual In-Flight Performance Measurement to Fatigue in a Sleep-Deprivation Paradigm. December 2000. (ADA386457)

By John Caldwell, Kecia Hall, Bradley Erickson, Karla Kubitz, Erick Labrada, and David Norman

2001-03. Is Fatigue a Problem in Army Aviation? The Results of a Survey of Aviators and Aircrews. December 2000. (ADA386488)

By John A. Caldwell, Stephen R. Gilreath, Bradley S. Erickson, and Nicholas K. Smythe

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Presentations:

- Barazanji, Khalid, Licina, Joe, Bostic, Tracie, Crowley, John. 2000. The Airworthiness Certification Evaluation (ACE) program: Present and future. Presented at the Advanced Technology Applications for Combat Casualty Care (ATACCC) 2000 Conference. Presented by Dr. Barazanji and COL Crowley, 2000 September; Fort Walton Beach, FL.
- Barazanji, Khalid. 2000. Dual certification efforts: The Army Airworthiness Certification Evaluation (ACE) program. Presented to the PMI Summit Meeting, 2000 October, Scott AFB, IL.
- Brozowski, Fred T., McEntire, Barney J., Crowley, John S., Johnson, Philip A., Alem, Nabih M. 2000. USAARL's UH-60 CABS research program. Presented to/at 71st Annual Meeting of the Aerospace Medical Association, May 15-18, 2000, 2000 May; Houston, TX.
- Caldwell, J. Lynn, Gilreath, Steven R. 2000. A survey of subjective sleep length of shiftworkers based on time of day of sleep onset. Presented to/at the 14th Annual Meeting of the Associated Professional Sleep Societies, 2000 June, Las Vegas, NV. (Poster)
- Caldwell, John A. 2000. Psychophysiological monitoring of helicopter pilots in flight: feasibility and applications. Presented to/at 14th Triennial Congress of the International Ergonomics Association, 2000 August, San Diego, CA.
- Caldwell, John A. 2000. Monitoring aviator fatigue in real-time via telemetered electroencephalographic data. Presented to/at fatigue research coordination meeting, Brooks AFB, 2000 November, San Antonio, TX.
- Caldwell, John A. 2000. Fatigue countermeasures for aviators involved in military sustained operations. Presented to/at the Fatigue Avoidance Scheduling Tool Program Review (Air Force), 2000 January, Brooks AFB, TX.
- Caldwell, John A. 2000. Fatigue effects and feasible fatigue countermeasures for the military aviator. Presented to/at School of Aerospace Medicine Flight Surgeon's Course, 2000 March, Fort Rucker, AL.
- Caldwell, John A. 2000. Efficacy of stimulants for fatigue management: The effects of modafinil and dextroamphetamine on sleep-deprived pilots. Presented to/at the Fourth International Conference on Fatigue in Transportation, 2000 March, Fremantle, WA.

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- Caldwell, John A. 2000. The sustainment of helicopter-pilot performance. Presented to/at Armed Forces Radiobiological Research Institute, 2000 March, Bethesda, MD.
- Caldwell, John A. 2000. Countermeasures for fatigue in aviation sustained operations. Presented to/at the U.S. Air Force Fatigue Avoidance Scheduling Tool Program Review, 2000 January, Brooks Air Force Base, TX.
- Caldwell, John A., Smythe, Nicholas K., Caldwell, J.L. 2000. Efficacy of 600 mg modafinil for the sustainment of aviator performance throughout 40 hours of continuous wakefulness. Presented to/at 14th annual meeting of the Associated Professional Sleep Societies, 2000 June, Las Vegas, NV.
- Caldwell, John A. 2000. A comparison between modafinil and dextroamphetamine in the treatment of alertness and performance decrements in sleep-deprived aviators. Presented to/at the APSS Cephalon-Sponsored Satellite Symposium on New Findings in the Treatment of Performance Impairing Sleepiness Associated with Sleep Loss, 2000 Jun, Las Vegas, NV.
- Caldwell, John A. 2000. Fatigue management for aviators in normal and sustained operations. Presented to/at Aviation PreCommand Course, 2000 July, Fort Rucker, AL.
- Caldwell, John A. 2000. Fatigue facts and tips for fatigue management in aviation settings. Presented to/at DynCorp Safety Class, 2000 September, Fort Rucker, AL.
- Caldwell, John A. 2000. Maximizing the performance of Army aviators in sustained operations: Dexedrine is an effective fatigue countermeasure. Presented to/at U.S. Army Science Conference, 2000 December, Baltimore, MD.
- Crowley, John S., Alem, Nabih. 2000. The USAARL Vision for Simulation support of head-supported mass research. Presented to Systran, 2000 March, Dayton, OH.
- Crowley, John S. 2000. STO Z background and research strategy. Presented to TTCP Subgroup U, TP-7 Annual Meeting, 2000 May; Dayton, OH.
- Crowley, John S. 2000. Preliminary report of results of US Army female neck pain survey study. Presented to TTCP Subgroup U, TP-7 Annual Meeting, 2000 May, Dayton, OH.

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- Crowley, John S. 2000. Report on the TTCP workshop, inflatable restraints in aviation. Presented to the TTCP Subgroup U, TP-7, Meeting, 2000 May, Dayton, OH.
- Crowley, John S. 2000. UH-60 cockpit airbag aeromedical studies. Presented to/at the International Academy of Aviation Space Medicine Meeting, 17-21 September 2000, Rio de Janeiro, Brazil, 2000 July, Rio De Janeiro, Brazil.
- Estrada, Arthur. 2000. In-Flight spatial disorientation training in the United States Army and National Guard. Presented at the Symposium on Recent Trends in Spatial Disorientation Research, 2000 November, San Antonio, TX.
- Francis, Gregory, Rash, Clarence E. 2000. Optimization of information presentation on multifunction displays. Presented to/at European Meeting of Human Factors and Ergonomics Society, November 2000, 2000 November, Maastricht, Netherlands.
- Lattimore, Morris R., Lewis, Robert B., Schallhorn, Steven N., Kaupp, Sandor E., van de Pol, Corina. 2000. A preliminary model for identifying Army Flight applicants who have been treated by photorefractive keratectomy (PRK). Presented at the Aerospace Medicine Association, 2000 May, Houston, TX.
- Lattimore, Morris R. 2000. A model for statistically analyzing corneal thickness profiles regarding presence or absence of refractive surgery. Presented to/at AsMA, May 2000, 2000, Houston, TX.
- Lattimore, Morris R. 2000. Proposed Telemedicine-Based Keratoconus Screening and Diagnosis Program. Presented to/at International Consortium on Ocular Telehealth/American Telemedicine Association Annual Meeting, 2000 May, Phoenix, AZ.
- Lattimore, Morris R. 2000. Soft Contact Lens Fluid Barrier Function. Presented to/at International Meeting on Corneal Research, 2000 July, Istanbul, Turkey.
- LeDuc, Patricia A., Gallagher, Siobhan, Johnson, Philip. 2000. The effects of sleep deprivation on spatial disorientation.. Presented at AsMA, 2000 May, Houston, TX.
- LeDuc, Patricia A. 2000. A review of U.S. Army rotary wing accidents from 1996-2000: Impact of spatial disorientation. Presented at the Symposium on Recent Trends in Spatial Disorientation Research, 2000 November, San Antonio, TX.

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- LeDuc, Patricia A. 2000. Current and Future Spatial Disorientation Research at USAARL. Presented to the Human Factors Working group at the Centre for Human Sciences DERA, 2000 November, Farnborough, UK.
- van de Pol, Corina. 2000. Refractive surgery in the military environment: Impact on Army operations and research directions. Presented to/at Federal Service Optometry Meeting, 2000 October; San Antonio, TX.
- van de Pol, Corina. 2000. USAARL update. Presented to the Armed Forces Optometric Society at Annual SECO meeting, 2000 February, Atlanta, GA.
- van de Pol, Corina, Schallhorn, Steve C., Brown, Mitch C., Tanzer, David J., Kaupp, Sandor E., Lattimore, Morris R. 2000. Effect of altitude on anterior and posterior corneal curvature: LASIK, PRK, and RK compared. Presented at the Annual meeting of the Association of Researchers in Vision and Ophthalmology, 2000 May, Ft. Lauderdale, FL.
- van de Pol, Corina, Hwang, David G., Klein, Stanley A. 2000. Variation in corneal power affects vision after refractive surgery. Presented at the American Optometric Association Annual Conference, 2000 June, Las Vegas, NV.

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Technical Memoranda:

Subject: Health hazard assessment report of whole-body vibration for the vibratory self-propelled roller system

Customer: US Army CHPPM

Subject: Health hazard assessment report on the M915A3 truck tractor

Customer: US Army CHPPM

Subject: Health hazard assessment report on the Wolverine Heavy Assault Bridge (HAB) system

Customer: US Army CHPPM

Subject: IHAR on the Bobcat Model 763 skid steer loader

Customer: US Army CHPPM

Subject: The Technical Cooperation Program: CABS Conference

Customer: The Technical Cooperation Program

Subject: Review of STANAG 3950-AI

Customer: ASC/ENFC

Subject: Prelim review of proposal to man-mounting the Heeds compressed air bottle in Comanche cockpit

Customer: AMCOM

Subject: Upper extremity injury risk during deployment of the enhanced UH-60 lateral airbag

Customer: PM ACIS

Subject: Evaluation of injury potential in static deployment OH-58D cockpit airbag system

Customer: PM ACIS

Subject: Evaluation of injury potential in static deployment OH-58D cockpit airbag system

Customer: PM ACIS

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**Subject: Expeditious evaluation of clear laser eye protection-infrared spectacles
Customer: PM-ACIS**

**Subject: Informal evaluation of the panoramic night vision
Customer: NV/ESD**

**Subject: Panoramic night vision goggles in UH-60 flight simulator
Customer: NV/ESD: ATTN: AMSL-RD-NV-ASB**

**Subject: ANVIS Class A compatibility analysis of spectral data supplied by two vendors
Customer: AVRDECR, Redstone Arsenal**

**Subject: Analysis of the chromaticity and neutrality specification for the Military Eye
Protection System (MEPS)
Customer: US Army Natick RD&E Center**

**Subject: Evaluation of effects of the M48 chemical-biological aircraft mask on field of
view with the helmet display unit (HDU) for the AH-64 Apache helicopters
Customer: PEO-Aviation**

**Subject: Evaluation of 7-notch laser eye protective spectacles and visor
Customer: PM-ACIS**

**Subject: Resolution versus eyepiece luminance for two types of ANVIS
Customer: Air Force Research Laboratory/Human Engineering Program**

**Subject: ALSERP case number 911
Customer: US Army Safety Center**

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Teaching Services:

Subject: Pre-command course briefing
Customer: USASAM

Subject: Management of fatigue with behavioral and pharmacological measures
Customer: Flight Surgeons Course

Subject: Fatigue management for aviation sustained operations
Customer: Aviation PreCommand Course

Subject: Effects of fatigue and fatigue countermeasures for aviation personnel
Customer: USASAM

Subject: Fatigue management in aviation settings
Customer: USASAM Aviation Psychology Course

Subject: Fatigue management in aviation
Customer: USASAM

Subject: Situational awareness, spatial disorientation, and fatigue.
Customer: Idaho Air National Guard

Subject: HushKit
Customer: Oregon Aero

Subject: ASOC presentation
Customer: USASC

Subject: ALSERP
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Subject: Research at USAARL
Customer: Armed Forces Optometric Society

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