Aerospace Human Factors Research Division

AAM-500

Civil Aerospace Medical Institute

Greetings,

Welcome to the Aerospace Human Factors Research Division. Our division conducts field and laboratory research in supporting the performance of front-line aviation personnel, including pilots, air traffic controllers, mechanics, dispatchers, avionics (technical operations) technicians, flight attendants, and ramp workers. We have 39 employees comprised of research psychologists, research technicians, statisticians, engineers, and computer specialists. Our research activities include:

- maximizing human performance under various conditions
- analyzing and mitigating human errors
- conducting agency workforce optimization
- assessing the impact of advanced automated systems on aviation/ aerospace personnel requirements and performance
- evaluating human factors aspects of performance changes associated with use of advanced multifunction displays controls in general aviation and air traffic control
- evaluating the psychophysiological effects of workload and shift work on job proficiency and safety in aviation-related human-machine systems

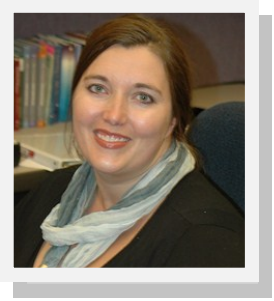
Our research is accomplished within two research laboratories, the Flight Deck Human Factors Research Laboratory and the National Airspace System (NAS) Human Factors Safety Research Laboratory. This brochure highlights our people, facilities, and accomplishments.

On a personal note, I am currently acting as the Deputy Director of our parent organization, the Civil Aerospace Medical Institute. Dr. Carla Hackworth is acting capably in my stead. Again welcome!

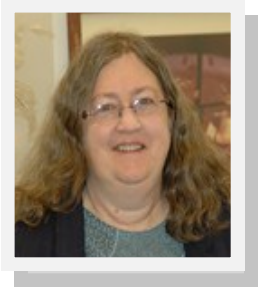
Thomas R. Chidester, Ph.D .
Manager, Aerospace Human Factors
Research Division

Aerospace Human Factors Research Division Management Team

Carla Hackworth, Ph.D.
Acting Division Manager, AAM-500
Aerospace Human Factors Research Division



Katrina Avers, Ph.D.
Acting Branch Manager,
AAM-510
Flight Deck Human Factors
Research Laboratory



Carol A. Manning, Ph.D.
Branch Manager,
AAM-520
NAS Human Factors Safety
Research Laboratory

EXCELLENCE IS OUR PROMISE

Our Vision: The Aerospace Human Factors Research Division, through sustained excellence, is a world leader in all aspects of civil aerospace human factors research, constantly enhancing global aerospace safety.

The Aerospace Human Factors Research Division consists of two laboratories:

Flight Deck Human Factors Research Laboratory: This laboratory conducts applied human factors research on causal factors associated with aviation accidents and issues involving the design, operation, and maintenance of flight deck equipment in the National Aerospace System (NAS). Research includes assessing advanced technologies, measuring flight performance and risk, evaluating pilot/controller information transfer, determining the effects of stressors on human performance, identifying human factors involved in accidents and incidents, and quantifying the effects of advanced displays, procedures, and task design on pilot performance.

NAS Human Factors Safety Research Laboratory: This laboratory conducts an integrated program of research on the relationship of factors concerning individuals, work groups, and organizations as employees perform their jobs. Research is focused on improved person-job fit through training and changes to technology. Employees in this laboratory may conduct job analyses, develop or evaluate human factors assessment methods such as tests and questionnaires, and develop individual and group job performance metrics. We also perform research on the impacts of advanced technologies on ATCS performance, information transfer and human/machine design by utilizing real-time ATC simulation capabilities to investigate human factors operations concepts.

Our areas of expertise include:

- Documenting human capabilities and limitations
- Developing mitigation strategies for overarching limitations (i.e., perception, sleep & fatigue, memory capacity, control forces)
- Guiding design of controls, displays, and systems
- Developing training
- Monitoring operations for emerging human-performance problems

Number of activities accomplished each year, on average:

20	Technical reports & peer-reviewed journal articles
23	Domestic & international scientific presentations
11	Electronically published media
11	Grants or contracts awarded
14	Completed software programs
6	Proceedings articles and white papers
5	Surveys
6	Approved IRB protocols
12	Teaching events or workshops held
63	Served on committee or workgroup

SAFETY IS OUR PASSION

The mission of the Aerospace Human Factors Research Division is to promote civil aerospace safety through excellence in aerospace human factors research.

Important tasks we have accomplished to contribute to aviation safety are:

- Fatigue research
  - Pilots, controllers, maintenance personnel, and flight attendants
  - Enabled duty/rest policy for Air Traffic Controller Specialists (ATCSs) and regulations for pilots
- ATCS performance
  - Operational Error assessment using SATORI, OE database
  - ATCARS laboratory for simulation of radar and tower air traffic control
  - Situational Judgment test for tower controllers
- Pilot performance
  - Quantifying effects of advanced displays, procedures, and task design, measuring performance and risk
- Specialized survey assessments
  - Employee Attitude Survey, assessments of Office of Aerospace Medicine (OAM) medical certification program, program evaluation
- Air traffic controller selection
  - Validation of selection tests
  - Color vision
  - Assistance with Professional Air Traffic Controller Organization strike recovery, current surge in controller hiring

Today's Research Requirements:

- Aviation Safety
  - Advanced automation
  - Synthetic vision
  - Jet upset prevention, detection, recovery
  - Equipment design, evaluation, operational approval guidance
  - Human Factors risk management in maintenance

- Air Traffic & Technical Operations
  - Standardized Scenario Development and Performance Metrics
  - Improving ATCS training
  - Strategic job analysis and job analysis database
  - Automation usage in maintenance of national airspace systems
  - Advanced technology in technical training

Tomorrow's Challenges:

- FAA Strategic Priorities and Priority Initiatives
  - Risk-based decision making
  - Lay the foundation for the NAS of the future
  - Enhance global leadership
  - Workforce of the future

- Nearer term requirements
  - Unmanned Aircraft Systems (UAS) Human Factors considerations
  - Rotorcraft safety

AEROSPACE HUMAN FACTORS RESEARCH DIVISION TIMELINE

1960s

Initial CARI report assessed factors predicting longitudinal performance in air traffic control specialists.

Vertigon used to familiarize thousands of pilots with spatial disorientation as part of CAMI's educational training for pilots.

Multiple Task Performance Battery served as a synthetic work task to assess the effects of various stressors on performance.

1970s

Several studies were initiated to investigate the effects of sonic booms on sleep and startle responses.

Psychologists and physiologists collaborated to assess stress in air traffic control specialists and found that controllers were not uniquely stressed.

1980s

Support for the ATC strike recovery following firing of 11,345 controllers by U.S. President Ronald Reagan.

Development and conduct of the first workforce-wide FAA Employee Attitude Survey to assess job satisfaction and employee burnout.

Aviation Psychology Laboratory acquired separate branch status (from the Aeromedical Research Branch) as the Human Resources Research Branch.

1990s

CAMI-Academy-Air Traffic collaboration to develop and validate the AT-SAT test.

Color vision tests were developed and validated to screen terminal and en route air traffic control applicants.

Development of the Systematic Air Traffic Operations Research Initiative –the capability to analyze the dynamics associated with ATC operational errors and incidents in air route traffic control centers.

Development and integration of a Basic General Aviation Research Simulator and a reconfigurable Advanced General Aviation Research Simulator to support a new program of general aviation human factors research.

2000s

Development of the HFACS taxonomy

The Human Resources Research Branch became the Human Resources Research Division which then became the Aerospace Human Factors Research Division.

Development and implementation of the Air Traffic Control Advanced Research Simulator.

Initiated program of research on Flight Attendant fatigue, which led to extensive survey and field study.

Initiated program of research on civilian unmanned aircraft systems and developed medical certification requirements for Unmanned Aircraft System (UAS) operators.

2010s

The general aviation human factors research program capabilities were expanded in 2012 with the introduction of a very light jet simulator with a sophisticated 225-degree visual system.

INTEGRITY IS OUR TOUCHSTONE

We conduct research activities in response to requirements generated through the Aviation Safety (AVS) and Air Traffic Organization (ATO) Research, Engineering, and Development requirement processes. These processes result in sponsor-driven research being brokered to the division by the FAA NextGen Human Factors Division (ANG-C1). This means that we accomplish work that assists operational units within the agency to answer human factors questions necessary to support or enhance certification, development, administrative, or operational decisions.

As a division within the FAA Aviation Safety organization, AAM-500 conforms to ISO-9001:2008 standards for Quality Management.

All our research must be approved by an Institutional Review Board whose purpose is to ensure human participants are protected from physical or psychological harm.

We comply with the American Psychological Association's Ethical Principles of Psychologists and Code of Conduct.

Work within the division is accomplished under two processes: involvement in organizational/scientific workgroups and research knowledge.

Involvement in Organizational/Scientific Work Groups

We participate in a variety of functions within scientific and technical organizations or work groups, such as serving in leadership roles, organizing and chairing scientific sessions for meetings, acting as a peer reviewer, serving as a consulting editor for a scientific journal, participating with a group in writing white papers, participating on a committee to accomplish certain activities related to an organization, or acting as chairs of committees or officers in an organization.

We also collaborate with international scientific or governmental organizations to share information about aerospace human factors activities and develop alliances that contribute to advances in science or aviation safety.

Some of the work groups we participate in are:

- Aerospace Medical Association
- Aerospace Human Factors Association
- Human Factors & Ergonomic Society
- American Psychological Association
- Association for Aviation Psychology
- International Symposium on Aviation Psychology
- Society of Industrial and Organizational Psychologists

Research Knowledge

The research knowledge process ensures all research is peer-reviewed, authorized, and accomplishes organizational needs in accordance with ethical guidelines. Our research knowledge products include:

journal article	technical report
book	book chapter
book review	literature review
display evaluation	abstract
proceedings paper	lecture
presentation	demonstration
advisory document	magazine/bulletin article
opinion/consultation	white paper
laboratory procedure development	response to query/ consultation
data analysis	

PEOPLE ARE OUR STRENGTH

We are a team of professionals who are committed to aviation safety.

We employ experts in human factors and engineering with diverse skills and abilities in optimizing human performance for safety.

Our Teams

Color Vision and Advanced Lighting Technology Team | Fatigue in Aviation Team

Training and Performance (TAP) Lab/Team | ATCARS Lab/Team | EEG Team

Tech Ops Research Team (TORTe) | ATC Succession Planning Team

Maintenance Human Factors Team | Organizational Assessment Team

General Aviation, Unmanned Aircraft Systems, and Rotorcraft Simulation Team

Information Technology and Program Management Support Team

These organizations direct our research:

Human Factors Division, ANG-C1	Flight Standards Service, AFS-1
Aircraft Maintenance Division, AFS-301A	UAS Integration Office, AFS-80
Safety Analysis Branch, AAI-220	ATO Safety and Technical Training, AJI-0
Flight Standards Service – Air Transportation Division, AFS-200	FAA Academy, AMA-1
Aircraft Certification Service, ACE-114	CSTA Human Factors Maintenance, AIR-100
Weather Technology in the Cockpit, ANG-C64	Technical Training, AJI-2
Transport Airplane Directorate, ANM-111	Management Services, AJG-0

We collaborate with several organizations to accomplish our research:

KeyBridge Technologies Inc.

ZedaSoft

KONGSBERG

NASA

College of Engineering The University of Oklahoma

American Institutes for Research

Rockwell Collins Building trust every day

PCMS

Raytheon

Manpower

META/R

University of Dayton

SAAB

HCM

Xyant

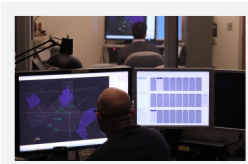
Capital Aviation Inc.

ATSC LLC Atmospheric Technology Services Company

INNOVATION IS OUR SIGNATURE

We have six simulators, a color vision laboratory, an EEG laboratory, and a computerized testing laboratory we use to conduct innovative and cutting edge research that supports FAA safety goals.

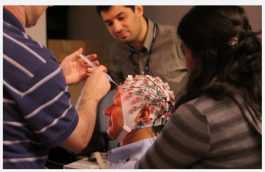
ATCARS – the Air Traffic Control Advanced Research Simulator provides two test stations for en route radar and radar associate positions. A lower-fidelity tower simulation is also available.



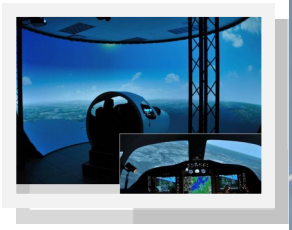
AGARS – the Advanced General Aviation Research Simulator is a reconfigurable fixed-based device allowing simulation of multiple aircraft types and a variety of missions.

EPS – the Envelope Protection Simulator is a Cessna-182 airframe and flight model used to evaluate parameters associated with an active envelope protection system. Researchers can vary the boundaries of the warning envelope and the characteristics of the auditory, visual, and tactile warnings/guidance provided by the system.

EEG Laboratory – The 64-channel electroencephalography (EEG) system provides high-density recordings suitable for use in identifying event-related potentials (ERP) and independent components (IC) associated with pilot and controller cognitive performance within AGARS and ATCARS.

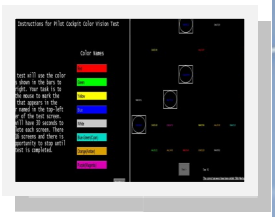


Very Light Jet—the Frasca Flight Simulator Training Device features an accurate Cessna Mustang jet flight deck with an actual Garmin G 1000 avionics suite. It was built with digital electric control loaders and high-fidelity, digital surround system that accurately replicates flight, engines, system and environmental sounds.



VGARS—the Vertical General Aviation Research Simulator provides a basic experimentation platform for helicopter operations.

Color Vision Laboratory—the color vision lab conduct experiments to establish and maintain appropriate color vision for pilots and air traffic controllers. The lab contains essential equipment for measuring ambient light, color chromaticity characteristics, and human color vision.



UAS— the UAS control station simulator provides for manual, vector, and waypoint control of any aircraft model that can be hosted within Microsoft Flight Simulator 2004.

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Our Core Beliefs

We foster creativity and vision to provide solutions beyond today's boundaries.

Our success depends on the respect, diversity, collaboration, and commitment of our workforce.

We work so that all air and space travelers arrive safely at their destinations.

We perform our duties honestly, with moral soundness, and with the highest level of ethics.

We seek results that embody professionalism, transparency, and accountability.