

Research Development and Human Factors Laboratory

In the Aviation Safety Research Act of 1988 (Public Law 99-591), the United States Congress mandated that the Federal Aviation Administration (FAA) make a special effort to focus on human factors in civil aviation.

In response to this mandate, the FAA developed the Research Development and Human Factors Laboratory (RDHFL) at the FAA William J. Hughes Technical Center. The RDHFL, which became operational on November 2, 1992, provides a state-of-the-art facility where aviation-related human factors issues are studied in a controlled scientific environment.

The mission of the RDHFL is to perform research to acquire a better understanding of the part that a human plays in current and future aviation systems. This research environment is specifically designed to measure and assess human performance and workload. Additionally, the RDHFL investigates how new technologies should be integrated into air traffic control (ATC) and airway facilities (AF) systems.

RDHFL FACILITY DESCRIPTION

The RDHFL is a multipurpose facility that is staffed by people with backgrounds in engineering, mathematics, computer science, and psychology. It consists of approximately 10,000 square feet of laboratory space and 6,000 square feet of office space. The laboratory includes four experiment rooms, which can be used separately or together. Each experiment room has its own Experiment Operator Station (EOS). Video and audio links allow communication among

the four experiment rooms and between the experiment rooms and the RDHFL briefing room. While an experiment is in progress, observers can unobtrusively monitor the experiment in either the EOS or the briefing room.

The RDHFL is designed to be flexible and expandable. Most physical structures (e.g., movable walls), voice and electronic communications, computers, and system peripherals are modifiable and reconfigurable. Voice communications and data networks link the RDHFL with other simulation laboratories at the Technical Center and other research facilities. Outside communications links can be easily integrated with the lab networks to meet the needs of an experiment.

The RDHFL also contains specialty areas. A blackroom with an audiometric booth provides the capability for conducting perceptual and display evaluation studies that require precisely controlled lighting and acoustic environments. A virtual reality room is used to aid in the development of future systems. This capability has been used to explore ergonomic design issues related to the Display System Replacement program and the next generation Maintenance Monitoring and Control Facility. Finally, a General Purpose Engineering area provides specialized engineering and integration support for experiments and simulations. Experienced in-house engineers and scientists routinely develop customized hardware and software and integrate new systems and capabilities into the RDHFL. A recent development in the RDHFL is the capability to perform real-time oculometry studies.





System Efficiency

KEY CAPABILITIES

The three primary human factors research capabilities at the RDHFL are computer-human-interface (CHI) rapid prototyping, the ability to perform real-time ATC simulations, and sophisticated human performance data collection and analysis capabilities. CHI rapid prototyping is a cost effective, iterative approach in which a user interface can be developed quickly, evaluated, modified, and reevaluated. The RDHFL has commercially available, as well as custom built, prototyping tools that can simulate the look and feel of an interface prior to actual software development. RDHFL scientists are currently developing the capability to integrate ATC CHI prototypes into end-to-end and part-task ATC simulations.

The RDHFL can perform real-time ATC simulations of any en route or terminal air space in the country. Laboratory researchers have also developed generic airspaces for conducting experiments that can be generalized. The ATC simulator can present realistic air traffic scenarios while collecting the objective and subjective data required to assess an air traffic controller's performance and workload. Once the prototyping capability is integrated with this simulation capability, the RDHFL will be able to evaluate the performance of new systems prior to their physical development. To measure complex ATC and AF performance and workload, the RDHFL has developed sophisticated data collection and analysis capabilities. Each experiment room has video and audio recording equipment

that can be controlled from the EOS. In addition, the computers that simulate ATC or AF operations or control the equipment under test employ custom data collection software. A central time source is used to synchronize the audio, video, and computer data collection. Once the data are collected, a multimedia data analysis system can replay all audio, video, and computer data simultaneously so that the viewer can correlate objective performance data (e.g., reaction times, errors) with any audio or video variable of interest (e.g., the introduction of an audible alarm; a verbal command from a supervisor). Additional postprocessing software is used to reduce the data into aggregate variables.

The RDHFL has performed numerous experiments on human factors issues affecting the performance of pilot, air traffic controller, and airway facilities maintenance work forces. This research is helping to decrease human error through user-centered evaluation activities and by an integrated consideration of the role humans play in the increasingly automated National Airspace System.

For more information on the Research Development and Human Factors Laboratory, contact:

Federal Aviation Administration
William J. Hughes Technical Center
Atlantic City International Airport, NJ 08405
Phone: (609) 485-5380
www.tc.faa.gov/hfl