AAR-100

Human Factors Newsletter # 04-05

February 21 2004 – March 5, 2004

Technical Information: *Language Error in Aviation Maintenance*, Year Two Interim Report, C.G.Drury and J. Ma, University at Buffalo, The State University of New York, January 2004.

In a 2001 report to the secretary of Transportation by the Aircraft Repair and Maintenance Advisory Committee, the FAA raised many issues concerning outsourcing of maintenance to foreign repair stations in considering changes to the domestic and foreign FAR Part 145. They recommended that: "The FAA should establish a method for determining whether language barriers result in maintenance deficiencies".

This project is a direct response to these concerns that non-native English speakers, in repair stations in the USA and abroad, may be prone to an increased error rate that could potentially affect airworthiness.

The first two years of this project developed seven scenarios of language error based on visits to sites in the USA and UK. In these two years, the team also provided a model for these unique communication errors, based on the communications literature and analysis of several databases. These included the NASA Aviation Safety Reporting System error database and responses to a questionnaire on language skills provided by a major manufacturer. Our analyses showed that language skills varied (as expected) by world region, and that not all sites with lower language skills translated documents into the native language.

In year two, we have taken the language error scenarios developed in year one, and used them as the basis for designing questionnaires to determine the frequency of these scenarios, how they can arise, and what interventions are pursued to prevent errors from propagating through the system. As we begin our data collection, we will use these questionnaires at each site we visit to build a comprehensive database for analysis in year three.

The interventions experiment has also been designed and tested on two groups of participants: English-speaking maintenance personnel, and Chinese-speaking engineering graduate students. Neither is the final target group, but the methodology has been verified before on-site data collection. The main comprehension task takes less than half an hour to complete, while the

other measures such as the English reading ability test and the rating scales together take another 15 minutes or so. Because many people can be tested together, we can be efficient in data collection at each site. At this stage, the small sample sizes are precluding and significant effects, so these pilot studies are being used for testing the methodology, training the experimenters, and providing an English-speaking baseline condition.

After having one data collection visit cancelled, and encountering some difficulties with other foreign sites post "9-11", we are now planning data collection using our contacts in China and Taiwan. Data collection at these sites will take place in March and April 2004, with any other sites coming in summer 2004.

Point of Contact: W. Krebs, AAR-100

Tower Siting: Upon request, human factors expertise was provided in the revision and update of FAA Order 6480.4, Airport Traffic Control Tower Siting Criteria. This order was originally published in 1972. Capitalizing on recent research and assistance rendered for the siting of the Deer Valley (AZ) ATCT, recommendations were provided on concepts and analysis methods to address object obscuration, object discrimination, two-point lateral discrimination, and tower cab design human factors considerations. Graphics, formulae, and examples were provided to clarify the use of human factors concepts. The order is to be staffed for review in the near future. (Kip Krebs, Glen Hewitt, Larry Cole, AAR-100)

Human Factors Design Standard (HFDS): ACB-220 continues to review and document research in the emerging technologies domain for the Interaction Device Chapter of the HFDS. The research of primary sources for the revising and rewriting of the chapter on Interaction Devices has grown to over 500 research articles and a few books which are currently being reviewed and placed in a spreadsheet that can be sorted by keyword, author, abstract, experimental procedures and conclusions. Information from these primary sources is being incorporated into the Interaction Device chapter. Any information which appears to conflict is being investigated further for clarification to ensure that references are accurate and up-to-date. The outline for the Interaction Devices chapter has been developed and continues to be refined to ensure that complete information is given in a well-organized manner and documented for each device. Discrepancies in other chapters in the HFDS, specifically Chapter 4, have been found and are currently being investigated and corrected. (E. Stein, WJHTC)

EAS: In February, the FAA Employee Attitude Survey (EAS) 2003 Line of Business, Major Office, and Facility summary reports (around 1,300) were delivered via CD to the EAS points-of-contact. (C. Hackworth, CAMI)

REDAC: The Research, Engineering and Development Advisory Committee (REDAC) Human Factors Subcommittee held its meeting at the William J. Hughes Technical Center's Research and Development Human Factors Laboratory during the first week of March. The meeting went very well, and the Subcommittee identified valuable areas for future human factors research that will add to the quality of NAS Modernization in line with the Flight Plan to the Future. (T. McCloy, AAR-100)

HFACS: Dr. Scott Shappell and Ms. Cristy Detwiler participated in the Alaska Air Carriers Association 38th Annual Conference and Tradeshow in Fairbanks, Alaska, March 3-5, 2004. A presentation was made concerning results of the Human Factors Analysis and Classification System (HFACS) analysis of Alaska general aviation accidents and the Human Factors Intervention Matrix. Meetings were held with Mr. Pat Poe (Alaska Regional Administrator), Mr. John Halinan (Alaska Capstone Coordinator), and Mrs. Angela Elgee (AAL) regarding CAMI's role in their commercial and general aviation safety programs. A meeting with Mr. Jerry Dennis (Medallion Foundation) also took place. (S. Shappell, CAMI)

FAA/EUROCONTROL R&D Committee Meeting: The FAA is hosting the 28th meeting of the R&D Committee in Miami, FL. Joan Bauerlein is co-chairing the meetings with her EUROCONTROL counterpart, Mr. Jan Van Doorn. Approximately 40 attendees from the FAA, NASA, JPDO, EUROCONTROL, and the European Commission will review the progress of 15 current action plans and discuss the creation of two new action plans. They will also review the progress towards the establishment of a single FAA/EUROCONTROL Memorandum of Cooperation (MOC) to include both R&D and Operations. Topics for discussion regarding this new MOC will include the pending resolution of a mutually acceptable liability clause as well as the adoption of a new MOC/Annex/Action Plan framework and management structure. The FAA and EUROCONTROL signed a MOC in 1992 that provided the legal framework for joint civil aviation R&D. In 1996, the FAA/EUROCONTROL R&D Committee was established to develop action plans for furthering R&D of mutual interest and benefit to both organizations by leveraging limited personnel and monetary resources. The MOC requires at least an annual review of the joint work. The Committee conducts two video-conferences and two face-to-face meetings alternating between Europe and the U.S. each year. (T. Kraus, AAR-200)

REDAC: The Research, Engineering and Development Advisory Committee (REDAC) Air Traffic Services Subcommittee will meet in Washington, DC, on March 16-18. The Airports Subcommittee met on March 9-10; the Aircraft Safety Subcommittee met on March 9-10; the Environment and Energy Subcommittee met on March 10-11; and the Human Factors Subcommittee met on March 2. Established in 1989 by a requirement in the Aviation Safety Research Act, the REDAC:

- Is composed of a maximum of 30 members representing corporations, universities, associations, consumers, and government agencies. Members serve two year terms
- Has 6 standing subcommittees: Air Traffic Services, Airports, Aircraft Safety, Human Factors, Environment and Energy, Security
- Advises the FAA Administrator on research and development issues
- Provides recommendations on the FAA's research portfolio and budget priorities
- Coordinates the FAA's research, engineering and development activities with industry and other government agencies
- Considers aviation research needs in capacity, system safety, aircraft safety, human factors, aeromedical research, aviation security, future technology, and the national airspace system--present and future.

Point of Contact: T. Kraus, AAR-200

National Aviation Research Plan: The 2004 National Aviation Research Plan is currently being distributed and can be found on-line at http://172.27.70.66/nasiHTML/RED/narp04/index1.html.

More information on human factors research can be found at the FAA Human Factors (AAR-100) web site: http://www.hf.faa.gov

Mark D. Rodgers
FAA (AAR-100)

CALENDAR

March 8-11, 2004 – SAE World Congress, Cobo Hall, Detroit, MI
http://www.sae.org/congress/index.htm

March 11-13, 2004 – International Women in Aviation Conference, Reno Hilton Hotel, Reno, NV http://www.wai.org

March 15-17, 2004 – HAI Heli-Expo 2004, Las Vegas, NV *http://www.heliexpo.com*

March 15-17, 2004 – 16th Annual European Aviation Safety Seminar, Barcelona, Spain
http://www.flightsafety.org/eass04_cfp.html

March 22-24, 2004 – Eye Tracking Research and Applications Symposium, Menger Hotel, San Antonio, TX *http://www.e-t-r-a.org/*

March 22-25, 2004 – HPSAA II Conference, Human Performance, Situation Awareness, and Automation Technology, hosted by Embry-Riddle Aeronautical University and the University of Central Florida, Hilton Oceanfront Resort, Daytona Beach, FL
http://faculty.erau.edu/vincenzd/hpsaa

March 23-26, 2004 – 4th International Workshop on Smart Appliances and Wearable Computers, Tokyo, Japan *http://www.unl.im.dendai.ac.jp/IWSAWC/*

March 25-26, 2004 – FAA Aviation Forecast, Wash, DC *mailto:linda.baranovics@faa.gov*

March 29-April 1, 2004 – 47th Annual Aircraft Electronics Association Trade Show, Paris Las Vegas Hotel, Las Vegas, NV
http://www.aea.net/PressRoom/AEAConvention0104.pdf?Category=8

April, 2004 – SAE General Aviation Technology Conference and Exhibition, Century II Convention Center, Wichita, *KS* http://www/sae.org/calendar/aeromtgs.htm

April 13-19, 2004 – Sun 'n Fun, Lakeland Linder Regional Airport, Lakeland, FL *http://www.sun-n-fun.org/content/*

April 18-21, 2004 – FAA Worldwide Airport Technology Transfer Conference, Hilton Atlantic City Hotel, Atlantic City, NJ *http://www.airtech.tc.faa.gov/att04/*

April 20-22, 2004 – SAE General Aviation Technology Conference and Exhibition, Century 21 Convention Center, Wichita, KS *http://www.sae.org/calendar/aeromtgs.htm*

April 20-22, 2004 – Air Transport Association MRO Conference and Exhibition, Cobb Galleria, Atlanta, GA *http://www.AviationNow.com/conferences*

April 20-22, 2004 – General Aviation Technology Conference& Exhibition, Century Two Convention Center, Wichita, KS General Aviation Technology Conference & Exhibition

April 21-23, 2004 – Phoenix Sky harbor International Aviation Symposium 2004, J.W. Marriott Desert Ridge Resort, Phoenix, AZ *http://www.phxskyharbor.com*

April 22-23, 2004 – 4th Air Cargo Economics Conference, Prague, Czech Republic *http://euroavia.com*

April 24-29, 2004 – CHI 2004, Conference on Human Factors in Computing Systems, Vienna, Austria *http://www.acm.org/sigchi/chi2004/*

April 25-28, 2004 – SAE Cabin Safety Technical Committee Meeting, Oklahoma City, OK mlemank@sae.org

April 27-29, 2004 – 49th Annual Corporate Aviation Safety Seminar, Tucson, AZ *http://www.flightsafety.org/cass04_cfp.html*

May 3-6, 2004 – SAE Aircraft Oxygen Equipment Committee, Anchorage, AK mlemank@sae.org

May 3-6, 2004 – 75th Annual Scientific Meeting of the Aerospace Medical Association, Egan Convention Center, Anchorage, AK http://www.asma.org/

May 6-8, 2004 - AHS International 60th Annual Forum and Technology Display, Virginia Beach, VA. Contact Staff@vtol.org

May 10-12, 2004 – Royal Aeronautical Society 10th AIAA CEAS Aeroacoustics Conference, Manchester Town Hall, UK *http://www.aerosociety.com/homepage.asp*

May 10-13, 2004 – DOD TAG-51, Atlantic City, NJ *http://hfetag.dtic.mil/meetschl.html*

May 11-13, 2004 – SAE SEAT – Aircraft Seat Committee, Savannah, GA mlemank@sae.org

May 17-18, 2004 - The Technical Cooperation Program, Human Resources and Performance Group (HUM)-TP9, Human Systems Integration Workshop, Ottawa, Ontario, Canada http://hfetag.dtic.mil/news.html

May 18-20, 2004 – Aviation Industry Week, Las Vegas Convention Center, Las Vegas, NV *http://www.AviationIndustryWeek.com*

May 23-26, 2004 – Tenth International Conference on Mobility and Transport for Elderly and Disabled People, Hamamatsu, Japan http://trb.org/calendar/

May 25, 2004 - Human Factors Integration Symposium, MoD, Abbey Wood, Bristol, UK http://hfetag.dtic.mil/docs/HFI-Symposium-Flyer.doc

May 26-27, 2004 – Royal Aeronautical Society Conference – Flight Simulation 1929-2029, A Centennial Perspective, London, UK *http://www.aerosociety.com/homepage.asp*

June 7-11, 2004 – 2004 US/Europe International Aviation Safety Conference (FAA/JAA), Philadelphia, PA *http://www.jaa.nl/conference/20th/closing.html*

June 15-17, 2004 – SAE Digital Human Modeling for Design and Engineering Meeting, Oakland University, Rochester, Michi*gan* *http://www.sae.org/calendar/aeromtgs.htm*

July 8, 2004 - Human Factors Tool Symposium, Orlando, Florida http://hfetag.dtic.mil/docs/NASA-Tools-Workshop.doc

July 19-25, 2004 – Farnborough International 2004, Farnborough Aerodrome, England *http://www.farnborough.com/*

July 22-August 2, 2004 – 52nd Annual EAA AirVenture Fly-In, Wittman Field, Oshkosh, WI EAA AirVenture Oshkosh 2004

July 27-August 2, 2004 – 52nd Annual AirVenture, Oshkosh, WI http://airventure.org/

July 28 – August 1, 2004 – 112th Convention of the American Psychological Association. Honolulu, Hawaii http://www.apa.org/convention

August 1-4, 2004 – Designing Interactive Systems, Cambridge, MA *http://www.sigchi.org/DIS2004/*

September 8-9, 2004 – Civil Aviation Safety Symposium 2004, Westin Hotel Galleria, Dallas, TX *http://www.asdnet.org/cass/default.htm*

September 20-24, 2004 – Human Factors and Ergonomics Society 48th Annual Meeting, Sheraton New Orleans Hotel, New Orleans, LA http://www.hfes.org/

September 27-29, 2004 – SAFE Association 42nd Annual Symposium, Grand America Hotel, Salt Lake City, UT *http://www.safeassociation.com/symposium.htm*

September 29 – October 1, 2004 – 2004 International Conference on Human Computer Interaction (HCI-Aero), Toulouse, France
http://www.eurisco-international.com/hci-aero2004.

October, 2004 – 18th Airbus/JetBlue Human Factors Symposium, New York City, NY
http://www.airbus.com/customer/events.asp

October 4-7, 2004 – SAE SEAT – Aircraft Seat Committee Meeting, Albuquerque, NM
mlemank@sae.org

October 12-14, 2004 – Shared Vision of Aviation Safety Conference, San Diego, CA
http://www.aviationsafetyconference.com/index2.html

October 12-14, 2004 – 57th Annual Business Aviation Association Meeting and Convention, Las Vegas County Convention Center, Las Vegas, NV *http://web.nbaa.org/public/cs/amc/*

October 18-19, 2004 – National Academies Institute of Medicine Annual Meeting, National Academy of Sciences, Washington, DC *http://wwwsearch.nationalacademies.org/*

October 21-23, 2004 – Aircraft Owners and Pilots Association Expo 2004, Long Beach Convention and Entertainment Center, Long Beach, CA *http://www.aopa.org/expo/2003/virtual/*

October 23-27, 2004 – NordiCHI 2004, Tampere, Finland *http://www.cs.uta.fi/nordichi2004/*

October 25-28, 2004 – SAE S-9 Cabin Safety Technical Committee Meeting, San Diego, CA
mlemank@sae.org

October 25-28, 2004 – DoD Maintenance Seminar and Exhibition, Hilton Americas, Houston, TX *http://www.sae.org/calendar/aeromtgs.htm*

January 9-13, 2005 – TRB 84th Annual Meeting, Washington, DC http://trb.org/calendar/

April 11-15, 2005 – SAE 100th Anniversary World Congress, Cobo Hall, Detroit, MI
http://www.sae.org/congress/about/news/congressdates.htm

May 9-12, 2005 - 76th Annual Scientific Meeting of the Aerospace Medical Association, Kansas City, MO *http://www.asma.org/*

August 18-21, 2005 - 113th Convention of the American Psychological Association, Wash, DC
http://www.apa.org/convention

September 26-30, 2005 – Human Factors and Ergonomics Society 49th Annual Meeting, Royal Pacific Resort at Universal Orlando, Orlando, FL *http://hfes.org/meetings/menu.html*

October 24-25, 2005 – National Academies Institute of Medicine Annual Meeting, National Academy of Sciences, Washington, *DC http://wwwsearch.nationalacademies.org/*

January 22-26, 2006 – TRB 85th Annual Meeting, Washington, DC http://trb.org/calendar/

Note: Calendar events in Italics are new since the last Newsletter

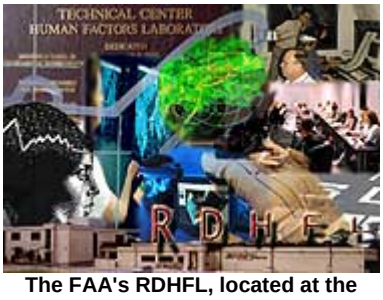
Comments or questions regarding this newsletter?
Please contact Bill Berger at (334) 271-2928
or via e-mail at bill.ctr.berger @faa.gov

Federal Laboratory Consortium Article

Human Factors in Human Aviation

12/11/2003

Exciting new research is taking place to achieve a better understanding of the integral role human factors plays in both current and future aviation systems.



The FAA's RDHFL, located at the William J. Hughes Technical Center in Atlantic City, N.J, is a state-of-the-art research facility designed specifically to support research in aviation human factors.

It is happening in the **Research Development and Human Factors Laboratory** (RDHFL) at the **Federal Aviation Administration** (FAA) **William J. Hughes Technical Center**, near Atlantic City, N.J.

This unique research environment is specifically designed to enable scientists to measure and assess human performance and workload. Specialists also investigate how new technologies should be integrated into air traffic control and airway facilities systems in the laboratory.

The Aviation Safety Research Act of 1988 mandated the FAA to focus a special emphasis on human factors in civil aviation. In response to this mandate, the FAA established the RDHFL at the Technical Center.

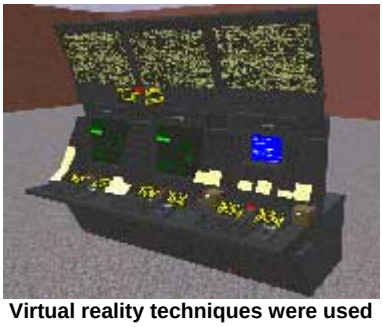
The RDHFL, which became operational on November 2, 1992, is a state-of-the-art complex where aviation-related human factors issues are studied in a controlled scientific environment.

Facilities

The human factors laboratory is a multipurpose facility staffed with highly experienced and skilled engineers, computer scientists, and psychologists. The laboratory encompasses approximately 10,000 square feet of laboratory space and 6,000 square feet of office space, including a briefing room. The laboratory space includes four experiment rooms that can be used separately or together. This unique testing facility 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.

The laboratory also contains specialty areas. A black room with an audiometric booth provides scientists with the capability to conduct perceptual and display evaluation studies that require precisely controlled lighting and acoustic environments. A virtual reality laboratory allows users to dynamically interact with three-dimensional graphical representations of concepts, designs, and data sets that might otherwise be too complex to visualize. 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 continually integrate new systems and capabilities into the facility. They have developed in-house simulation capabilities for both en route and terminal operations. The simulator can be reconfigured to reflect future features not available in current systems.

RDHFL's cyber glove system provides tactile feedback and high-accuracy joint measurements of the human hand that can be used to interact with virtual environments.



Virtual reality techniques were used to design, visualize and evaluate proposed new designs of the next-generation air traffic control display consoles. During the evaluation process, a multidisciplinary team was able to navigate anywhere in the virtual air traffic control rooms to view the various consoles from any vantage point. Movable parts of the consoles were animated to illustrate some of the proposed features, such as tabletops lowering and raising, displays tilting back and forth, and printers sliding to different positions. This approach enabled end users and designers to quickly and inexpensively identify and correct design flaws early in the process.

Research

The laboratory features three primary human factors research capabilities: computer-human-interface rapid prototyping; the ability to perform real-time simulations; and sophisticated human performance data collection and analysis capabilities. Computer-human-interface rapid prototyping is a cost-effective, iterative approach whereby a user interface can be developed quickly, then evaluated, modified, and reevaluated. The laboratory uses both commercially available and custom-built prototyping tools that can simulate the look and feel of an interface prior to actual software development.

Laboratory scientists have performed numerous experiments to study human factors issues affecting the performance of pilots, air traffic controllers, and airway facilities maintenance workforces. These experiments included field studies, laboratory experiments, and human-in-the-loop simulations. Additionally, engineering research psychologists at the laboratory performed usability analyses and developed system specifications, performance metrics, and design standards.

Recently, the RDHFL released "The Human Factors Design Standard," an important work in the field of human factors. It is a comprehensive compilation of human factors standards, principles, and guidelines integral to the procurement, design, development, and testing of FAA systems, facilities, and equipment. The standard also provides a single easy-to-use source of human factors design criteria oriented to the needs of the FAA mission and systems.

"Bravo for your excellent new Human Factors Design Standards document," said Dr. Ben Shneiderman, computer science professor and founding director (1983-2000) of the Human-Computer Interaction

Laboratory at the University of Maryland at College Park. "I found your analysis thoughtful and more complete than other sources. I like your courageous statement of standards, rather than guidelines. Readability of the six level hierarchy is tough, but the tight organization makes this a valuable and different kind of document that complements other instructional materials."

For more information:

Web site: http://rdhfl.tc.faa.gov/index.htm.

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