



AAR-100

Human Factors Newsletter # 03-03

February 8, 2003 – February 21, 2003

Project Report: *Identification of Automation Issues*

Human factors researchers at George Mason University identified a set of crew performance issues in using automated systems in the operational environment based on a carrier's internal incident reporting system. These incidents were analyzed for common themes and potential causal patterns. One common theme was the set of difficulties crews had when working with the interfaces to the automated cockpit systems. Errors in providing input to the device and interpreting output from the device led to a number of problems on the flight deck. Another common theme was that pilots are often interrupted in the course of executing their duties. The procedures for using automated systems are long, requiring many steps that must be executed in a specific order. Interruptions were often followed by difficulties in resuming the task or errors in the resumption process. A third theme identified was a problem in coordinating communications about the automated systems. Crewmembers are required to cross-check and verify flight-critical changes in the status of automated flight management systems. The analysis of incidents suggested that flight-critical information is not always effectively communicated from one crewmember to another. These common themes were used as the basis for our cognitive modeling efforts.

Model Pilot/Crew Procedures and Processes

Based on the issues identified in the first phase of the project and an initial model of pilot performance developed under a related grant from NASA-Ames, George Mason University researchers constructed a crew model with a simulated PF (Pilot Flying) and Pilot Not Flying (PNF). These crewmembers were simulated by separate ACT-R software models based on a cognitive task analysis of the duties of each person. The simulated task scenario was the time period just before and after Top of Descent (TOD) in the descent phase of flight. The PNF tasks included verification and programming of the Flight Management System (FMS) computer as well as gathering appropriate information for completion of the flight. The PF monitors and flies the aircraft except for required briefings and responses. Required aspects of crew interaction such as crew communication (e.g., briefings, acknowledgments) were implemented by a communication link between the PF and PNF simulations using a multi-model extension of ACT-R. Simulated communications involved goals, specific actions, or situational facts and features.

The linked PF and PNF models were evaluated by manipulating the simulated expertise of the crew. Expertise was simulated by changing ACT-R parameters and structures. Specifically, higher expertise was simulated by combinations of high strength of associative links for procedural behavior, higher working memory capacity, and less activation noise. One advantage of using the cognitive architecture was that a complete profile of cognition and performance could be measured for each simulation run. Model performance measures included: total time for all tasks; average time for each task; checklist steps skipped, repeated, or performed out-of-order; automation programming delayed, skipped, or incorrect; and the omission of required communications. Qualitative results such as step skipping, repetition, and intrusion of incorrect steps were observed at lower levels of simulated expertise. Additional results included crew miscommunication, differential situation awareness, and forgetting relevant goals under certain conditions of delays and interruptions. The precise profile of performance differences for different levels of crew expertise can be used to develop assessment items, strategies, and guidelines for assessing performance of commercial air carrier crews. (E. Edens, AFS-230)

ATC Shiftwork and Fatigue: Dr. Thomas Nesthus provided an invited guest lecture to a University of North Dakota Aerospace graduate course (Issues in Aviation). His lecture concerned a past-to-present introduction of CAMI research studies on Air Traffic Control Specialist shiftwork and fatigue. During the visit, he was provided a tour of the UND Aerospace facilities, including the aircraft and air traffic simulation environments, as well as the airport aviation operations center with over 80 aircraft and 170 certified flight instructors. (S. Shappell, CAMI)

Capstone Phase II: Dr. Kevin Williams was invited to participate in a beta evaluation of a training program for pilots participating in the Capstone Phase II Program. This program involves the installation of advanced primary and multi-function flight displays into general aviation aircraft in the Juneau, Alaska area. Initial installations of the equipment are scheduled to begin within the next few months. Training classes for instructors will be conducted at the University of Alaska, Anchorage Aviation Center. Feedback on the content and effectiveness of the training was provided, along with comments on the human interface design of the displays. (D. Schroeder, CAMI)

Aviation Maintenance: Dr. Nicole Nelson met with the Director of Quality Control/Chief Inspector at the BF Goodrich Aviation Technical Services facility to begin work on a project involving evaluating the use of broadband technologies and their applications to aircraft maintenance safety. The project involves identifying the advantages and disadvantages in using electronic signatures, portable display units, and electronic manuals in the aviation maintenance work environment. Organizational issues and attitudes will be measured to determine the effects of broadband technologies on aviation maintenance personnel performance. A task analysis will compare and contrast electronic and non-electronic devices by examining the number of steps required to perform a maintenance task, evaluate the efficiency of each device in completing a maintenance task, and assess the effects on training, productivity, and safety. (N. Nelson, CAMI)

Air Traffic Management: The Traffic Management User Team met at the William J. Hughes Technical Center's Human Factors Laboratory the week of February 24th to discuss the current progress of user sub-teams such as the National Traffic Management Log working group. They also heard briefings from members of other traffic flow management user teams on products that will facilitate more efficient operations in the traffic management units. (E. Stein, WJHTC)

En Route ATC:

- Researchers at the William J. Hughes Technical Center (ACB-230) continued to support En Route Communication Gateway testing. The same team supported RAPPI hardware and software installation, which was completed on February 24th. Dry Runs began February 25th.
- ACB-230 personnel continue to work on integrating the En Route ATC Center Maintenance Control Center Data Acquisition System and the Host Interface Device NAS Local Area Network System Monitor into the Host and Oceanic Computer System Replacement Monitor and Control environment. Work will continue.
- ACB-230 personnel are migrating their network infrastructure to follow the Cisco Systems SAFE blueprint for enterprise level security and design. The infrastructure upgrades will incorporate a model to accommodate En Route operational and administrative networks. (J. Sirolli, WJHTC)

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)



February 25-26, 2003 – FAA Research, Engineering and Development Advisory Committee, Subcommittee on Human Factors Meeting, FAA Headquarters, Room 932
<mailto:gloria.dunderman@faa.gov>

March 3-6, 2003 – SAE 2003 World Congress, Cobo Center, Detroit, MI
<http://www/sae.org/congress/index.htm>

March 5-6, 2003 – ASPA/ICAO Seminar on Cross-Cultural Issues in Aviation Safety, Mexico City, Mexico <mailto:dmaurino@icao.int>

March 18-19, 2003 - 28th FAA Commercial Aviation Forecast Conference at the Renaissance Washington DC Hotel, Washington, DC. For more information, visit [Event Website](#)

March 17-19, 2003 – 15th Annual European Aviation Safety Seminar presented by the Flight Safety Foundation and European Regions Airlines Association, Hotel Intercontinental Geneva, Geneva, Switzerland <http://www.flightsafety.org/seminars.html>

March 24-26, 2003 – ICAO ADS-B Study and Implementation Task Force Meeting, Brisbane, Australia http://www.icao.int/icao/en/ro/apac/adsb_2003/index.html

March 24-28, 2003 – SAE Airplane Safety Assessment Committee, Lisbon, Portugal
<mailto:lemon@sae.org>

April 2-8, 2003 – Sun ‘n Fun EAA Fly In, Lakeland, FL <http://www.sun-n-fun.org>

April 5-10, 2003 –CHI 2003 Conference on Human Factors in Computing Systems, Broward Convention Center, Ft. Lauderdale, FL <http://www.chi2003.org/>

April 9-11, 2003 – SAE Aircraft Environmental Systems Committee, Dayton, OH
<mailto:elizd@sae.org>

April 22-23, 2003 – 48th Annual Corporate Aviation Safety Seminar, presented by the Flight Safety Foundation and the National Business Aviation Association, Westin Diplomat Resort and Spa, Hollywood, FL <http://www.flightsafety.org/seminars.html>

April 27-30, 2003 – Symposium on Interactive 3D Graphics, Monterey Marriott, Monterey, CA
<mailto:Pausch@cmu.edu>

April 29-30, 2003 - FAA Research, Engineering and Development Advisory Committee (REDAC) Meeting, FAA Headquarters, Bessie Coleman Room gloria.dunderman@faa.gov

May 3-10, 2003 – International Conference on Software Engineering, Hilton Portland, Portland, OR <mailto:ldillon@cse.msu.edu>

May 4-9, 2003 – 74th Annual Scientific Meeting of the Aerospace Medical Association, Convention Center, San Antonio, TX <http://www.asma.org/>

May 6 – 8, 2003 - AHS International 59th Annual Forum and Technology Display, Phoenix Civic Plaza, Phoenix, AZ. [General Information](#) - [Call for Papers](#) - [Exhibitors](#)

May 12-15, 2003 – DOD TAG-49, Country Suites Augusta Riverwalk, Augusta, GA
<http://hfetag.dtic.mil/meetschl.html>

May 12-17, 2003 - 2003 IEEE International Conference on Robotics and Automation, The Grand Hotel, Taipei, Taiwan <http://www.icra2003.org/>

June, 2003 – SAE Digital Human Modeling for Design and Engineering, Location TDB
<http://www.sae.org/calendar/aeromtgs.htm>

June 2-3, 2003 - The National Center of Excellence for Aviation Operations Research (NEXTOR) Conference on Air Traffic Management and Control, hosted by NEXTOR - Virginia Tech, Virginia Tech Graduate Center, Falls Church, VA

June 9 – July 4, 2002 – World Radio Communication Conference, Geneva, Switzerland
<http://www.itu.int/ITU-R/conferences/wrc/wrc-03/index.asp>

June 15-22, 2003 – 45th Paris Air Show le bourget <http://www.paris-air-show.com/index3.htm>

June 16-19, 2003 – SAE Digital Human Modeling for Design and Engineering, Montreal, Canada <http://www.sae.org/calendar/dhm/index.htm>

June 18-19, 2003 – 6th GAIN World Conference, Alitalia Auditorium, Rome, Italy
<http://www.gainweb.org/whatsnew.html>

June 22-27, 2003 – 10th International Conference on Human-Computer Interaction, Institute of Computer Science Foundation, Research and Technology, Science and Technology Park of Crete, Heraklion, Crete, Greece <mailto:info@hciei2003.gr>

June 23-25, 2003 – Human Systems Integration Symposium “Enhancing Human Performance in Naval and Joint Environments”, Sheraton Premier Hotel, Tyson’s Corner, VA
<http://www.navalengineers.org/Events/HSIS2003/HSIS.html>

July 7-10, 2003 – SAE 33rd International Conference on Environmental Systems, The Westin Bayshore Resort and Marina, Vancouver, Canada <http://www.sae.org/calendar/aeromtgs.htm>

July 14-17, 2003 – AIAA/ICAS International Air & Space Symposium and Exposition, Dayton Convention Center, Dayton, OH <http://www.flight100.org/>

July 21 – 23, 2003 - 4th Australian Pacific Vertiflite Conference on Helicopter Technology, Melbourne, Victoria, Australia. Contacts: [Dr. Arvind K. Sinha](#) and [Mr. Raden Kusumo](#)

July 29-August 4, 2003 – 51st Annual AirVenture, Oshkosh, WI <http://airventure.org/>

August 7-10, 2003 – 111th Convention of the American Psychological Association, Toronto, Ontario, Canada <http://www.apa.org/convention>

September 8-12, 2003 – SAE Aerospace Congress and Exhibition, Palais des Congrès, Montreal, Quebec, Canada <http://www.sae.org/calendar/aeromtgs.htm>

September 15-17, 2003 – FAA/TCA/CAA Safety Management in Aviation Maintenance Symposium, Toronto, Canada

September 16-18, 2003 - 1st International Congress on Health and Safety in Transportation. Paris, France <http://www.biomedicale.univ-paris5.fr/LAA/eindex.htm>

September 16 – 18, 2003 - 29th European Rotorcraft Forum, Friedrichshafen, Germany. Contact B. Gmelin at bernd.gmelin@dir.de

September 18-19, 2003 – National Academy of Engineering 2003 Frontiers of Engineering Symposium, Irvine, CA [Welcome to the National Academy of Engineering \(NAE\)](#)

September 22 – October 3, 2003 – ICAO 11th Air Navigation Conference, Montreal, Canada
<http://www.icao.int/icao/en/anb/meetings/anconf11/index.html>

October 6 – 9, 2003 - NATO Research and Technology Agency, Applied Vehicle Technology Panel (AVT) will present "The Vehicle Propulsion Integration Symposium" in Poland. For more information contact cheynes@rta.nato.int

October 7 – 9, 2003 - National Business Aviation Association Annual Meeting & Convention, Orlando, Florida. Contact: www.nbaa.org

October 13-17, 2003 – Human Factors and Ergonomics Society 47th Annual Meeting, Adams Mark Denver Hotel, Denver, CO <http://www.hfes.org/>

October 27-28, 2003 – National Academies Institute of Medicine Annual Meeting, National Academy of Sciences, Washington, DC <http://wwwsearch.nationalacademies.org/>

October 27-30, 2003 – SAE DoD Maintenance Symposium and Exposition, Valley Forge Convention Center, King of Prussia, PA <http://www.sae.org/calendar/aeromtgs.htm>

November, 2003(tentative) – DOD TAG-50, Fall 2003, Phoenix, AZ
<http://hfetag.dtic.mil/meetschl.html>

November 17-20, 2003 – 56th Annual Air Safety Seminar, A Joint Meeting of Flight Safety Foundation, International Federation of Airworthiness, and International Air Transport Association, Bangkok, Thailand <http://www.flightsafety.org/seminars.html>

January 11-15, 2004 – Transportation Research Board Annual Meeting, Washington, DC
<http://www4.trb.org/trb/annual.nsf>

January 21 – 23, 2004 - AHS 4th Decennial Specialists' Meeting on Aeromechanics, Fisherman's Wharf, San Francisco, CA. For more information contact the Technical Chairman, Tom Maier at tmaier@mail.acr.nasa.gov

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

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

May 2-7, 2004 – 75th Annual Scientific Meeting of the Aerospace Medical Association, Egan Convention Center, Anchorage, AK <http://www.asma.org/>

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>

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

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

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

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
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