ATO-P R&D

Human Factors Research and Engineering Division

Human Factors Newsletter # 06-11

May 20, 2006 – June 2, 2006

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Articles in this newsletter:

Technical Note: Ahlstrom, U., & Friedman-Berg, F. J. (in press). Using Eye-Movement Activity as a Correlate of Cognitive Workload. *International Journal of Industrial Ergonomics.* (Accepted for publication).

Abstract.
In the present study, we investigated the effect on air traffic controller operations and workload from the use of weather displays. Specifically, we assessed the impact on severe weather avoidance, controller efficiency, controller-pilot communications, and the safety of airspace operations when controllers managed traffic during adverse weather conditions. The results showed a significant impact on controller efficiency from the use of weather displays with an increase in sector throughput by up to 10%. We found no significant effects of weather displays on severe weather avoidance, controller communications, and subjective workload ratings. However, using eye movement activity measures that correlate with cognitive workload, we found significantly shorter blink durations when controllers operated traffic in conditions lacking a weather display, indicating a higher workload level during these conditions. Also, the mean pupil diameter was significantly larger when controllers used a static storm forecast tool compared to when controllers used a dynamic forecast tool, indicating a higher workload level during the use of static tools. We conclude that eye movement activity measures can provide a

more sensitive measure of controller workload, and that subjective ratings might not capture more transient fluctuations in workload levels during system or display interactions. By using real-time eye movement activity measures, designers can better evaluate changes in operator workload during the design and evaluation of complex systems. If we can detect workload-inducing conditions early in the design process, we can improve the design, optimize operator workload, and reduce developmental costs.

This research activity supports the Administrator's Flight Plan Goal for Greater Capacity, Objective 3: Increase on-time performance of scheduled carriers.

Point of Contact: U. Ahlstrom , WJHTC

Technical Note: Ulf Ahlstrom, ATO-P & Ferne Friedman-Berg, L-3 Communications, Titan Corporation. Controller Scan-Path Behavior during Severe Weather Avoidance. Technical Report DOT/FAA/TC-06/07

Abstract.
In the present study, we examined controllers' fixation behavior on storm motion tools during severe weather avoidance. The data consisted of eye movement recordings from time intervals when controllers activated a static or a dynamic storm motion tool. Both of these tools provided information about the direction of storm cell motion and future extrapolated positions of the storm cell leading edge. By analyzing the location and extent of fixations, we performed an assessment to identify the static weather tool features that captured controllers' visual attention (i.e., areas of visual interest). Second, we analyzed controller scan path behavior (a series of fixations and saccades) while they were using the static and the dynamic tools. Third, we assessed controller fixation prioritization strategies during static tool usage. Our analysis revealed that controllers focused their visual attention significantly more on the area between the storm cell leading edge and the 10 minute extrapolated position compared to other areas of the static storm motion tool. With regards to controller scan paths, we found that dynamic storm motion tools significantly reduced controller scan path areas, scan path distances, and scan path durations compared to the static tool. Furthermore, the mean pupil diameter was significantly larger for controllers while using the static tool compared to the dynamic tool, indicating a higher visual and cognitive workload during this display condition. We found little evidence for systematic controller fixation behavior while they were using the static tool. The few systematic patterns that we revealed were two-step fixation patterns (e.g., aircraft → 10 minute extrapolated position), and the vast majority of fixation orders (patterns) were unique to each individual controller. Evidently, the static storm motion tool provided weak affordances to controllers during tactical operations. We discuss these results in relation to the attentional capture phenomenon and suggest possible ways to improve static storm motion tools for tactical operations.

This research activity supports the Administrator's Flight Plan Goal for Increased Safety, Objective 5: Enhance the safety of FAA's air traffic systems.

Point of Contact: U.Ahlstrom, Ferne Friedman-Berg, WJHTC

Safety Culture Seminar: A seminar entitled "Toward a Safer Culture" sponsored by ATO-P Human Factors Research and Engineering Division, will be presented by Dr. Manoj Patankar (Saint Louis University), on Wednesday, June 28, 2006, from 9:00 a.m. to 12:00 p.m. in the Bessie Coleman Conference Center, HQ FAA (Orville Wright Bldg), 2nd Floor, 800 Independence Ave. S.W., Washington, D.C. 20591 There is no tuition cost to FAA employees. Travel expenses, if applicable, are the responsibility of the participant's organization. The purpose of the seminar is to provide participants a working understanding of Safety Culture—what is it, what is its significance, how to measure the current status, what/how to change, how to measure the change, and how to institutionalize the change. This is a three-hour module presented in conjunction with other human factors technical workshops and seminars. It provides an overview of the principles of a safety culture, how to apply them in an operational setting, and how to measure the results. This seminar provides a tutorial on safety culture theory, key parameters, actionable means to implement, behaviors and methods to improve performance, qualitative and quantitative measures and assessment techniques, and reporting. Enrollment is limited to 40 participants. To register, Learning Coordinators should email the following information to Kelly W. Coachman: *Name;* (FAA EMPLOYEES)*Organization Name/Symbol;* (CONTRACTORS) *Company Name/Supported Organization Symbol; Phone; Email Address.*

This activity supports the Administrator's Flight Plan Goal for Organizational Effectiveness, Objective 1: Make the organization more effective with stronger leadership, increased commitment of individual workers to fulfill organization-wide goals, and a better prepared, better trained, safer, diverse workforce. (Glen Hewitt, ATO-P R&D)

New Cooperative Research Grant: In June, 2006, ATO-P R&D will award a new Cooperative Research Grant to Massachusetts Institute of Technology titled "Cognitive Evaluation of Potential Approaches to Increase the Efficiency of Air Traffic Controller Training and Staffing."

Abstract:
There is increasing concern over the FAA's ability to meet the training demands created by an impending surge in controller retirements over the next decade. The FAA's ability to quickly respond to these developing staffing shortages is challenged by the extensive time and effort required to train both *ab initio* controllers and experienced controllers transferring into new positions. While there are several ongoing efforts aimed at improving controller training, including the integration of advanced simulation technologies into the training process (MITRE, 2005), there is a unique opportunity to consider how changes to either the training process or operational practices could be used to simplify operations, increase staffing flexibility, reduce training times, lower training costs, and/or more effectively utilize training resources. The objective of the proposed research is to use cognitive models of how controllers use "Structure" in the Air Traffic Control environment (e.g. procedures, flows, sector geometry, and airspace elements) to reduce cognitive complexity and identify and evaluate opportunities to increase the efficiency of the controller training process and increase staffing flexibility.

In order to identify opportunities for improving the controller training process by modifying operational practices or the training process, an approach is proposed based on a cognitive and operational analysis of how the underlying "structure" impacts the requirements for *ab initio* and cross-facility training. The approach will be to review the current training protocols, procedures

and airspace structure from the context of cognitive models which identify how controllers use "structure" to develop strategies and abstractions. Based on the review, a value-added analysis will be used to identify opportunities to improve the training processes. A second part of the approach will focus on identifying opportunities to increase standardization of "structure" or other aspects of the operational environment in order to streamline the training process, increase staffing flexibility, and increase system efficiency.

This activity supports the Administrator's Flight Plan Goal for Organizational Effectiveness, Objective 1: Make the organization more effective with stronger leadership, increased commitment of individual workers to fulfill organization-wide goals, and a better prepared, better trained, safer, diverse workforce.

D. Piccione, ATO-P R&D

Scientific Meeting: During the week of May 14-18, 2006, CAMI personnel made fifteen scientific presentations at the Aerospace Medical Association Annual Convention. The sessions were well attended and CAMI scientists had an opportunity to confer with international colleagues regarding shared research interests. Scientists also conferred with colleagues during the committee and association meetings (Science and Technology, Aerospace Human Factors and Aerospace Human Factors Association). During the meeting, Dr. Carol Manning was elected as a Vice President of the Aerospace Medical Association. *This activity supports the Administrator's Flight Plan Goal for International Leadership, Objective 1: Promote improved safety and regulatory oversight in cooperation with bilateral, regional, and multilateral aviation partners.* (D. Schroeder, CAMI)

Air Traffic Controller Selection: At the request of the US Navy's Center for Naval Aviation Technical Training, Human Performance Center, Dr. Ray King traveled to Pensacola Naval Air Station, FL on April 24, 2006 to support the Navy's examination of a growing problem with attrition from air traffic control training. The leadership of the US Air Force Flight Standards Agency also participated in this meeting and reported a similar problem with growing attrition. The military services rely on a composite score which is based on a written test. The FAA uses the Air Traffic Selection and Training (AT-SAT) battery, which is a computerized air traffic control selection test. The Navy is familiar with the FAA testing vehicle after participating in three years of collaborative research to create a parallel version of AT-SAT and re-host it on Windows 2000/XP. While both military services are eager to use AT-SAT to select candidates for air traffic control positions, Dr. King proposed a study to directly compare AT-SAT to the military written test. Such a comparison is possible because over 1,000 military air traffic control students participated in the FAA's AT-SAT study. AT-SAT subtest scores and military written test scores are available as well as outcome data (how the students did in training). The result of this meeting was an agreement between the Air Force and the Navy to jointly participate in this study and to release the necessary written test scores and outcome data. The co-investigator in this study with Dr. King will be Dr. Thomas Carretta, an internationally known personnel selection expert, who is currently assigned to the Air Force Research Laboratory (AFRL) at Wright-Patterson AFB, OH. Permission for the military services to use AT-SAT has been secured from its sponsors in ATO-A and AHR, with the understanding that the security of AT-SAT will be maintained. *This activity supports the Administrator's Flight Plan Goal for*

Organizational Effectiveness, Objective 1: Make the organization more effective with stronger leadership, increased commitment of individual workers to fulfill organization-wide goals, and a better prepared, better trained, safer, diverse workforce. (R. King, CAMI)

National Traffic Management Log (NTML): A research psychologist from the William J. Hughes Technical Center's Human Factors Group participated in a meeting of the NTML Working Group on May 15-18, 2006. The NTML was developed to provide a single system for automated logging, coordination, and dissemination of traffic management initiatives throughout the National Airspace System. It is an automated log used by Traffic Management Specialists at the Command Center as well as in en route, terminal, and tower environments. This diverse user population brings with it significant challenges to display design. The working group is developing requirements for enhancements to the NTML that will provide new capabilities and streamline existing processes. The working group includes subject matter experts from each of the environment domains to ensure that their needs are represented. The researcher's role is to use iterative, rapid prototyping to guide display design such that the resulting interface meets human factors guidelines and best practices. *This research activity supports the Administrator's Flight Plan Goal for Greater Capacity, Objective 3: Increase on-time performance of scheduled carriers.* (T. Yuditsky, WJHTC)

CAMI Interactive Exhibits: On Saturday, June 3, 2006, representatives from AAM 510 participated in The Ninety-Nines, Inc., International Organization of Women Pilots open house at The Ninety-Nines Museum of Women Pilots located at Will Rogers International Airport in Oklahoma City. Two interactive exhibits were presented, with Barry Runnels, Jerry Ball, and Kevin Williams operating the Vertical-Flight General Aviation Research Simulator, and Dennis Beringer operating a control-input-force testing station. Attendance was estimated at 500 persons. *This activity supports the Administrator's Flight Plan Goal for International Leadership, Objective 1: Promote improved safety and regulatory oversight in cooperation with bilateral, regional, and multilateral aviation partners.* (T. Chidester, CAMI)

Electronic Flight Bag (EFB): A proposed amendment to ICAO Annex 6 (Operation of Aircraft) regarding approvals of EFBs was accepted at the May 2006 meeting of the ICAO Operations Panel in Montréal. The amendment was prepared and coordinated by Robert-Jan Venema (Civil Aviation Authority Netherlands) and Colleen Donovan (FAA/ICAO). It includes guidance on human factors assessment of EFBs based on FAA-funded research conducted at the Volpe Center. The proposed amendment is expected to be forwarded on to ICAO's Air Navigation Commission in the fall of 2006, after which it will be sent to the 189 member States of the United Nations for consideration and comment. If adopted, this document will provide EFB approval guidance in all 189 member states of the United Nations. (D.Chandra, VNTSC)

Air Traffic Management (ATM) R&D Seminar: The Seventh USA/Europe ATM R&D Seminar will be held in Barcelona, Spain June 11-14, 2007. Papers must be submitted before January 26, 2007. Both in Europe and the USA, considerable efforts are ongoing to define and develop the next generation ATM systems. The Advisory Council for Aeronautics Research in Europe developed Strategic Research Agendas 1 & 2 for the system after 2020. The Single European Sky ATM Research Program has just started its definition phase aiming for development & implementation from 2008 until 2020. The Next Generation Air Transport

System is an initiative of the Joint Program Development Office to transform today's Air Transport System to meet the needs of 2025;

A significant contribution to these developments is expected from ATM research and development activities aligned with the strategic directions that are being established. In a continuous effort to foster realization of a harmonized global ATM system, the FAA and EUROCONTROL are jointly organizing the Seventh USA/Europe Seminar on ATM R&D. It is a continuation of seminars held since 1997 in both Europe and the USA. In the ICAO ATM Global Concept document, ATM is defined as "the dynamic, integrated management of air traffic and airspace - safely, economically, and efficiently - through the provision of facilities and seamless services in collaboration with all parties." ATM encompasses airspace organization and management, flow and capacity management, and en-route, terminal and airport air traffic control. Papers submitted for consideration need to be focused on these ATM aspects of aviation.

Seminar organizers hope to create and reinforce working and personal relationships between leading experts and researchers in the ATM R&D community, share available results, and build and maintain consensus on major issues. (P. Krois, ATO-P R&D)
http://atmseminar.eurocontrol.fr/call-for-paper

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

Paul Krois
FAA (ATO-P R&D Human Factors)

June 6-8, 2006 – IEE System Safety Conference, Savoy Place, London, UK
http://www.iee.org/events/event/CE202BA5-A0D3-8FE7-2F35A59A02C8B3F3

June 8-10, 2006 – NTSB Bar Association Annual CLE Conference, NTSB Conference Center, L'Enfant Plaza, Wash, DC http://www.ntsbbar.org/

June 11-14, 2006 – The American Society of Safety Engineers Safety 2006 Conference, Washington State Convention and Trade Center, Seattle, WA
http://www.asse.org/2006pdcallforpapers.pdf

June 12-16, 2006 – UPA 2006 – 15th Annual Conference, Broomfield, CO
http://www.usabilityprofessionals.org/conferences_and_events/upa_conference/2006/

June 12-17, 2006 – Human Factors in Flight Safety and Accident Investigation, SAS Flight Academy, Stockholm, Sweden www.sasflight-academy.com

June 24-26, 2006 – AAMI Conference & Exposition, Wash, DC http://www.aami.org/proposals/index.html

June 24-28, 2006 – ASHRAE Annual Conference, Quebec, Canada http://www.ashrae.org/

June 26-29, 2006 - General Aviation Technology Conference , Hyatt Hotel, Wichita, Kansas,

June 27-29, 2006 – 4th Annual Cognitive Systems Workshop, Santa Fe, New Mexico http://sandia.gov/cog.systems/cognitive_workshop/index.htm

June 27-29, 2006 – CGAR 2006 Conference, Embry-Riddle Aeronautical University, Prescott, AZ http://www.cgar.org/default.asp

June 28, 2006 – Toward a Safer Culture Seminar, FAA Headquarters, Wash, DC glen.hewitt@faa.gov

July, 2006 - 26th International Congress of Applied Psychology, Athens, Greece dgeorgas@dp.uoa.gr , http://www.erasmus.gr/dynamic/conventions.asp?conv_id=21r/dynamic/conventions.asp?conv_id=21

July 5-9, 2006 - International Organization of Women Pilots 2006 Convention, Washington Marriott, Wash, DC http://www.ninety-nines.org/

July 8-11, 2006 – ASA 2006 Annual Conference, Las Vegas, NV www.aviationsuppliers.org

July 10-14, 2006 – IEA 2006, 16th World Congress on Ergonomics, Maastricht, The Netherlands http://www.iea2006.org/

July 17-23, 2006 – Farnborough International Air Show, London, UK http://www.farnborough.com/

July 24-30, 2006 – EAA AirVenture, Oshkosh, WI http://www.airventure.org/

July 26-29, 2006 – CogSci 2006, Sheraton Vancouver Wall Centre, Vancouver, BC, Canada http://www.cogsci.rpi.edu/~rsun/cogsci2006/

August 1, 2006 - The International Journal of Aviation Psychology, Special Issue on Air Traffic Control Human Factors, CALL FOR PAPERS. Please contact Jim Hitt at hitt_james@bah.com <mailto:hitt_james@bah.com> or Mike McAnulty at mike.mcanulty@faa.gov <mailto:mike.mcanulty@faa.gov> with any queries, or to submit papers.

August 1-3, 2006 – 27th National Aerospace FOD Prevention Conference, Seattle, WA www.nafpi.com

August 10-13, 2006 – American Psychological Association Annual Meeting, New Orleans, LA http://www.apa.org/convention05/future.html

August 21-24, 2006 - AIAA Modeling and Simulation Technologies Conference and Exhibit. Keystone Resort and Conference Center, Keystone, CO http://www.aiaa.org/content.cfm?pageid=1

August 21-24, 2006 - AIAA Guidance, Navigation, and Control Conference and Exhibit, Keystone Resort and Conference Center, Keystone, CO http://www.aiaa.org/content.cfm?pageid=1

August 29-31, 2006 – General Aviation Technology Conference & Exhibition, Wichita Hyatt, Wichita, KS http://www.sae.org/events/gat/

September 6-8, 2006 - 11th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, Renaissance Portsmouth, Portsmouth, VA, http://www.aiaa.org/content.cfm?pageid=1

September 6-7, 2006 - FAA-ATA 18th Annual International Symposium for Human Factors in Maintenance and Ramp Safety, Orlando, FL. www.airlines.org

September 8-13, 2006 – 75th NASAO Convention, New Orleans, LA www.nasao.org

September 10-14, 2006 - 54th International Congress of Aviation and Space Medicine, Bangalore, India. A preliminary registration form may be found at http://www.isam-india.org/conference44/newreg.php.

September 12-14, 2006 – 23rd International Air Cargo Forum and Exposition, Calgary, Ontario, Canada http://www.tiaca.org

September 19-21, 2006 – Space 2006, San Jose, CA www.aiaa.org

September 20-22, 2006 – HCI-Aero 2006, Seattle, WA http://www.eurisco.org/hci-aero2006
Note: Submission Deadlines:
15th March 2006 - Full Research Papers
15 April 2006 - Industry Papers
15 April 2006 - Early Stage Research Papers
15 April 2006 - Panels, Workshops
15 April 2006 - Posters and Demos

September 26-27, 2006 – AIAA Aviation Technology, Integration and Operations Conference, Hyatt Regency, Wichita, KS http://www.aiaa.org/content.cfm?pageid=1

October 8-11, 2006 - IEEE International Conference on Systems, Man, and Cybernetics, The Grand Hotel, Taipei, Taiwan http://ins.cn.nctu.edu.tw/smc2006/
March 1, 2006: Deadline for submission of papers (full papers only)

October 15-19, 2006 – Digital Avionics Systems Conference, 25th DASC Network Centric Environment: The Impact on Avionics and Systems, Hilton Portland and Executive Tower, Portland, OR www.dasconline.org
February 19, 2006 – Deadline for submitting abstracts of 1000 words

October 15-20, 2006 – 2nd Annual Augmented Cognition International Conference, Hilton San Francisco, San Francisco, CA www.augmentedcognition.org

October 16-20, 2006 – Human Factors and Ergonomics Society Annual Meeting, San Francisco Hilton, San Francisco, CA http://www.hfes.org/web/HFESMeetings/meetings.html
Key Dates:

June 26 – Proceedings papers due
September 8, 2006 – Early registration deadline

October 16-19, 2006 – ATA 49th Annual Non-Destructive Testing Forum, Ft. Worth, TX www.airlines.org

October 17-19, 2006 – NBAA 59th Annual Meeting and Convention, Orlando, FL http://web.nbaa.org/public/cs/amc/futuresites.php

October 23-25, 2006 – 44th Annual SAFE Symposium, Reno Hilton Hotel, Reno, NV http://www.safeassociation.org/symposium.htm

October 23-26, 2006 - DoD Maintenance Symposium & Exhibition, Reno Hilton, Reno, Nevada http://www.sae.org/events/conferences/aerospace/

October 25-27, 2006 – Cargo Facts 2006, Miami, FL ashoemaker@cargofacts.com

October 29 - November 1, 2006 – ATCA Convention and Exposition, Marriott Wardman Park, Wash, DC

November 9-11, 2006 – AOPA Expo 2006, Palm Springs, CA http://www.aopa.org/expo/2005/virtual/

November 13-14, 2006 ASTM F38 Unmanned Aircraft Systems Committee Workshop, Hyatt Regency, Atlanta, GA http://www.astm.org/

November 14-16, 2006 – Aerospace Testing Expo, Anaheim, CA www.aerospacetesting-expo.com

November 17-19, 2006 – NBAA Annual Meeting and Convention, Orlando, FL www.nbaa.org

January 8-11, 2007 - 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno Hilton, Reno, NV http://www.aiaa.org/content.cfm?pageid=1

January 27-31, 2007 - ASHRAE Winter Meeting**,** Dallas, TX jyoung@ashrae.org, or www.ashrae.org.

February 13-15, 2007 – US Air Force T&E Days, Hilton San Destin Beach, Destin, FL http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=1474&viewcon=submit

March 3-10, 2007 – IEEE Aerospace Conference, Big Sky, Montana http://www.aiaa.org/content.cfm?pageid=1&show=All

March 7-8, 2007 – Avionics 07 Expo XXI, Amsterdam http://www.avionics-event.com/avionics06/why_exhibit.html

March 9-11, 2007 - Human-Robot Interaction Conference 2007Washington, DC: http://www.hri2007.org/

March 19-21, 2007 – HSIS 2007 – Bridging Human Performance Science to Engineering Practice, Lowes Hotel, Annapolis, MD http://navalengineers/org/Events/HSIS2007

April 17-23, 2007 – Sun 'n Fun, Lakeland, FL http://www.sun-n-fun.org/content/

April 22-26, 2007 – 2007 International Symposium on Aviation Psychology, Dayton, OH www.wright.edu/isap (NOTE: Call for Papers – Due July 10, 2006)

May 21-22, 2007 - ASTM F38 Unmanned Aircraft Systems Committee Workshop, Waterside Convention Center, Norfolk, VA http://www.astm.org/

May 23-26, 2007 – Regional Airline Association, Memphis, TN http://www.raa.org/

June 11-14, 2007 - Seventh USA/Europe ATM R&D Seminar, Barcelona, Spain
http://atmseminar.eurocontrol.fr/
NOTE: Call for Papers – Papers must be submitted before January 26, 2007

June 23-27, 2007 – ASHRAE Annual Meeting, Long Beach, CA jyoung@ashrae.org, www.ashrae.org

July 22-27, 2007 – 12th HCI International, Beijing, China http://www.hcii2007.org/

September 25-27, 2007 - NBAA 60th Annual Meeting and Convention, Atlanta, GA http://web.nbaa.org/public/cs/amc/futuresites.php

October 1-5, 2007 – Human Factors and Ergonomics Society Annual Meeting, Baltimore Waterfront Marriott Hotel, Baltimore, MD
http://www.hfes.org/web/HFESMeetings/meetings.html

November 13-16, 2007 – DoD Maintenance Symposium and Exhibition, Rosen Shingle Creek, Orlando, FL http://www.sae.org/events/conferences/aerospace/

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

Comments or questions regarding this newsletter?
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