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From: General Aviation Human Factors Program Manager, AAR-100  
To: General Aviation TCRG

Subj: GENERAL AVIATION HUMAN FACTORS SECOND QUARTER '04  
REPORT

Ref: General aviation human factors execution plans (<http://www.hf.faa.gov/gafunded.htm>)

1) Each project is listed below.

- a) Human Error and General Aviation Accidents: A Comprehensive, Fine-Grained Analysis using HFACS

*Human factors quality assurance (HFQA).* Before the HFACS data can be made available for use in the field, CAMI and the University of Illinois will need to complete their HFQA of the data. The HFQA consists of reviewing all pilot-rater classifications of NTSB subject and modifier codes for each accident using HFACS. Since there are over 35,000 classifications currently in the database, the process has been quite time consuming. This process began in December, but has been delayed a few months due to some pop-up priorities (e.g., the Air Tour Accident analysis and the Emergency Medical Service Accident analysis). To date, we are roughly half-way done with the HFQA.

*HFACS rotorcraft analysis.* The initial analysis of all rotorcraft accidents between 1990-2000 was completed in December and briefed by telephone to AFS-830 (Mr. Bill Wallace) and a representative from the Helicopter Association International (Mr. Richard Wright). From those conversations, it was determined that additional analyses would need to be conducted prior to publication and presentation in an open forum. In addition, Mr. Wallace requested that a specific analysis involving Emergency Medical Service (EMS) operations be conducted. Specifically, he wanted to know what human factors were most prevalent during EMS operations. The initial analysis of 73 EMS accidents associated with aircrew error has been completed. Dr. Boquet will brief both Mr. Wallace and Mr. Wright in mid-April. A report describing the human factors components of rotorcraft accidents and EMS operations is on schedule to be completed this FY.

*HFACS Analysis of Air Tour Accidents.* Mr. Paul Joly (Las Vegas FSDO), the National Resource Specialist for Air Tour Operations requested that CAMI conduct an HFACS analysis of all Air Tour Accidents (both part 91 and 135 operations). Ms. Cristy Detwiler has completed her initial analysis of the 135 Air Tour operations (41 commercial accidents associated with aircrew error) and will brief Mr. Joly in mid-April. The analysis of part 91 Air Tour accidents will be more time consuming since the NTSB does not specifically code these types of operations in their database. A keyword search has been conducted and a large number of potential part 91 Air Tour accidents identified (over 200). The process of individually confirming each accident as either Air Tour or other GA operations has been initiated and will be completed in April as will the HFACS analysis. A final report and briefing of Air Tour accidents will be provided to Mr. Joly this FY.

*Fine-grained analysis of GA accident data.* The University of Illinois, in cooperation with CAMI have completed their initial analysis of the “top-10” skill-based, decision, and perceptual errors as well as violations committed by aircrew. However, the University of Illinois is waiting on the completion of the HFQA to conduct their final analyses. Although the HFQA has been delayed, no impact is anticipated on the delivery of the final report due in September of 2004.

*The Human Factors Analysis (using HFACS) of 2003 Fatal GA Accidents.* CY 2003 (through October) witnessed a slight increase in the raw number of fatal GA accidents and a substantial increase in the total number of fatalities over CY 2002. In response, ADA-1 asked CAMI and the University of Illinois to meet with senior leadership at the NTSB to explore the possibility of conducting an HFACS analysis of CY 2003 fatal GA accidents. This analysis would require NTSB investigators to conduct an HFACS analysis of several active cases (those that have not been finalized) – something that had not been done previously. A white paper that suggested that the apparent spike in fatal accidents and the associated increase in fatalities might have been a statistical aberration was delivered to ADA-1. That report suggested that when the relative proportion of fatal to non-fatal GA accidents has not changed over the last 20 years (including CY 2003). This suggests that while the absolute number of GA accidents has declined, the relative proportion of fatal accidents has remained relatively constant (averaging roughly 20%) since 1983. No additional work has been done in this area in the last quarter and none is planned pending guidance from AAI and AVR.

*Alaska Safety Initiative.* One of the larger HFACS efforts focused on a comparison of the human factors associated with GA accidents in Alaska and those occurring in the rest of the U.S. (see FY03, Q4 report). Dr. Scott Shappell and Ms. Cristy Detwiler presented their findings at the annual meeting of the Alaska Air Carriers Association in March. Ms. Detwiler will also present her findings at the Annual Meeting of the Aerospace Medical Association in May. She is also coordinating with Ms. Angela Elgee (AAL-240) to provide additional analyses and to enable the Alaska Region to conduct their own HFACS inquiries

of the accident data. Ms. Detwiler is also coordinating with Mr. Jerry Dennis (Director of the Medallion Program in Alaska) in their safety efforts in Alaska. As part of that effort, she will be presenting her research findings in Anchorage at the Alaska Airmen's Association State Aviation Conference and Trade Show (typically involving several thousand Alaska GA aviators).

*Human Error Intervention Matrix.* In FY 2004 the HFACS project that included coding all GA and commercial aviation accident data since 1990 will officially be ended as an R,E, & D task. The annual updates, HFQA, and maintenance of the HFACS database will continue to be conducted by CAMI until a suitable operational substitute is found. However, the next step in the effort to reduce human error will be to build upon the work conducted by CAMI and the University of Illinois and develop an intervention matrix. A prototype matrix was presented to ACE-100, AFS-800, AFS-600, and AAI-220 in March. CAMI and the University of Illinois have been tasked with continuing that development effort and validation of the prototype. A collaborative agreement will be established with the University of Illinois to fully develop and validate the HF Intervention Matrix prototype with data from ACE-100, AFS-800, and AFS-600. While the actual collaborative agreement will not be funded until FY05, CAMI and the University of Illinois have agreed to proceed this FY with funding available from the existing HFACS fine-grained analysis collaborative agreement.

*All available information indicates the project is on track.*

b) Comparison of the Effectiveness of a Personal Computer Aviation Training Device, a Flight Training Device and an Airplane in Conducting Instrument Proficiency Checks.

Between January 1 and March 31, 24 pilots were scheduled for all types of sessions. Three pilots started the study, five pilots completed IPC#1, and six pilots completed IPC#2. To date, 75 of 91 pilots completed the study with a total of 468 sessions scheduled. The below table shows the totals as of March 31, 2004:

Researcher submitted the six month interim report (Feb 27<sup>th</sup>, 2004). To view the document, point to

<http://www.hf.faa.gov/docs/508/docs/FTDPhaseIIIinterim022704.pdf>

The researcher presented the findings at two conferences:

Taylor, H.L., Talleur, D.A., Emanuel, T.W., and Rantanen, E.M. (March 5, 2004). The effectiveness of Personal Computer Aviation Devices (PCATDs), Flight Training Devices (FTDs), and an airplane in conducting instrument proficiency checks. Annual Midyear Symposium of APA Division 19 and 21 and the Potomac Chapter of the HFES, Ft. Belvoir, VA – to view document point to <http://www.hf.faa.gov/docs/508/docs/PCATD030504.pdf>

Taylor, H.L., Talleur, D.A., Emanuel, T.W., and Rantanen, E.M. (May 2004). The Effectiveness of Personal Computers (PCATDs) and Flight Training Devices (FTDs) on instrument training for pilots. Aerospace Medical Association 75<sup>th</sup> Annual Scientific Program Meeting, Anchorage, AK.

Sessions Run:	Totals
Air-fam*	80
PCATD-fam*	82
Frasca-fam*	83
IPC#1	75
IPC#2	75
P-Training	27
F-Training	45
A-Training	1
All types:	468
# of Subjects Started	91
Total completed:	75

The remaining schedule for this project is as follows: Prepare data file (FY04 Q3), complete analysis (FY04 Q3), and submit final report (FY04 Q4).

*All available information indicates the project will be completed in FY04.*

c) Credit for Instrument Rating in a Flight Training Device or Personal Computer: Phase III: Transfer of Training Effectiveness of a Flight Training Device (FTD).

On January 22<sup>nd</sup>, 2004 the General Aviation Human Factors TCRG group recommended that this study reduce the total number of subjects from 180(30 subjects in each group) to 120 (20 subjects in each group). On March 1, 2004 the FAA extended the termination date of Exemption No. 7921 to November 30, 2006. The exemption permits the University of Illinois, Institute of Aviation to hold examining authority for its FAA – approved training course that does not meet the minimum flight training time requirements of Part 141.

AVI 130

Twenty-seven students enrolled in the AVI 130 Basic Instrument course for the spring semester 2004. To date, 25 of the 27 students remain enrolled in the AVI 130 course. The students were assigned as follows: Airplane (n=3); PCATD 5, (n=2); FRASCA 5, (n=7); FRASCA 10, (n=3); FRASCA 15, (n=6); and FRASCA 20, (n=4). This assignment will provide approximately an equal number of subjects in each group when these subjects complete AVI 140.

## AVI 140

A total of 30 students enrolled in the AVI 140 Advanced Instrument course for the spring semester. To date, 28 of the 30 students remain enrolled in the AVI 140 course.

Researcher submitted the six month interim report (Mar 20<sup>th</sup>, 2004). To view the document, point to

<http://www.hf.faa.gov/docs/508/docs/PCATDinterim032004.pdf>

The researcher presented the findings at two conferences:

Taylor, H.L., Talleur, D.A., Emanuel, T.W., and Rantanen, E.M. (October 22, 2003). Incremental Transfer of Training Effectiveness of a Flight Training Device (FTD). Technology Enhancements for Aviation Classrooms Seminar, University Aviation Association Fall Education Conference, Dayton, OH., to view the document point to <http://www.hf.faa.gov/docs/508/docs/FTD102203.pdf>

Taylor, H.L., Talleur, D.A., Emanuel, T.W., and Rantanen, E.M. (July 2004). Incremental Effectiveness of Personal Computer Aviation Training Devices (PCATDs) and a Flight Training Device (FTD). American Psychological Association 2004 Annual Meeting, Honolulu, HI. to view the document point to <http://www.hf.faa.gov/docs/508/docs/gaFTDAPA2004.pdf>

*All available information indicates the project is on track.*

### e) Visibility in the Aviation Environment

The researcher completed a draft of a product that is designed to help pilots better locate traffic. One reason some pilots have difficulty locating targets is that they have a poor knowledge about the image size of target aircraft at different distances. Our product is an information card that displays images of a small aircraft and an airliner and is designed to remind pilots of approximate target sizes at different distances.

The researcher has begun applying Dr. Bruno Olshausen's "sparse representation" analysis to natural images. In addition, the researcher is evaluating alternative models of visual detection (e.g. Ahumada and Beard) and image statistic analysis for application to visual scenes. In reference to the Phase I tasks, data collection has continued for images in the aviation environment. This data collection includes a series of inflight images of other aircraft using a stabilized telephoto lens. These images will be useful for construction and developing stimuli for the proposed experimental sessions involving target aircraft detection. The researcher has begun to develop our software product that will be used for training pilots to become skilled at rapid determination of target distance, altitude and direction of flight.

*All available information indicates the project is on track.*

f) Electronic Primary and Multi-function Flight Displays for GA; Certification Criteria and Usability Assessments.

A number of activities were accomplished during the quarter in preparation for the initiation of data collection. The COTR for the software-development contract held numerous telecons with ZedaSoft (the contractee) to provide continued guidance for finalizing the Primary Flight Display, and final integration of the system with the Advanced General Aviation Research Simulator was accomplished during a site visit to CAMI by the contractee. Acquisition of specific display hardware for the cockpit was abandoned in favor of the use of a high-resolution device already in-house on which a reduced-size PFD could be presented using a subset of the available display surface. The display hardware was installed in the AGARS along with a repeater display on the safety pilot's side of the cockpit, and functionality of both was verified.

Pretesting was conducted and Phase 1 experimentation began according to schedule. Two University of Oklahoma industrial engineering students (former students of the PI) were participating in the data collection as part of their senior-year internship "capstone" project, and they will also be involved in data reduction/analysis and preparation of the report. A presentation of the preliminary data will be made on April 23 to the OU faculty to satisfy these students' project requirements. Of the 32 pilot participants required for Phase 1 of the study, 19 had been completed as of the end of the quarter. Data collection is scheduled to be completed on April 9. Preliminary discussions were held regarding Phase 2 of the study, including required software revisions and experimental design/procedures, and software development was initiated for Phase 2.

*All available information indicates the project is on track.*

g) FAA/Industry Training Standards (FITS)

Activities performed during the last quarter included meetings with representatives from Cessna Aircraft, Michael Preston a distributor of Diamond aircraft located, and several local flight instructors to discuss the FITS program. A number of important issues were raised in our discussions including: 1) confusion regarding what is meant by scenario based training and how it differs from the cross country flight requirement of existing flight training programs; 2) concerns that the training syllabi available at FAA FITS web site describe training programs that are considerably longer than existing training programs; 3) doubts that the program can achieve the stated goals of reducing training time and cost while also improving safety; 4) questions regarding what minimum criteria a flight training program would need to satisfy to be recognized as a FITS program; 5) concerns that attempts to accommodate FITS training programs within existing

regulations are inappropriate; and 6) confusion regarding how a flight instructor would be certified to train pilots of FITS aircraft and whether the certification would be specific to a particular aircraft and avionics package.

*Indications are that this activity is on track.*

h) Migration of HFACS database to a web-based interface

Between 1/1/2004 and 3/31/2004, the initial requirements gathering phase began. The researchers met with AFS-800, CAMI, and AAR-100 personnel to assess end user needs and workflow of the application. During this reporting period, CAMI sent HFACS and NTSB NASDAC data feeds. Work is underway to merge the HFACS and NASDAC data into a warehouse for searching. Also, a preliminary interface is being constructed to allow for searching to take place.

*All available information indicates the project is on track.*

i) Unmanned Aircraft Operator Qualification and Training Requirements

On January 22<sup>nd</sup>, 2004 the General Aviation TCRG identified a FY04 “pop-up” unmanned aerial vehicle operator qualification requirement. The requirement’s objective will be to support the rapidly growing industry of Unmanned Aerial Vehicles (UAVs) as they transition from military to non-military surveillance and cargo applications. Historically, flight operations assumed an onboard pilot controlling an aircraft to ensure safe operation in the National Airspace System (NAS). An unmanned aerial vehicle may be controlled by a pilot or operator from a distant ground station, and in some cases, operate autonomously where the UAV’s flight path is based on pre-programmed global position system waypoints and the ground pilot or operator has very limited control over the aircraft flight movements. UAVs offer exciting opportunities for civil aviation; however before non-military UAV operations are fully integrated into the NAS, the FAA’s General Aviation and Commercial Aviation Division (AFS-800) needs to define operator qualification and training requirements. A market survey announcement will be distributed in two months with an expected start date of September 2004.

*The final report is due to AVR on December 31<sup>st</sup>, 2005*

j) Human Factors Maintenance Considerations of Unmanned Aircraft

On January 22<sup>nd</sup>, 2004 the General Aviation TCRG identified a FY04 “pop-up” unmanned aerial vehicle operator qualification requirement. The requirement’s objective will be to investigate what human factors maintenance unmanned aircraft issues need be addressed so that the Federal Aviation Administration can begin to “develop policies, procedures, and approval processes to enable operation of unmanned aerial vehicles” (Federal Aviation Administration’s Flight Plan 2004-2008, objective two: reduce the number of fatal accidents in general

aviation, strategy: establish standard procedures and guidelines for general aviation operators). A market survey announcement will be distributed in two months with an expected start date of September 2004.

*The final report is due to AVR on December 31<sup>st</sup>, 2005.*

k) National Airspace Human Factors Integration Plan for Unmanned Aerial Vehicles

To achieve the Federal Aviation Administration's (FAA) Flight Plan 2004-2008 Increased Safety Goal objective 2 to reduce the number of fatal accidents in general aviation, the General Aviation and Commercial Aviation Division (AFS-800) needs to develop policies, procedures, and approval processes to enable operation of unmanned aerial vehicles. To date, the vast amount of resources allocated to the development, testing, and integration of unmanned aerial vehicles in the national airspace have been invested in hardware solutions; however AFS-800 recognizes human factors is an integral component to safe unmanned aerial vehicle operations. AFS-800 requests a five-year human factors integration plan that identifies human factors issues mapped to the FAA's Regulation and Certification unmanned aerial vehicles plan. This research plan will provide supporting documentation for human factors issues that have been resolved, and recommendations for future human factors research.

*The research plan is due to AVR on December 31<sup>st</sup>, 2004*

William K. Krebs