FEDERAL AVIATION ADMINISTRATION
AAR-100 (Room 907)
800 Independence Avenue, S.W.
Washington, D.C. 20591

Tel: 202-267-8758
Fax: 202-267-5797
william.krebs@faa.gov

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

Subj: GENERAL AVIATION HUMAN FACTORS FIRST 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

Migration of HFACS database to a web-based interface. Following a meeting with ASY-1, NASDAC, and AFS-800, it was agreed that the HFACS database should be hosted on an FAA web-based server so that Air Safety Investigators would have access to it remotely and in their offices. AAR-100 had originally planned to develop a web-based interface and host it on their server, but after discussions with ASY-1 and the NASDAC Team Lead, it was decided that the HFACS database would be hosted on the NASDAC intra-net web site. Plans to make the database available to the public remain to be determined.

To begin the migration, the HFACS event and cause/factor databases were delivered to ASY in December for initial evaluation. A meeting will be held in January with AFS-800 and ASY to discuss the graphic user interface (GUI) and to develop a list of anticipated queries and the type of returns (tables, powerpoint graphs, data) that will be made available to ASIs.

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. This process began in December and should be completed in late-February. 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.

HFACS rotorcraft analysis. In November, CAMI added an additional principal investigator, Dr. Bert Boquet, to the HFACS team. Dr. Boquet has subsequently been tasked with conducting the HFACS analysis of commercial and general aviation rotorcraft accidents. The initial analysis was completed in December and will be briefed in January to AFS-830 (Mr. Bill Wallace) and a representative from the Helicopter Association International (Mr. Richard Wright). That meeting will provide the necessary guidance to focus the investigation and identify the specific questions to be answered by CAMI in the final HFACS rotorcraft report.

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 and write the report due in September of 2004. No delays in the delivery are anticipated.

In addition to these tasks, the HFACS project has been modified to include several additional tasks as a result of an informal briefing to ADA-1 in mid-November. Specifically, the Deputy Administrator tasked CAMI researchers with three additional tasks: 1) The Human Factors Analysis of 2003 Fatal GA Accidents, 2) Coordination with Alaska Region Aviation Safety Efforts, and 3) The development of a human error matrix to go along with HFACS. A brief description of each task and the progress to date follow:

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. A meeting was held with Mr. Jeff Guzzetti (Deputy Director for Regional Operations), Dr. Evan Byrne (Chief, Human Performance Division), and Dr. Deborah Bruce (Chief, Safety Studies Division) regarding a preliminary human factors analysis of 2003 GA fatal accidents. Knowing that few, if any, of those accidents have been completed, we discussed ways in which we could collect "preliminary" information from the field before the final report was released. The hope was that we could conduct a "preliminary" HFACS analysis of the fatal accident data to compare with existing data from CY 1990-2000.

In mid-December, Mr. Guzzetti provided CAMI with a draft white paper that suggested that the apparent spike in fatal accidents and the associated increase in fatalities may have been a statistical aberration. Indeed, when examining the relative proportion of fatal to non-fatal GA accidents over the last 20 years the trend was relatively flat (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.

Arguably, fatal accidents have been a major focus of the FAA. That being said, it is disappointing that we appear to have made little or no impact on the relative proportion of fatal accidents seen each year. It seems reasonable therefore, to take a closer look at these accidents using HFACS.

Our previous work at CAMI using HFACS has shown that the major difference between fatal and non-fatal accidents is the violation of rules. That is, if a pilot violates the rules and is involved in a GA accident, he/she is 4 times more likely to die. While this provides some insight into the differences between fatal and non-fatal accidents, the next step is to conduct a fine-grained analysis of the specific types of unsafe acts committed for each causal category (e.g., what are the types of violations committed during fatal and non-fatal GA accidents). CAMI will begin that work at the conclusion of the HFQA in the second quarter.

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). As requested by ADA-1, CAMI presented that data to AAL-1 (Mr. Patrick Poe) and his staff in December. Following the presentation, meetings were held with Mr. John Halinan (Alaska Capstone Coordinator) and Ms. Angela Elgee (Manager of the Systems Safety Branch). It was clear from our discussions that the Alaska Safety Initiative included much more than the Capstone effort. Indeed, there are no less than 10 separate initiatives in place of planned in Alaska. Discussions with AAL-1 included the use of HFACS to assist in prioritizing those safety initiatives and monitor their success. A follow-up meeting with the entire CAMI HFACS team is planned for early in the 2nd quarter.

Human Error Intervention Matrix Project. In FY 2004 the HFACS project that included coding all GA and commercial aviation accident data since 1990 will officially be ended as an RE&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 ADA-1, AAI-1, ACE-100, and AFS-800 in December. CAMI and the University of Illinois have been tasked with continuing that development effort and validation of the prototype. A meeting is planned with AAI, ACE-100, and AFS-800 early in FY04, Q2 to develop the requirement for this effort and to provide guidance to CAMI and the University of Illinois in the development of the research proposal. That proposal should be available for the GA TCRG early in FY04, Q3.

All indications indicate that this project is on track to complete the milestones as planned.

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

During FY04 Q1, 6 pilots started the study. A total of 30 pilots have been participated in the study this quarter. Of those, five completed IPC#1 and eight completed IPC#2, thereby completing the study. The following table shows the totals as of December 31,2003:

Sessions Run:	Totals
Air-fam*	75
PCATD-fam*	77
Frasca-fam*	80
IPC#1	70
IPC#2	69
P-Training	27
F-Training	45
A-Training	1
All types:	444

# of Subjects Started	82

Total in progress to completion: 77

All indications indicate that this project is on track and will be completed in FY04.

c) Credit for Instrument Rating in a Flight Training Device or Personal Computer

i. Phase I: Survey UAA, Part 61, and Part 141 institutions.

Project completed. Report delivered to TCRG.

ii. Phase II: Capabilities of FTDs/PCATDs

Project completed. Report delivered to TCRG.

iii. Phase III: Transfer of Training Effectiveness of a Flight Training Device (FTD).

AVI 130 Basic Instrument Course. A total of 30 students completed the AVI 130 Basic Instrument course for the fall semester and took the final check ride for the course. Table 1 shows the results of the check ride. A total of 16 students passed the check ride on the first attempt and 14 on the second attempt. Two students failed to complete the course requirements and were recommended for AVI 102, the remedial course.

Table 1
Lesson 45 Statistics (Fall, 2003)

	Airplane Only	PCATD 5.00	Frasca 5.00	Frasca 10.00	Frasca 15.00	Frasca 20.00
Number of Students	5	6	4	5	5	5
% First Flight Pass Rate	60.00 (N=3)	50.00 (N=3)	25.00 (N=1)	80.00 (N=4)	80.00 (N=4)	20.00 (N=1)
% Second Flight Pass Rate	100.00 (N=2)	100.00 (N=3)	100.00 (N=3)	100.00 (N=1)	100.00 (N=1)	100.00 (N=4)
Students Recommended 102	1	0	0	0	1	0
Total Dual to Completion	22.16 (N=5)	21.30 (N=6)	19.70 (N=4)	25.64 (N=5)	20.66 (N=5)	20.43 (N=5)
Variance Total Dual to Completion	5.15	5.05	32.68	2.30	13.91	5.18

Note: This lesson is the final check ride.

A combined total of 101 students have completed the AVI 130 Basic Instrument course for the fall 2002, spring 2003, summer 2003 and fall 2003 semesters and took the final check ride for the course. Table 2 shows the results of the stage check. A total of 61 students passed the check ride on the first attempt and 38 on the second attempt. One student failed the check ride on the second attempt and was recommended for a remedial course, AVI 102. Seven other students failed to complete the course and were recommended for AVI 102. These failures to successfully complete the course are consistent with expectations. It should noted that the variance in time to complete the course is substantial which indicates that additional subjects must be completed to provide the power needed to determine the statistical differences between groups.

Table 2. Aviation 130 Combined Statistics
Lesson 45 Statistics (Fall, 2002; Spring, Summer and Fall, 2003)

	Airplane Only	PCATD 5.00	Frasca 5.00	Frasca 10.00	Frasca 15.00	Frasca 20.00
Number of Students	18	18	15	18	16	16
% First Flight Pass Rate	50.00 (N=9)	66.67 (N=12)	53.33 (N=8)	72.22 (N=13)	81.25 (N=13)	37.50 (N=6)
% Second Flight Pass Rate	100.00 (N=9)	100.00 (N=6)	100.00 (N=7)	100.00 (N=4)	66.67 (N=2)	100.00 (N=10)
Students Recommended 102	1	0	1	1	3	2
Total Dual to Completion	22.69 (N=18)	20.19 (N=18)	19.55 (N=15)	21.35 (N=17)	19.38 (N=15)	18.31 (N=16)
Variance Total Dual to Completion	8.88	7.09	12.19	14.20	8.49	11.15

Note: This lesson is the final check ride.

AVI 140 Advanced Instrument Course. A total of 24 students completed the AVI 140 Advanced Instrument course for the fall semester and took the final check ride for the course. Table 3 shows the results of the check ride. A total of 9 students passed the check ride on the first attempt and 11 on the second attempt. Four students failed to pass the check ride on the second attempt and were recommended for AVI 102, the remedial course. Two other students failed to complete the course and were recommended for AVI 102.

Table 3
Lesson 60 Statistics (Fall, 2003)

	Airplane Only	PCATD 5.00	Frasca 5.00	Frasca 10.00	Frasca 15.00	Frasca 20.00
Number of Students	3	4	4	6	2	5
% First Flight Pass Rate	0.00 (N=0)	25.00 (N=1)	50.00 (N=2)	50.00 (N=3)	0.00 (N=0)	60.00 (N=3)
% Second Flight Pass Rate	100.00 (N=3)	66.67 (N=2)	100.00 (N=1)	66.67 (N=2)	100.00 (N=2)	50.00 (N=1)
Students Recommended 102	1	1	1	1	1	1
Total Dual to Completion	26.73 (N=3)	24.37 (N=3)	23.63 (N=3)	24.98 (N=5)	28.40 (N=3)	19.70 (N=4)
Variance Total Dual to Completion	34.74	.34	4.85	15.13	3.38	9.85

Note: Lesson 60 is the final check ride.

A combined total of 60 students completed the AVI 140 Advanced Instrument course for the spring 2003, summer 2003 and fall 2003 semesters and took the final check ride for the course. Table 4 shows the results of the check ride. A total of 33 students passed the check ride on the first attempt and 27 on the second attempt. Therefore 60 students out of a planned 180 students have completed the entire study. Five students failed to successfully pass the second check ride and were assigned to the remedial course AVI 102. Seven subjects failed to complete the course requirements and were assigned to AVI 102. There is a significant amount of variance in the groups "total dual to completion.

Table 4.
Lesson 60 Statistics (Spring, Summer, Fall, 2003)

	Airplane Only	PCATD 5.00	Frasca 5.00	Frasca 10.00	Frasca 15.00	Frasca 20.00
Number of Students	11	12	9	13	8	12
% First Flight Pass Rate	45.45 (N=5)	50.00 (N=6)	77.78 (N=7)	38.46 (N=5)	32.50 (N=3)	58.33 (N=7)
% Second Flight Pass	100.00	83.33	100.00	85.71	100.00	80.00

Rate	(N=6)	(N=5)	(N=1)	(N=6)	(N=5)	(N=4)
Students Recommended 102	2	1	3	2	3	1
Total Dual to Completion	27.66 (N=11)	26.05 (N=11)	24.91 (N=8)	24.39 (N=11)	22.86 (N=8)	20.04 (N=11)
Variance Total Dual to Completion	13.99	4.62	5.60	8.93	15.10	9.62

Indications are that this activity is on track.

d) Developing And Validating Criteria for Constraining False & Nuisance Alerts For Cockpit Display Of Traffic Information Avionics.

Draft report was submitted to sponsors on December 5, 2003. The final report that includes sponsors feedback was submitted to AAR-100 on January 6th, 2004. Sponsors, CAMI, and AAR-100 personnel are reviewing the final report.

Project completed.

e) Visibility in the Aviation Environment

The researcher has completed the second phase of construction of the PCATD and continued to evaluate models of visual detection and image statistic analysis for application to visual scenes. Data collection has continued for images in the aviation environment as proposed in Phase 1 of the project. Approximately 300 images have been so far collected in the Reno area, the Los Angeles basin, Central and Northern California, Arizona, New Mexico, Texas, Louisiana, Florida, Idaho, Oregon, and Washington. These images now extend in time from summer into winter conditions and include difficult high contrast masking conditions encountered in snowy environments in the mountains. The researcher continues to research possible implementation of specific models of visual detection (e.g. Ahumada and Beard) for the future image generation and analysis. Begun to generate simple aids for pilot awareness as preliminary products. Specifically these are printed cards/sheets which show how small and large aircraft appear at various distances. We are also developing and aid to demonstrate how the apparent elevation of targets varies with distance and altitude difference.

During the current reporting period, our best accomplishments have been the completion of the simulation system with outside visuals and the collection of large amounts of imagery data as scheduled for the project. Data collection is fairly time consuming and we have managed to gather data from an increasingly large geographical region and across seasonal variation as noted above.

Indications are that this activity is on track; however milestone dates will be pushed back by one quarter due to the delay of the start date of the grant. The researcher does not predict any future delays beyond the delay of the start date.

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

A number of activities were accomplished during the quarter. The COTR for the software-development contract held a number of telecons with and conducted a site visit at ZedaSoft (the contractee) to provide interactive guidance for the development of the display so that it would be in accordance with recent submissions to the certification process (i.e., a representative display with appropriately modifiable parameters for experimentation). Software (display-generating) and hardware (back-up computer for the HMD system) were delivered by the contractor (ZedaSoft) at the end of the first quarter according to the defined schedule.

The independent functioning of the system was verified, along with the appropriate response of the various features of the display. The accomplished modifications included the addition to the existing terrain depiction of attitude symbology, aircraft performance indicators, and guidance symbology, the latter including a simplified highway-in-the-sky presentation. An additional experimental feature was incorporated into the display to provide graphical command guidance, both in pitch and roll, for an ordered return to straight-and-level flight from unusual or unknown attitudes. This feature was also tested and it was verified that it functioned according to the logic specified for this function (order of commands dictated by direction of pitch-attitude departure upon exceeding envelope). This feature was included to allow examination of the potential for the terrain to induce incorrect responses during attempted recoveries from unusual attitudes and the potential beneficial effect that remedial guidance cues could have.

The task of interfacing the additional display indices with their associated variables in the AGARS simulation system was initiated, involving the AGARS maintenance contract group. This was in progress at the end of the quarter and was expected to be completed early in the second quarter. The sponsor was kept informed of progress on a regular basis and sent numerous graphical representations of the display in various modes of operation and in normal and extreme attitudes so that continued compliance with sponsor requirements could be assessed. Experimentation in response to several sponsor issues was scheduled to begin in the second quarter.

Indications are that this activity is on track.

g) FAA/Industry Training Standards (FITS)

Researchers have completed their search for technical reports from government-supported programs (NASA, FAA, Air Force etc) for literature related to stated objectives of the FITS program. In addition they are on schedule to complete their review of the FITS objectives, plans and organization. They are presently writing a summary of this literature. Cessna Aircraft Company has agreed to participate in the research by reviewing FITS' goals and objectives and evaluating how they may affect their pilot training programs. In addition, an independent consultant has begun reviewing the training materials developed thus far by the FITS program including the TAA Transition Training Master Syllabus and the FITS Master Instructor Syllabus.

The project's expected deliverables will be (1) review of the current state of research and technology needed to support the goals of the FITS program, (2) summary of potential obstacles (financial, regulatory, technological or logistic) identified by flight training schools, aircraft manufacturers and avionics manufacturers in fielding FITS related technology program, and (3) report identifying the future research needs to support the successful implementation of the FITS program.

Due to budget constraints, this project was reduced 37% for the fiscal year 2004 tasks.

All indications indicate that this project is on track and will be completed in FY04.

William K. Krebs