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

Subj: AVIATION MAINTENANCE HUMAN FACTORS THIRD QUARTER '03  
REPORT

Ref: (a) Aviation maintenance human factors execution plans

1) Per reference (a), the third quarter 2003 report for each aviation maintenance human factors projects are listed below.

a) An Evaluation of Broadband Applications to Aircraft Maintenance Safety.

CAMI: The researcher gathered product information for various broadband applications and discussed advantages and disadvantages of various applications with Goodrich personnel. The researcher submitted a draft report (task: identify the advantages and disadvantages in using electronic signatures, portable display units, and electronic manuals in the aviation maintenance work environment) as specified by the execution plan. The researcher will submit completed draft in August '03.

NASA Ames: On April 14, 2003, researchers visited FedEx's main maintenance facility in Memphis, TN. FedEx's head of maintenance projects arranged briefings and demonstrations of all of FedEx's broadband and computing technologies used in their maintenance operation. Plans for out-year research projects were discussed.

On May 21, 2003 researchers visited Garrett Aviation Services, in Van Nuys, CA. Garrett provides both line and scheduled maintenance for corporate jet aircraft.

Researchers have scheduled two additional site visits to Continental Airlines and United Air Lines maintenance facilities. These visits will take place during Q4.

Researchers have begun to put together the final deliverable for FY03. The report will de-identify the narrative descriptions of all maintenance facility site visits.

*All indications indicate that this project is on track to complete year 1 milestones as planned.*

b) Vision Testing Requirements for Certain Persons Maintaining and Inspecting Aircraft and Aircraft Components.

NASA Ames: Researcher is near completion of the functional computational model of image discrimination for vision standards study. The psychophysics programming is nearly complete. Actual airframe crack images were modified for modeling and psychophysics efforts. Cracks were removed using drawing program. Two experienced aircraft inspectors viewed the modified crack images to identify cracks and judge appropriateness of crack removal.

Ohio State University/CAMI: Initial attempts to solicit complete and meaningful responses to aviation maintenance personnel have resulted in data inconsistencies. Rather than disseminating these surveys at receptive facilities for voluntary completion, the researchers have found that the quality of the survey responses has improved when the forms are distributed onsite. Additionally, researchers have encountered some difficulty gaining access to some maintenance facilities, especially the military facilities. While the facilities managers appear interested in participating in this program, requests for approval must be passed up the chain of command, which has proven to be a time consuming exercise. As a result, the researchers schedule has been modified:

- Disseminate personnel surveys at receptive facilities with assistance of AFS-300. (October 2003).
- Collect facility data using the facility survey form. (October 2003).
- Analyze data from personnel and facility surveys. (November 2003).

Researchers achieved the following during this reporting period:

- traveled to Greensboro, NC, for a data collection session at the Timco Aviation Services, Inc., facility (4/8-10).
- traveled to Everett, WA, for a data collection session at the Goodrich Aviation Technical Services facility (5/13-16).
- traveled to Lake City, FL, for a data collection session at the Timco Aviation Services, Inc., facility (5/28-30).
- traveled to Midwest City, OK, for a data collection session at the Tinker AFB Air Logistics Center (6/3-5).

*All indications indicate that this project is on track to complete Phase II milestones as planned; however there may be problems accessing military and civilian maintenance facilities which will impact the Phase II deliverables.*

c) Language Barriers Result in Maintenance Deficiencies. During this quarter the data collection was completed at two sites outside the USA. The researcher's data

collection was based on that used at the preliminary sites in the USA during the previous quarter, and included both focus groups and a comprehension test. Both of the foreign sites were in the UK, as planned trips to Asia were canceled because of the SARS outbreak there. Each site was an MRO, giving a total of 15 additional participants. Combining this data with the earlier USA data gave the following patterns of language errors:

Verbal (Synchronous)

1. AMT unable to communicate verbally to the level required.
2. AMT and colleagues / supervisors have poorly matched models of their own and each other's English ability.
3. Native English speakers with different regional or non-US English accents (e.g. UK, India, Caribbean) prevent adequate communications.
4. AMTs unable to understand safety announcements over the PA system.

Written (Asynchronous)

5. AMT unable to understand safety placard in English.
6. AMT unable to understand written English documentation.  
Foreign documentation poorly translated into English.

In addition, data from the 15 participants who took part in the pilot test of workcard comprehension as a function of Simplified English was analyzed using ANOVAs of speed and accuracy. No main effects of Simplified English were found, but workcard difficulty was significant in both measures. There was a significant correlation between speed and accuracy. The conclusion is that the proposed methodology is effective for use in subsequent years of data collection.

The final report has been written on the first year of work, detailing the modeling of communication errors, the analysis of databases on errors, the analysis of survey data on language issues in maintenance, and the on-site data collection and analysis.

For the following quarter, the researcher will develop detailed questionnaires based on the patterns of language errors found above, using the wording proposed in our original proposal. The researcher will also design the experiment on intervention effectiveness in detail. Data collection on both studies can begin in the next quarter, depending on cooperation with airlines and MRO's worldwide.

*All indications indicate that this project is on track to complete year 1 milestones as planned.*

- d) Using Technology to Support Inspector Training. The researcher conducted repeat site visits to GA facilities in Columbia, Greenville and Pickens. The researcher used the task analysis developed from the grant to measure inspection performance and to identify inspection errors. Based on the results, the researcher is developing objectives for the training program. Currently, the researcher is identifying training needs and linking them to American Society of Non-

Destructive Testing (ASNT) specifications. The researcher submitted the annual report entitled “Use of Advanced Technology to Support Inspection Training in the General Aviation Industry” on June 11<sup>th</sup>, 2003. The report can be found at <http://www.hf.faa.gov/docs/508/docs/GATrainInterimRpt.pdf>

*All indications indicate that this project is on track to complete year 1 milestones as planned.*

- e) Review Amateur-Built Aircraft Accident/Incidents. The researchers are waiting for the sponsor to select a date to brief the phase I results.

*Project is complete.*

- f) General Aviation Alaska Maintenance Accidents. The HFACS database for the years 1990 through 2000 was completed. Maintenance-related accidents were coded as being a “cause” a “factor” or as “other”. The accuracy of the coding was verified by checking all accidents with the code of “other”. The researcher examined a sample of accidents and sorted them into either a category of error or as a violation.

*All indications indicate that this project is on track to complete year 1 milestones as planned.*

William K. Krebs