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

Subj: AVIATION MAINTENANCE HUMAN FACTORS FOURTH QUARTER '03
REPORT

Ref: (a) Aviation maintenance human factors execution plans
(<http://www.hf.faa.gov/maintfunded.htm>)

1) Fourth quarter report for each project is listed below.

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

CAMI: Identified the advantages and disadvantages of using electronic signatures, portable display units, and electronic manuals in the aviation maintenance work environment. The researcher visited Goodrich ATS to gather information for the development of a survey. The survey will be used to measure organizational issues and attitudes to determine the affects of broadband technologies on aviation maintenance personnel performance. The researcher presented the FY03 annual report at the program review.

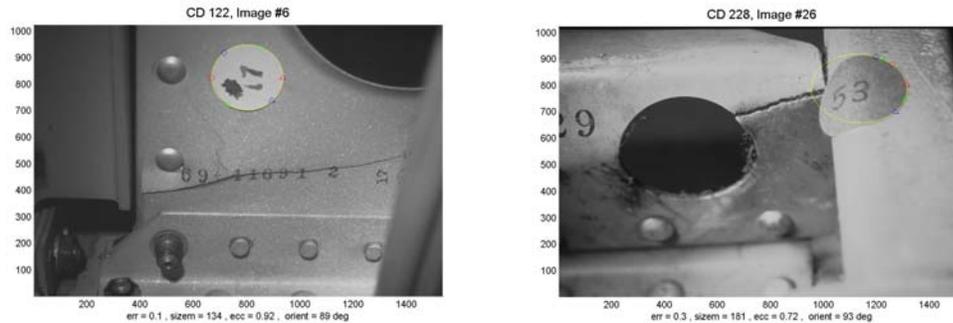
NASA Ames: We created a web site containing all project deliverables for FY03, including: a project literature review, our final FY03 report, a list of computer/broadband technology manufacturers and products, a matrix of maintenance facilities and the computer/broadband technologies they use. The information can be found at <http://automation.arc.nasa.gov/mx/>. The researcher presented the FY03 annual report at the program review.

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: The computational model was modified to analyze airframe crack images. To determine the crack size, we had to estimate the magnification in each

photo received from Sandia Labs. When Sandia captured each photo, they included a reference measurement, “sticky”, of 0.75 in. To estimate the image magnification, we used Adobe Photoshop to identify the coordinates of six points along the perimeter of the sticky.



Sandia Labs airframe crack images.

Mouse clicks on the perimeter are shown with colored symbols. These estimates of the perimeter were taken by eye, therefore we also determined the error in these judgements. The magnitude of this error is shown along the bottom of the figure along with other variables that will be used in the model to calculate the crack size. The modeling program (and ultimately the psychophysics program) take these data and compute a magnification value estimating the diameter of the sticky. When the sticky is a circular ellipse, the estimates are very accurate. Some of the photos were taken at an angle relative to the sticky, or the sticky could be located on an edge (right figure). In these cases, we identified coordinates only on the flat portion of the sticky and estimated the ellipse based on this flat portion. Note that the error is larger in these cases.

The researcher presented the FY03 annual report at the program review.

Ohio State University and CAMI: Drs. Van Nakagawara, Greg Good, Jason Nichols, and Manoj Venkiteshwar traveled to Pittsburgh, PA, for a data collection session in the US Airways maintenance facility at Pittsburgh International Airport (7/8-10). Coordination was ongoing with Tinker AFB Air Logistics Center to obtain NDT demographic and medical surveillance data at their facility. The researchers presented the FY03 annual report at the program review.

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 the fourth quarter we have developed the detailed questionnaire as planned. They are based on the patterns of language errors found in the third

quarter. The experimental design has been completed and the workcards and questionnaires translated into Korean and Chinese for use in data collection in S. Korea and China.

The first data collection trip to Seoul, South Korea, was abortive as the airlines involved reneged three days before the visit. It is doubtful whether a second visit would be fruitful. In the next quarter, plans are being made to visit airlines in China and Germany to collect data on the effectiveness of different language interventions.

The researcher presented the FY03 annual report at the program review.

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

d) Using Technology to Support Inspector Training.

Started work on organizing material for inspection training and developing paper prototype. Started initial review on interface design. Sought feedback on the material developed from subject matter experts. Conducted repeated visits with subject matter experts to evaluate the developed material. Identified appropriate methods for training, such as wing inspection and door inspection.

Disseminated research through the following sources:

- Gramopadhye, A. K. Melloy, B. J., Bingham J., Master R. and Chen, S. (2003). The use of high fidelity simulator to support aircraft inspection training: Development and Usability Analysis. Human Factors and Aerospace Safety, 3(2), 121-146.
- Gramopadhye, A. K., and Desai, R. R., Task Analysis of General Aviation Inspection Activities: Methodology and Findings, Proceedings of the Human Factors and Ergonomics Society Meeting, Denver, Colorado, 2003.
- Gramopadhye A. K., Use of Advanced Technology to Support Inspection Training in the General Aviation Industry, Technical Report Presented to Federal Aviation Administration – Human Factors Division, FAA Grantees Meeting, University of Nevada, Reno, September 7, 2003.
- Jacob, R. and Gramopadhye, A.K. (2004). Customized Computer Based Training to meet GA aircraft inspection needs. Abstract submitted to IERC (Industrial Engineering Research Conference), Houston.
- Raina, S. and Gramopadhye, A.K. (2004). Development and evaluation of a CBT to support decision making. Abstract submitted to IERC (Industrial Engineering Research Conference), Houston.
- Regunath, S. and Gramopadhye, A.K. (2004). Use of HTA in designing computer based simulator. Abstract submitted to IERC (Industrial Engineering Research Conference), Houston.
- Subramanian, R. and Gramopadhye, A.K. (2004). An error taxonomic approach to support inspection training. Abstract submitted to IERC (Industrial Engineering Research Conference), Houston.

The researcher presented the FY03 annual report at the program review.

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 presented results to Bill O'Brien (Maintenance TCRG POC).

Project completed.

- f) General Aviation Alaska Maintenance Accidents.

Reviewed the last 10 years NTSB and FAA General Aviation (GA) accident and incident data for the U.S. to determine the leading maintenance factors that contributed to GA accidents and incidents with particular emphasis placed on human error. Compared the Alaska data to the rest of the United States to determine if there were any significant differences between the two regions. Determined if maintenance errors were a contributing factor or a direct causal factor to accidents to a greater degree in Alaska than in the rest of the country.

Phase I completed. Awaiting comments from TCRG on phase I draft report.

- g) An Assessment of Barriers to Implementation of Aviation Safety Programs (ASAP) in Maintenance Organizations.

This project was awarded on August 22, 2003. As of October 13, focus group discussions have been held with one airline (without an ASAP MOU). Two additional discussion sessions, one with an airline with an ASAP MOU and another with an airline without an ASAP MOU, have been scheduled for October 20 and 30. Additional meetings are being arranged at other airlines and the corresponding Certificate Holding Offices. It is likely that enough data will be collected through the focus group discussions so as to enable the development of the survey questionnaire by the target date of December 15, 2003.

A positive working relationship has been established with three airlines, two of which do not have a Maintenance ASAP agreement at this time. Also, at least two other airlines that do not have an ASAP agreement will be contacted by December 15, 2003. Consequently, at least four airlines without an ASAP agreement will have been contacted by the end of the first year of this project. As airlines and their associated Certificate Holding Offices are contacted regarding the ASAP agreements, more parties actively think about ASAP. Consequently, it is likely that a positive discussion regarding ASAP agreements will result at the corresponding airline sites.

Fourth quarter 2003 new start grant. All indications indicate that this project is on track to complete year 1 milestones as planned.

- h) Auditing and Surveillance Maintenance Error Tool.

New start, no progress to report.

Fourth quarter 2003 new start. All indications indicate that this project is on track to complete year 1 milestones as planned.

i) Effects of Fatigue, Vigilance, Environment on Inspectors Performing Fluorescent Penetrant and/or Magnetic Particle Inspections.

C. G. Drury visited Rusty Jones at FAA/HQ on September 22, 2003 to discuss potential choices for materials and participants in the following studies. Contacts have been established with CAMI (Thomas Netshus) for cooperation on vigilance and fatigue measurement, potentially using the Actiwatches originally used by Johnson et al (2001) to monitor sleep and shift patterns. Further contacts have been made with noted vigilance researchers, Joel Warm and Raja Parasuraman, for meetings at HFES, Denver. C. G. Drury met with Drew Dawson at the FAA/TC/CAA meeting in Toronto to establish contacts on shift work/sleep research. At the HFES, Denver meeting we will discuss possible software for FPI image inspection with Anand Gramopadhye.

Fourth quarter 2003 new start. All indications indicate that this project is on track to complete year 1 milestones as planned.

William K. Krebs