Chapter 0
PHASE VII OVERVIEW

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0.1 INTRODUCTION

Secretary Peña's Safety Summit held in 1995 has resulted in the Department of Transportation's Aviation Safety Action Plan - "Zero Accidents." Vice president Gore's Commission also identified numerous opportunities to improve airline safety; their Final Report, submitted February 12, 1997 to President Clinton, can be found on the World Wide Web at: http://www.aviationcommission.dot.gov. Such commissions have brought a new level of awareness and focus to applying Human Factors approaches to reducing human errors and developing methods and tools that allow cost savings without compromising safety. The airline industry is showing a great responsiveness in applying human factors methodologies to the maintenance environment. Maintenance Resource Management (MRM) or Technician Resource Management (TRM) using Crew Resource Management (CRM-Human Factors concepts is being viewed favorably by many airlines. Continental Airline's Crew Coordination Concepts (CCC) program for its maintenance personnel is an example of this effort. Airlines are trying to control and reduce "Human Error" and are moving away from "blame the technician" approach to using structured methods to identify the root cause of the errors. The Maintenance Error Decision Aid (MEDA), developed by Boeing in cooperation with the Federal Aviation Administration (FAA) and various airlines, is an example of this approach. With human error being the # 1 cause of aviation incidents, it is evident that applying human factors principles to aviation is the best optionfor the worldwide air transport system to continue to maintain and improve air safety.

The Office of Aviation Medicine (AAM) has conducted human factors-related research in aviation maintenance since 1989. The research ranges from basic scientific experimentation in laboratories to applied studies in airline working environments. The philosophy of this research program has been that "good science" must be the basis for "good practice" and the research conducted must have demonstrable benefits to the Aviation Industry. For this to happen, the end user of the research must be involved in all stages of the research. As such, the researchers in this program have actively sought input from airlines and FAA organizations to define, develop and evaluate the research initiatives.

There has been a strong emphasis on transitioning the research products to the industry. For example one major air carrier is using maintenance workcards that have been redesigned as part of the research. The FAA Flight Standards Service (AFS) is currently deploying the second version of an operational portable computing system called OASIS (On-line Aviation Safety Inspection System). Five hundred AFS Inspectors will be equipped with this new system by the summer of 1997, with a plan of all Inspectors receiving the system by 1999. OASIS was an offshoot of thepen-computing job aid developed as part of this research program. These and other research products and procedures generated by the research program have continued to demonstrate the effectiveness of using human factors principles in the aviation maintenance.

The research program has conducted 11 workshops on Human Factors in Maintenance and Inspection attended by over 1400 industry participants. In eight years, the research program has generated over 200 technical reports, journal articles, and presentations at industry meetings. Five CD-ROMs have been published so far and distributed to over 4000 recipients. A homepage has also been established on the world wide web of the Internet to disseminate Human Factors Information to the aviation community (http://www.hfskyway.com).

0.2 CHAPTER ABSTRACTS

This report describes the research activities performed during Phase VII of the research program. Each of the research activities is summarized below.

0.2.1 Advanced Technology in Aircraft Maintenance: The Turbine Repair Automated Control System (TRACS) (Chapter 1)

Each year, the research program investigates how advanced technology can be used to improve the safety and efficiency of aircraft maintenance operations. This year's project focused on automation of information flow in repair shops. A prototype system was developed to aid airline technicians in tracking, repairing and returning jet engine parts back to serviceability. This project demonstrates that task-centered information systems are feasible for supporting information flow in repair shops.

0.2.2 Re-purposing the System for Training of Aviation Regulations (STAR) to Aid On-the-Job Training for Aviation Safety Inspectors (Chapter 2)

This project is the third and final research phase for the System for Training of Aviation Regulations (STAR). The first two phases developed and evaluated an advanced computer-based training approach to teaching the Federal Aviation Regulations (FARs) to students in Part 147 schools. The approach incorporates multimedia presentations and storytelling techniques within several different computer-based learning environments. This year's effort involved re-purposing this information and structure to provide On-the-Job Training (OJT) to FAA Flight Safety Inspectors.

0.2.3 Supervisory Task Analysis: Aircraft Maintenance Environment (Chapter 3)

Task Analysis is a human factors technique that has been applied previously in the research program to identify training or job aiding needs. This year's project focused on analyzing the tasks of first and second level maintenance supervisors (foremen and lead mechanics). This chapter details the methodology and results of the task analysis which identified the need for improved training for new foremen and lead mechanics. A preliminary curriculum outline for leadership training is provided.

0.2.4 Documentation Design Aid Development (Chapter 4)

The Documentation Design Aid project follows several years of studies related to human factors in aviation maintenance task documentation. Previous projects have shown that it is possible to substantially reduce human errors in reading and interpreting documents, such as workcards, by incorporating human factors guidelines into document design. The current effort identified issues in the existing process for generating, testing and issuing of Engineering Orders (EOs) by leading a focus group at a partner airline. A Documentation Design Aid (DDA) was then developed using the technical literature on human performance in information transfer tasks. The project concluded with a field evaluation of both paper and software versions of the DDA. The evaluation showed that first-time technical users of the Document Design Aid (with less than 20 minutes of training-plus-quiz) were able to find about a third of all the expert-recommended human factors improvements in a typical Engineering Order within an hour.

0.2.5 A Proactive Error Reporting System (Chapter 5)

One approach to controlling maintenance errors is to develop error reporting systems which allow errors to be tracked, investigated, and analyzed. In the first phase of this project, a unified error reporting format was developed in response to the realization that current information about errors is dispersed in various systems and formats. This year's effort expanded on the concept of reactive error reporting and post incident analysis to develop a more proactive approach to preventing errors. The approach identified root causes for Ground Damage Incidents and linked these errors to known solutions. The researchers found that substantial error data, now being captured by error reporting systems, can be used to develop more proactive systems. Since the data on errors and solutions is not currently available, further development of the Proactive Error Report System is not planned.

0.2.6 Role Of Computers In Team Training: The Aircraft Maintenance Environment Example (Chapter 6)

Last year the research program identified the need for training aviation maintenance technicians to work as teams. A multimedia program called Aircraft Maintenance Team Trainer (AMTT) was developed to provide team training to aviation maintenance technicians. In this year's effort, the prototype AMTT computer-based training program was evaluated. The study showed that computer-based training is just as effective as instructor-led training in teaching "soft" skills (i.e., communication skills, interpersonal relationship skills, leadership skills, and decision making). As a result, the training program was modified for general distribution to the aviation maintenance industry on a standalone CD-ROM.

0.2.7 Creation Of Team Situation Awareness Training For Maintenance Technicians (Chapter 7)

The task represents the second phase of a three-phase effort. Phase I, completed last year, studied how the situation awareness concepts, developed for pilots and air traffic controllers, could be applied to aviation maintenance teams. This chapter documents the Phase II development effort. An 8-hour instructor-led course on Team Situation Awareness for maintenance technicians was developed in conjunction with aviation maintenance technicians at a partner airline. The objective of this curiculum is to equip Technical Operations personnel with the skills and abilities to develop an awareness and understanding of factors that affect SA in the maintenance domain and team processes. Five SA concepts are taught: 1) Shared Mental Model, 2) Verbalization of Decision, 3) Better Shift Meetings and Teamwork, 4) Feedback, 5) SA Errors. Materials include MS Office PowerPoint slides, group activities, and a Facilitator's Handbook. The PowerPoint slides are provided as a chapter appendix.