CHAPTER 1
ANNUAL PROGRAM SUMMARY

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1.1 EXECUTIVE SUMMARY

The Office of Aviation Medicine, once again, offers the annual detailed reports on each of the research and development projects. These reports are products of the Human Factors in Aviation Maintenance and Inspection research program. All of the Program's eleven years are documented on the Federal Aviation Administration (FAA) website (or directly at www.hfskyway.com). The first ten years of research are available on CD-ROM through the FAA Office of Aviation Medicine or Galaxy Scientific Corporation in Atlanta, Georgia. The FAA Program Manager and the research team are particularly proud that all written products of over a decade of research are readily accessible. This capability is representative of the manner in which the research focused on enhancing human performance by application of technology.

Requirements or suggestions from the White House, government safety committees, the National Transportation Safety Board (NTSB), and the industry representative groups drive much of the year's research. This direction is consistent with the applied nature of the program since its inception in 1988. This summary shall briefly review each of the eleven chapters and four individual research reports.

1.2 CHAPTER SUMMARIES

1.2.1 Chapter 2: Maintenance Error Causation

Chapter 2, written by David Marx , entitled *Maintenance Error Causation*, is a multifaceted research report. This research report covers aspects of human maintenance error in an attempt to determine the appropriate depth of an investigation of error. Secondly the research reports the results of an extensive maintenance error survey. Over 200 industry personnel responded to a survey assessing how they conducted error investigations. The survey tested six hypotheses regarding individual investigative style. Finally, the research offers and describes seven rules of causation that can guide human error investigations in maintenance organizations.

1.2.2 Chapter 3: Improving Operations and Oversight of Contract Maintenance

Raymond Goldsby of Galaxy Scientific Corporation writes Chapter 3. This research project report* is a result of accidents and incidents like ValuJet. The study is a result of extensive visits and discussions with personnel from U.S. repair stations and FAA field offices. In seven geographical locations over 60 personnel were interviewed. The research shows that there have been extensive improvements to the repair station system since the U.S. Government Accounting Office Report of 1997. The repair station regulatory oversight and cooperation is working well to ensure compliance and safety. The research identifies opportunities for improvement associated with FAA rulemaking, communication, and standardization of oversight across FAA geographical regions. The report ends each section with numerous direct quotes from both industry and FAA personnel. The report concludes with eight recommendations to ensure and improve the repair station system.

1.2.3 Chapter 4: Use of Computer-Based Training for Aircraft Inspection: Minimizing Errors and Standardizing the Inspection Process

Anand Gramopadhye and his colleagues from Clemson University author Chapter 4. This research project report describes the development and functionality of the Automated System of Self-Instruction for Specialized Training (ASSIST). The software is an interactive simulation that permits a variety of visual inspection tasks. The software includes routines to track student performance and also to modify training scenarios. Since the primary deliverable is the software, the report is purposely brief. The 2-CD-ROM set of ASSIST is available through www.hfskyway.com .

1.2.4 Chapter 5: An Assessment of Industry Use of FAA Human Factors Research from 1988 through 1998

Ms. Jean Watson of the FAA Office of Aviation Medicine and Dr. William B. Johnson of Galaxy Scientific write Chapter 5. This research report, published in mid-1998, is the result of a sampling to 122 respondents from the aviation maintenance industry worldwide. The results show that the industry is very familiar with the research program and is using the research technical information and products. The program receives high marks, as described in detail throughout the report. Of particular interest is the Appendix containing a multitude of open-ended comments.

1.2.5 Chapter 6: Standardizing the Shift Change Process: Efforts to Minimize Shift Change Errors

Anand Gramopadhye and colleagues at Clemson University write Chapter 6. Shift change has been widely reported as a cause of several errors/accidents in the aircraft maintenance industry. This can be attributed to a lack of well-defined shift change procedures for use by the aircraft maintenance industry. In response to this need, industry has developed ad-hoc measures and general guidelines to assist various personnel involved in the shift change process. This research looked at the entire shift change process at representative aircraft maintenance sites. Following a detailed task analysis of the shift change process, taxonomy of errors was developed. The analysis focused on communication norms, shift change procedures, guidelines, and existing mandated procedures. The analysis along with the taxonomy of errors was used to identify human factor interventions to develop a standardized shift change process that minimizes shift change errors.

1.2.6 Chapter 7: Standards for Certification of Aviation Maintenance Technician Training Program Using the AMT/AMT-T Integrated Curriculum

Chapter 7 is written by Charles White of Aviation Training and Technical Consulting and Professor Mike Kroes of Purdue University. This research report gives the results of a survey completed by 75 aviation maintenance training institutions. The respondents were not satisfied with the ability of the current regulatory system to measure quality or to encourage curricula upgrade. The report outlines suggestions to upgrade current curricula to meet the occupational requirements for airline maintenance. The research addresses a variety of issues including, but not limited to, curricula, course sequencing, faculty, class size, professional development, testing, facilities, and more.

1.2.7 Chapter 8: Human Factors Accidents Classification System Analysis of Selected NTSB Maintenance-Related Mishaps

CDR John K. Schmidt of the Naval Postgraduate School writes Chapter 8. This research project capitalizes on an FAA database of NTSB accidents that resides on the FAA (www.hfskway.com) website and on numerous CD-ROMs distributed by the FAA Office of Aviation Medicine. Dr. Schmidt uses the Naval Safety Center's Human Factors Accident Classification System to analyze the maintenance-related mishaps. The system identified inadequate supervision, failed communications, skill-based errors, and procedural violators as the primary human error categories. The report shows how the Navy tool can be used to better categorize and understand maintenance-related mishaps attributable to human error.

1.2.8 Chapter 9: Technology Based Solutions for Process Management in Aviation Maintenance

Anand Gramopadhye of Clemson University and Jeff Millians of Galaxy Scientific Corporation wrote Chapter 9. This research project describes the software systems for Product Data Management (PDM) and their applicability in the aviation maintenance environment. The large deliverable of the project was an operational prototype of PDM to create maintenance workcards for a repair station application. That process and product is described, including the results of user acceptance tests.

1.2.9 Chapter 10: Maintenance Resource Management On-Line Seminar

Dr. Terrell Chandler of Galaxy Scientific Corporation writes Chapter 10. Like Chapter 4, this research report describes a substantive software product. This software is the most substantive deliverable of this task. The chapter describes the Safe Maintenance in Aviation Resource and Training (SMART). The entire software system can be viewed at FAA website (www.hfskyway.com). SMART was used to deliver a maintenance resource management course, worldwide, in early 1999. The chapter describes the operations of this distance education system and also describes the first application and system evaluation.

1.2.10 Chapter 11: Study of Fatigue Factors Affecting Human Performance in Aviation Maintenance

Ben Sian of Galaxy Scientific Corporation writes Chapter 11. The research project was a result of an NTSB recommendation to the FAA. The research report details an exploratory study that examines duty times for aviation maintenance technicians. The chapter offers a succinct explanation of fatigue, its causes, and its potential effects. Individual Report Summaries

1.3 INDIVIDUAL REPORTS

The research conducted in 1998-1999 also resulted in five stand-alone reports that are published on the website and in limited hardcopy. A brief summary of these reports is included here.

1.3.1 Development of Process to Improve Work Documentation of Repair Stations

The first individual research report was written by Professor Colin Drury and his colleagues at the State University of New York at Buffalo. This research report describes the results of interviews conducted with managers and maintenance personnel at six repair stations. The report is divided into four sections addressing 1) the environment, 2) quality systems, 3) labor turnover and training, and 4) multiple document formats. The report recommendations fall into the categories of documentation improvement, documentation standardization, error control mechanisms, turnover and training, and organizational pressure. The report's appendices are of value since they contain numerous examples of how to improve upon workcards.

1.3.2 Human Factors Good Practices in Fluorescent Penetrant Inspection

This individual research report was written by Professor Colin Drury of the State University of New York at Buffalo. The report describes the important relationships among the organization, the procedures, the test equipment, and the human when conducting Fluroescent Penetrant Inspection (FPI). This report is very practical. It describes 86 best practices in nondestructive inspection techniques. The unique characteristic of this report is that it not only describes the best practices, but also offers tables of explanation as to why each best practice should be used.

1.3.3 Job Task Analysis of the Aviation Maintenance Technician

Ed Czepiel and Larin Adams at Northwestern University wrote the third individual research report. The substantive report will be available at FAA website (www.hfskyway.com). It is the end product of a five-year job task analysis. The study compares the results of a recent large industry survey to the findings of a similar study conducted as the Allen Study in the early seventies. The report is complete with numerous tables meant to have potential value to designers of aviation maintenance curricula.

1.3.4 Advisory Circular for Training Qualification and Certification of NDT Personnel

This Advisory Circular contains recommendations for the experience, training, qualifying, examining, and certifying nondestructive testing personnel for inspection of aircraft, engines, propellers, accessories, and components. The Advisory Circular recommends criteria for qualification of personnel requiring appropriate knowledge of technical principles underlying the nondestructive tests they perform.