# Current Activities

The Human Factors in Aviation Maintenance and Inspection research program has set a major goal for contributing to the reduction of error in aircraft maintenance.

**GOAL: Reduce maintenance-related accidents and incidents resulting from human error by 20% by the year 2003.**

The program shall periodically measure its success in achieving this goal by analyzing the number of fatalities caused by aircraft maintenance-related accidents and incidents resulting from human error. Data for this analysis will be collected from the U.S. National Transportation Safety Board and the Annual International Study of Airline Safety Statistics published by Boeing Commercial Airplane Company.

The following sections summarize the direction of the research program for each of the primary activities.

## Maintenance Resource Management (MRM)

MRM tasks shall develop, implement, evaluate techniques and distribute advisory materials, guidelines, and prototype training media related to MRM.

## Maintenance Error Reduction

In the next five years, the program shall develop and evaluate human factors interventions with partner airlines. In addition, the program will support the development of an advisory circular with guidelines for implementing error investigation and reporting systems.

## Job Task Analysis (JTA)

Job Task Analysis tasks shall continue to identify and analyze the critical knowledge and skill requirements for aviation technicians to perform safely and competently.

## Maintenance and Inspection Training

The research program shall continue to investigate issues which impact safety. Such training tasks shall help deliver information on human factors, maintenance resource management, workplace safety, and other such topics. The training research will also continue to push the envelope of instructional technology to find optimal delivery mechanisms for distance education, on-the-job learning, and just-in-time training.

## Job Aiding

Future research shall focus on "leading edge" technologies that have promise for enhancing human performance, reducing human error, and ensuring improved safety. These technologies shall be applied to work forces including not only airline maintenance personnel, but also the FAA Aviation Safety Inspectors, as appropriate.

## Information Dissemination

The research program will distribute human factors information to the aviation maintenance community. Information shall include an electronic database of NTSB reports of accidents related to maintenance error, updated *Human Factors Guide for Aviation Maintenance*, and research reports distributed via CD-ROM and the internet.

The research program shall continue to support aircraft maintenance rule-making by developing related advisory material and by participating in aviation rule- making as required.

## Communication and Harmonization

The most important factor that shall continue to drive the research program is constant communication with the aviation maintenance industry and with regulatory agencies worldwide. Such communication ensures that the research remains pragmatic and the research products are implemented into the industry as they are developed.

## Task Details

The following slide presentations give an overview of how the FAA/AAM research program fits in with the DOT strategic plan, the FAA strategic plan, and the AVR strategic plan and how each project fits in with specific goals and objectives as well as sub-goals.

## Strategic Plan Slides

### *Department Of Transportation Strategic Plan*

**Vision:** A visionary and vigilant DOT leading the way to transportation excellence in the 21st Century

**Mission:** Serve the US by ensuring a fast, safe, efficient, accessible, and convenient transportation system that meets our vital national interests and enhances the quality of life of the American people, today and into the future

### *Corporate Management Strategies*

- **Customer Service:** Deliver the result our customers want through a DOT that is more practical, works better, costs less
- **Research and Technology:** Advance transportation research and technology through strategic planning, exchange of information, education and partnerships
- **Information Technology:** Improve mission performance through secure, reliable, compatible, and cost-effective information systems that help us achieve our strategic goals

### *Department of Transportation Strategic Goal: SAFETY*

**Promote the public health and safety by working to the elimination of transportation-related, death, injuries, and property damage**

**We will measure our success by achieving the following outcomes:**

- Reduce the number of transportation related deaths
- Reduce the number and severity of transportation related injuries
- Reduce the dollars loss from high-consequence, reportable transportation incidents
- Reduce the number of reportable transportation incidents and other related economic costs

### *Federal Aviation Administration Mission: SAFETY*

**By 2007, reduce aviation fatal accident rates by 80 percent from 1996**

**Performance Goals:**

- **Fatal accident rate:** By 2007, reduce the US aviation fatal accident rate per aircraft departure, as measured by a 3-year moving average, by 80 percent from the 3-year average for 1994-1996
- **Overall Aircraft Accident Rate:** Reduce the rate per accident pre departure
- **Occupant Risk:** Reduce the risk of mortality to a passenger or flight crew member on a typical

## *SAFETY Strategic Focus Areas*

**Regulatory Reform:** Implement a regulatory process that is timely, responsive and consistently applied

**Safety Information Sharing and Analysis:** Develop partnerships with the aviation community to share data and information supporting safe, secure aviation

**Surveillance/Inspection:** Develop new approaches to working with others on inspection and surveillance and targeting FAA resources where they do the most good

**Accident Prevention:** Based on detailed root-cause analysis, prevent accidents before they happen through appropriate, targeted, systematic interventions in the aviation system

## *Global Leadership*

**Commitment to worldwide improvement to improve safety, security, and system efficiency globally through:**

- International Safety Oversight
- International Regulatory Harmonization

## *Corporate Cross-Cutting Strategies Providing Continuous Improvement:*

- **Partnership.** Mission goals must be achieved through many kinds of partnership with customers and stakeholders. Partnership with the transportation community is the only way to achieve the mission-based goals.
- **Communication.** Communication must be two way, listening and speaking. FAA will communicate with external customers and partners, employees and unions.
- **Risk Management.** FAA must target regulations and resources where they do the most good. FAA will use its newly developed risk management policy and other tools to target resources where they will do the most good.

## *Corporate Cross-Cutting Strategies Providing Continuous Improvement:*

- **Research, Engineering, and Development.** FAA will take full advantage of its acquisition capability to support research, engineering and development as a major strategy to develop and field new technologies that help FAA achieve its mission and meet customer needs.
- **Rapid Deployment of Existing Technology.** FAA must not only research, develop, and acquire new technology, but it must move quickly to deploy both technology it has developed and technology from other sources, including commercial-off-the-shelf (COTS) and non-developmental item systems.

## *Federal Aviation Administration Mission: SAFETY*

In partnership with NASA, Department of Defense, and other public and private organizations scientifically study issues and technologies (especially human factors) to improve policies, procedures, and equipment.

## *Focus Area: Safety Information Sharing and Analysis*

- Identify and address the root causes of aviation accidents
- Voluntary sharing of safety information  Voluntary Disclosure Advisory Circular (AC-00-58)
Aviation Safety Programs Advisory Circular (AC-120-66)

## *Mission of the Regulation and Certification Organization*

The mission of the AVR organization is promote aviation safety in the interest of the American public by regulating and overseeing the civil aviation industry. To fulfill this mission, AVR establishes aviation safety standards, monitors safety performance, conducts safety education and research, issues and maintains aviation certificates, licenses, and manages the FAA rulemaking program

- Establishes safety standards governing:
    1) the design, production quality, and airworthiness of aeronautical products
    2) the operation and continuing airworthiness of aircraft, training of airmen and aviation mechanics
    3) the medical qualifications of airmen and air traffic controllers
- AVR manages the rulemaking program which is the primary means by which safety standards and policy are drafted, opened to public comment, and finalized

- AVR monitors safety performance by:

  1) conducting reviews of products and reviewing safety data for trends

  2) conducting safety inspections and surveillance

  3) investigating violations and initiating enforcement action

  4) participating in accident and incident investigations

- AVR conducts aviation safety education, and conducts and sponsors related research

## *Primary Customers:*

- **Air Operators**

**Certificates:**

  FAR PART 121 (Large Transport)

  FAR PART 135 (Commuter Operations)

  FAR PART 91 (Public Use)

- **Air Agency**

**Certificates:**

  FAR PART 145 (Repair Stations)

  FAR PART 147 (Maintenance Schools)

- **Aviation Industry**

**Organizations**

- **ICAO**

- **Joint Aviation Regulations (JAR)**

- **Transport**

**Canada**

## *Targeting Performance Areas:*

- Contribute to aviation safety by developing policies and /or standards, programs, and systems to reduce the number of aviation accidents and incidents related to human factors.
- Contribute to aviation safety by developing policies and/or standards, programs, and systems to reduce the number of aviation accidents and incidents related to production systems, certification, and maintenance errors.
- Improve industry compliance with aviation standard through adoption of voluntary internal audit and voluntary self disclosure programs.

## *AVR Performance Goals:*

1. By 2007, reduce the fatal aviation accident rate by 80% of baseline levels primarily attributed to human error.

2. By 2007, reduce fatal aviation accident rate by 80% of baseline levels primarily attributed to elements in productions systems, certification process, or maintenance programs.

3. Increase the participation of industry in AVR partnership programs by 20% over the 1996 rate by FY 2002.

## *AVR Sub-Performance Goals:*

### AVR Performance Goals 1:

**Sub-goal 2:** Annually, the FAA will take those actions necessary to ensure that at least 85% of all open National Transportation Safety (NTSB) safety recommendations are in an “acceptable status,” and that at lease 60% of all FAA safety recommendations are classified as “acceptable” (AVR Performance Goal 1&2)

**Sub-goal 5:** By September 30, 2000, develop an advisory circular to implement, on a voluntary basis, a maintenance resource management system (MRM), based on technical recommendations for the results of the FY97-98 MRM report. MRM establishes methods for improved team performance and communication that should reduce human performance error

## *AVR Sub-Performance Goals:*

### AVR Performance Goals 2:

**Sub-goal 13:** By September 30, 2000, complete rulemaking to establish new ratings and training requirements for aviation maintenance personnel

**Sub-goal 14:** By September 30, 2000, implement Flight Operational Quality Assurance (FOQA) which provides maximum potential for use of a virtual data pool and data sharing for multiple airlines to determine national trends of relevance to identify problems in flight operations, personnel performance, and aircraft maintenance

**Sub-goal 18:** By September 30, 2002, complete a rule governing repair stations (14 CFR PART 145) to reflect technical advances in aircraft maintenance practices or aircraft technology, to require quality assurance systems, and to establish training programs covering employees who perform work for the repair station

## *AVR Sub-Performance Goals:*

### AVR Performance Goals 3:

**Sub-goal 21:** By September 30, 1999, identify and rank the most significant safety threats; identify the root causes and life cycle to failure for top-ranked safety threats and develop interventions

### AVR Performance Goals 4:

**Sub-goal 32:** By September 30, 2001, increase industry participation rate in internal audit and self disclosure programs by 5% over that of the 1996 rate

## Task Details Slides

## *Identification and Creation of Classification Methods for Maintenance Error Causation*

### AVR Performance Goal(s) 1, 2, 3, 4; Sub-goal(s) 14, 18, 21 ,32

- Requirement: Existing need for rules of causation to be used by FAA inspectors and air carrier/ repair station event investigators
- Regulations Affected: FAR 121.373, FAR 135.431, AC 120-16C
- Product: Recommendations, guidance materials, and workshop at 13th Annual Human Factors in Aviation Maintenance Symposium
- Output: Causation taxonomy describing causal models and causal biases. Statistical data on nature of investigator biases and investigative tools, recommendations for rules of causation for airlines, repair stations, FAA inspectors and attorneys
- Outcome: Improved human error investigation at air carriers and repair stations, improved FAA oversight of air carrier investigations, and reduction in maintenance errors
- Delivery Date: September 2000

## *Improving Operations and Oversight of Contract Maintenance*

### AVR Performance Goal 2 Sub-goal 18

- Requirement: FAA request to gain insight on relationships between Aviation Safety Inspectors, Principle Maintenance Inspectors, Contract Maintenance Organizations, and Air Carriers
- Regulations Affected: FAR Part 65, FAR Part 145, FAA Policy (including FAA Airworthiness Inspectors Handbook), NTSB recommendations, GAO report recommendations
- Product: Recommendations and guidance material
- Output: Description of the current relationships, issues and problems that may exist, and recommendations on ways and means of reconciliation
- Outcome: Solutions to issues and problems.
- Delivery Date: September 2002

## *Automated System of Self Instruction for Specialized Training (ASSIST): An Effort to Minimize Inspector Errors*

### AVR Performance Goal 2 Sub-goal 13, 18

- Requirement: Use of advanced technology for aircraft inspection training to minimize inspector errors
- Regulations Affected: 14 CFR Part 121.375
- Product: A computer-based inspection training software system (ASSIST) and workshop at 13th Annual Human Factors in Aviation Maintenance Symposium
- Output: Multimedia tool used by aircraft inspectors and A&P students for training and re-training on aircraft inspection
- Outcome: Reduction in inspection errors, improvement in inspection performance, standardization of inspection training process, and reduction in problems inherent to OJT
- Delivery Date: September 2000

## *Maintenance Personnel Duty Times*

### AVR Performance Goal 1 Sub-goal 2

- Requirement: Examination of how hours worked by AMTs impact the maintenance environment in response to a petition for rulemaking to the FAA and recent NTSB recommendations
- Regulations Affected: FAR 121.377

- Product: Guidelines that can be used to reduce and/or mitigate the safety-related effects of worker fatigue in aviation maintenance work environments
- Output: Exploratory research as a first step in assessing current FAR regulations concerning duty limitations for maintenance personnel
- Delivery Date: March 1999

### *Assessment of Industry Use of FAA A/C Maintenance Human Factors Research Products*

**AVR Performance Goal 3**

- Requirement: A formal assessment of the aviation industry's perception and acceptance of the importance of human factors in maintenance, including the extent of perceived cost savings and error reductions related to human factors interventions
- Regulations Affected: None
- Product: Recommendations for industry and government on how to measure and implement products from the research program
- Output: Research findings that quantify the extent to which the program results have impacted safety and efficiency in aviation maintenance work environments
- Outcome: Insurance that the research program is addressing industry issues most often affecting safety and human performance effectiveness. Research findings will drive future program direction.
- Delivery Date: March 1999

### *Development of Systems to Facilitate Shift Change Over Aircraft Maintenance*

**AVR Performance Goal(s) 1, 2**

- Requirement: Identify potential limitations of existing shift change processes and develop standardized procedures that offer solutions/human factors interventions to minimize errors
- Regulations Affected: FAR Part 121, FAR Part 135, FAR Part 145
- Product: Detailed guidelines and procedures that outline a standardized shift change process, which can be translated into a computer-based tool for use by mechanics, inspectors, and supervisors

- Output: Analysis of shift change at representative sites, development of industry-wide best practices, documentation of guidelines and procedures
- Outcome: Well-defined shift change procedures based on sound principles of human factors design, which can be applied to minimize shift change errors
- Delivery Date: March 1999

### *Development of Guidance and Support Material for the Certification of Aviation Maintenance Training Programs Using the AMT/AMT-T Integrated Curriculum*

**AVR Performance Goal 2, Sub-Goal 13**

- Requirement: Develop a training curriculum that integrates AMT/AMT-T requirements into a seamless educational program, and develop guidelines for certification and operation of training programs using the integrated curriculum
- Regulations Affected: FAR Part 147, FAR Part 66
- Product: Guidelines for certification and surveillance of aviation maintenance technician training programs using the AMT/AMT-T Curriculum, and workshop at 13th Annual Human Factors in Aviation Maintenance Symposium
- Output: Certification standards and procedures necessary for FAA approval for use in individual AMT training programs
- Outcome: Properly designed curriculum that increases efficiency in the learning process, resulting in more technically competent AMTs. These guidelines will be potential support material for future development of an agency Advisory Circular
- Delivery Date: September 2000

### *Identification and Documentation of Best Human Factors Practice for Engine NDI/NDT Inspections*

**AVR Performance Goal(s) 1, 3; Sub-goal 2**

- Requirement: Examination of human principles to the NDI process in response to the NTSB's recommendation that aircraft inspection, particularly NDI, be improved to reduce accident rates
- Regulations Affected: FAR Part 121, FAR Part 145, FAR Part 43
- Product: Recommendations for applying human factors principles to each component of engine NDI operations

- Output: Identification and documentation of best human factors practice for engine NDI/NDT inspections. Provide review and incorporation of principals into the AC
- Outcome: Application of human factors techniques to enhance the reliability of engine inspection and to reduce engine failures related to NDI processes
- Delivery Date: September 1999

### *Development of Advisory Circular on Qualifications and Certification of NDI/NDT Personnel*

**AVR Performance Goal(s) 1,2; Sub-goal(s) 2,3**

- Requirement: Update guidance on human factors issues involving the certification and qualification of nondestructive testing personnel in response to the NTSB's recommendation that aircraft inspection personnel qualifications, particularly NDI, be improved to reduce accident rates
- Regulations Affected: FAR(s) Part 121, Part 145, Part 147, Part 65, Part 43
- Product: Preparation and support material for an Advisory Circular (AC) covering qualification and certification of NDI personnel
- Output: Data collection on existing standards in U.S. and international NDI environments and preparation of support material for an AC
- Outcome: Guidance that integrates and clarifies certification and qualification standards, which eliminates the diversity of approaches to the certification process
- Delivery Date: September 2000

### *Development of Process to Improve Work Documentation in Repair Stations*

**AVR Performance Goal(s) 1, 2, 3; Subgoal(s) 2, 18, 21, 32**

- Requirement: Assess human errors/human factors issues in contract maintenance repair process with special attention to documentation issues, in response to NTSB recommendations and GAO report to Congress for improved oversight of repair stations
- Regulations Affected: FAR Part 145, FAR Part 121
- Product: Recommendations on how repair stations can use current human factors best practices to improve documentation quality and reduce errors due to documentation deficiencies

- Output: Research findings that address potential errors inherent in performing aircraft maintenance remotely from the airline and recommendations for improvement in work documentation at repair stations
- Outcome: No systematic data exists on repair station errors. This research is a first step towards documenting and controlling human errors in repair stations
- Delivery Date: September 2000

### *Technology-based Solutions for Process Management in Aviation Maintenance*

**AVR Performance Goal 2, Sub-goal 18**

- Requirement: Examine the applicability of commercial, off-the-shelf (COTS) Electronic Document Management/Product Data Management (EDM/PDM) software to the aviation maintenance environment, particularly repair station facilities
- Regulations Affected: None
- Product: Stand-alone prototype of EDM/PDM applied to a representative maintenance procedures
- Output: Electronic processes that mitigate deficiencies in the applicability, usability, and implementation of current aviation maintenance operation by providing improved tracking, automatic updating, and easy information “look up.”
- Outcome: By improving the effectiveness and efficiency of the processes that drive maintenance, complete and accurate information can be made available at the right place and the right time, directly supporting mechanics, staff, and managers
- Delivery Date: March 1999

### *Creation of Prototype for Safe Maintenance in Aviation: Resource Training Center*

- Requirement: Create and service a distance education, web-based training center and evaluate its feasibility and utility in response to the Gore Commission’s directives to the FAA to capitalize on advanced technology for improving aviation safety
- Regulations Affected: None
- Product: A web-based training center with an interactive seminar on maintenance resource management-related issues

- Output: An internet resource and learning center (SMART) for the delivery of on-the-job training to maintenance personnel, and developments of standards for quality web-based training and delivery
- Outcome: An economical and logistically efficient forum for providing continuing education to AMTs
- Delivery Date: March 1999

### *Creation of Annual CD-ROM #7*

- Requirement: Develop a medium for distributing technical and scientific products generated by the research program
- Regulations Affected: None
- Product: Annual Human Factors in Aviation Maintenance CD-ROM
- Output: Research results, the Human Factors Guide to Aviation Maintenance, and software prototypes for training and job aiding are provided to the industry via CD-ROM
- Outcome: Approximately 4,000 CD-ROMs containing reports, multimedia job aids and software prototypes will be developed for FAA distribution
- Delivery Date: March 1999

### *Support for FAA/CAA/Transport Canada Symposia*

- Requirement: Cooperative efforts by the FAA, CAA, and Transport Canada to organize standard forums for disseminating research results to the international aviation maintenance industry
- Regulations Affected: None, Global Harmonization
- Product: Annual Human Factors in Aviation Maintenance Symposia and meeting proceedings
- Output: Dissemination of information through meetings and proceedings on how human factors principles can improve international aviation safety through the reduction of accidents and incidents
- Outcome: The widest possible international dissemination of research and sharing of experiences of maintenance organizations, allowing research results to impact those who benefit most

- Delivery Date: February 1999

### *Job Task Analysis of the Aviation Maintenance Technician*

**AVR Performance Goal 2, Sub-goal 13**

- Requirement: Update the Allen Study (1974) Study, which includes an industry-wide survey of tasks AMTs perform and the basic AMT school curriculum.
- Regulations Affected: FAR Part 65, NPRM FAR Part 66, FAR Part 147
- Product: Survey data and analysis, recommendations from industry and AMT school representatives on content of a revised FAR Part 147, numerous presentations at industry and FAA meetings
- Output: Guidelines to revise the curriculum included in the current version of FAR Part 147
- Outcome: Regulatory support to revise FAR Part 147, reference data for FAR Part 66 and other related rulemaking
- Delivery Date: March 1999

## NASA Slides

### *NASA Aviation Safety Program Maintenance Human Factors*

- **Research Goals**
  - To better understand human error and human factors associated with maintenance tasks
  - To develop interventions and task aids that reduce human error and enhance safety and effectiveness in maintenance operations
- **Plan Elements**
  - Improved procedures
  - HF task/risk analysis tools

- MRM skills, training, and evaluation
- Advanced displays for maintenance aiding

## *Maintenance Human Factors Roadmap*