

Federal Aviation Administration

FY 2002 Office of Management and Budget Submission



Budget Item	Program Title	Budget Request
A08a	Flightdeck/Maintenance/System Integration Human Factors	\$10,023,000

GOALS:

Intended Outcomes: The FAA intends to improve air transportation safety by:

- Developing more effective methods for aircrew, inspector, and maintenance technician training.
- Developing improved human-centered flight controls and displays.
- Increasing human factors considerations in certification of new aircraft and equipment design and modification.
- Improving aircrew, inspector, and maintenance technician task performance.

Agency Outputs: The FAA is concerned with ensuring the safety and efficiency of operator performance through guidelines, handbooks, advisory circulars, rules, and regulations. It provides industry with human performance information and guidance critical to the design, operation, regulation, and certification of equipment, training, and procedures. With this in mind, the Human Factors Program conducts and manages research that provides the technical information necessary to generate these products and services.

Customer/Stakeholder Involvement: The Human Factors Program directly supports a number of aviation community initiatives:

- *FAA Strategic Plan Mission Goal for Safety.* By FY 2007, reduce U.S. aviation fatal accident rates by 80% from 1996 levels.
- ARA FY 2000 Performance Plan:
 - Goal 1. Contribute to the FAA goal to reduce the fatal aviation accident 80% by FY 2007 as compared to 1994 -1995 baseline data; and
- The FAA/Industry *Safer Skies* initiative, which will use the latest technology to help analyze U.S. and global data to find the root causes of accidents and determine the best actions to break the chain of events that lead to accidents.
- The *National Plan for Civil Aviation Human Factors: An Initiative for Research and Application* published in March 1995, with FAA, NASA, and DOD as signatories. This document, which had extensive aviation community participation in its development, outlines a coherent national agenda for human factors research and application leading

to significant improvements in NAS safety and efficiency.

- The FAA report entitled "The Interfaces Between Flight Crews and Modern Flight Deck Systems".
- Public Law 100-591, which establishes requirements for human factors research and its application.
- The Advanced Qualification Program (AQP), which has been adopted by every major U.S. carrier, incorporating human factors training into pilot qualification and recurrent training programs.
- Crew Resource Management (CRM) training procedures, a variant of which has been adopted by virtually every major domestic air carrier.

Accomplishments: The program output of data packages, models, and regulatory documents includes:

Information Management and Display

- Developed a manual that addresses appropriate human factors considerations in designing flight deck operating documents. This manual has been adopted by International Civil Aviation Organization (ICAO) for distribution to its member states.
- Published the *Aviation Maintenance Human Factors Guide*.
- Developed and implemented the Agency's first virtual collaborative research team to communicate and disseminate information in real time regardless of distance or other constraints on research team members
- Developed (with industry) the first industry standard and guidance document on implementing an Aviation Maintenance Human Factors Program.
- Developed the Aviation Maintenance Document Design Aid incorporating simplified English and utilizing advanced technology to standardize aviation maintenance documentation.
- Developed guidance and recommendations on human factors best practices in fluorescent penetrant inspection. This project provided a more systematic view of human/system interaction.
- Completed human factors guidelines for assessing advanced general aviation transportation experiment (AGATE) cockpit controls/displays.
- Developed human factors design and evaluation considerations for Electronic Flight Bags, Version 1.0.
- Completed assessment of human factors issues and current knowledge concerning use of head-up displays in air transports.



Federal Aviation Administration FY 2002 Office of Management and Budget Submission

- Completed Data Link lessons learned compendium for inclusion in RTCA DO-238A, "Human Factors Requirements and Guidance for Controller/Pilot Data Link Communications Systems".

Human-Centered Automation

- Completed human factors Certification Job Aid Version 1.0 for FAR Part 25 flightdeck displays.
- Developed aircraft certification human factors and operations checklist for stand alone global positioning system receivers.

Human Performance Assessment

- Developed prototype Automated Performance Measurement System (APMS) which allows air carriers to gather and analyze flight data from aircraft data recorders. This information and analysis capability provides the backbone for the Flight Operations Quality Assurance Program (FOQA), a joint FAA, industry and labor initiative to enhance aviation safety.
- Provided industry and FAA with preliminary reports on the antecedents of flight deck error.
- Validated human performance transfer functions for full flight simulators.
- Completed the Job Task Analysis of the Aviation Maintenance Technician Workforce.
- Developed guidance and standardized shift turn over procedures for use in aviation maintenance.
- Developed pilot performance profile, through flight simulation, for use in establishing certification standards for General Aviation auto-navigation and control systems.

Selection and Training

- Developed and validated a proceduralized pilot CRM training and assessment system.
- Developed the Model AQP to support regional air carrier participation. AQP is a proficiency based approach to pilot training that is considered to be highly effective and efficient for aircrew training.
- Developed air carrier training data analysis tools used by carriers and the FAA for quality assurance efforts.
- Provided Flight Standards guidance for developing pilot training regulations based on data from a study of 40,000 domestic air carrier pilots. The study examined pilot's perceptions of training effectiveness across the entire U.S. aviation industry.
- Developed Line Audit Methodology used by air carriers to help determine safety vulnerabilities.

This methodology has been adopted by ICAO and was distributed to member states.

- Provided industry and FAA with preliminary guidelines on training for flight deck interruptions and for the performance of concurrent critical tasks.
- Provided industry and FAA with training guidelines for pilot decision-making, addressing first officer's hesitancy to challenge the captain in potentially high risk situations.
- Developed a system to allow air carriers to reconfigure FAA approved flight scenarios to unique training segments and developed a generic line oriented evaluation event set database to be used by any air carrier.
- Incorporated air carrier and FAA user comments into an enhanced reconfigurable event set scenario development system.
- Provided FAA and Industry preliminary guidelines on managing pilot skill degradation through innovative training schedules.
- Provided Industry and FAA preliminary training guidelines for automated flight decks.
- Provided FAA and Industry guidance on approaches to incorporating realistic radio communications into simulators to train pilots for the complex operating environment.
- Developed the Maintenance Resource Management (MRM) handbook for use by industry.
- Completed the prototype MRM distance learning project which will be implemented and used by the U.S. Navy for training their Naval Aviation Maintenance Technicians. Further application can be applied to U.S. Coast Guard Aviation Maintenance Technicians.
- Developed an Advisory Circular on Training, Qualification, and Certification on Nondestructive Inspection Personnel.
- Developed a prototype automated system of self instruction for specialized training for the industry aviation maintenance inspector workforce.
- Developed a CD-ROM training program that guides General Aviation pilots through the creation of a personal checklist that incorporates minimum operating conditions and procedures based upon their own personal capabilities and experience.
- Developed a CD-ROM training program which describes the structured decision-making style of experienced General Aviation pilots compared to less experienced pilots. The program stresses

Federal Aviation Administration

FY 2002 Office of Management and Budget Submission



situational awareness, diagnosis, resolution, and vigilance.

- Developed a CD-ROM training program which teaches General Aviation pilots to recognize the cues associated with deteriorating weather while in-flight, and to take appropriate action to avoid weather.

R&D Partnerships: Collaboration has continued between the FAA and industry partners to develop intervention strategies and reduce aviation accidents through the various Joint Safety Awareness Teams (JSATs) developed as part of the Safer Skies agenda. The human factors program is linked to NASA and DOD under the auspices of the *National Plan for Civil Aviation Human Factors: An Initiative for Research and Application*. Specific areas of coordinated program execution with NASA include cockpit automation, CRM, team decision-making, air-ground communication, and aviation maintenance. DOD joint efforts are in team performance, decision-making, aviation MRM, distance learning, and human error risk analysis. Additionally, the FAA is represented on the DOD Human Factors Engineering Technical Advisory Group, a forum for the coordination of research across a variety of technical areas.

Through aviation maintenance partnerships with industry, the FAA and industry are receiving real world applied research results. Aviation maintenance human factors is also working with other countries (such as Transport Canada) for globalization of aviation maintenance and inspection human factors. The FAA participates on all of the Society of Automotive Engineers G-10 human factors subcommittees related to human factors research areas, ensuring transition of the results to standards, guidelines, etc. The FAA also has extended seventeen grants to universities supporting research on air carrier training, flight deck automation, aviation accident analysis, general aviation, and aviation maintenance technician and inspector training.

MAJOR ACTIVITIES AND ANTICIPATED FY 2001 ACCOMPLISHMENTS:

Information Management and Display.

- Completed software tools for enhanced maintenance documentation.
- Developed human factors design and evaluation considerations for Electronic Flight Bags, Version 2.0.

- Developed general aviation head up display information/symbology recommendations.
- Addressed human factors issues for Cockpit Head Motion Box associated with air transport head-up displays.

Human-centered Automation.

- Provided industry and FAA guidance addressing training for automated cockpits. These guidelines will encompass the performance difficulties associated with increased coupling, complexity, and autonomy of modern cockpit technology.
- Completed human factors Certification Job Aid Version 2.0 for FAR Part 25 flightdeck displays.

Human Performance Assessment.

- Provided expanded APMS methodologies and analysis capabilities in order that air carriers can collect and analyze increasing amounts of flight and simulator data.
- Developed mapping of flight data parameters onto AQP qualification standards.
- Completed assessment of the utility of PC-based aviation training devices in maintaining General Aviation pilot instrument proficiency.
- Completed a comprehensive human factors analysis of scheduled air carrier and fatal general aviation accidents using the human factors analysis and classification system (HFACS).
- Identified human factors trends in aviation accident/incident data to produce data driven research initiatives.

Selection and Training.

- Developed methods to incorporate automation specific training scenarios into the system which reconfigures event sets for unique training sessions.
- Validated simulator motion training requirements
- Developed advanced data analysis methods for linking FOQA and simulator training data.
- Refined and validated training guidelines and training schedules for degradation vulnerable flight tasks.
- Refined training guidelines for automated flight decks.
- Expanded Realistic Radio Communications in simulator training to include data link and other forms of nonverbal communication.



Federal Aviation Administration FY 2002 Office of Management and Budget Submission

- Analyzed data from line observations and laboratory studies to provide training guidance on human error management

KEY FY 2002 PRODUCTS AND MILESTONES:

Information Management and Display.

- Develop and implement guidelines for maintenance error investigating and reporting systems.
- Develop flight data recording and analysis capability for flight simulators.
- Complete human factors design and evaluation considerations for Electronic Flight Bags, Version 3.0.
- For general aviation aircraft, conduct comparative analyses to determine if any substantial degradation in visual search is concurrent with the presence and/or use of the head up or head down display, and which tasks benefit most from each type of presentation.
- Complete initial computational model to assess information accessibility for air transport head-up display/head-down display combinations.
- Determine operational criteria and training guidance for night vision goggles in rotorcraft operations.
- Determine type of information to be presented to develop adequate situational awareness required to avert Controlled Flight Into Terrain (CFIT) in general aviation.
- Define display location boundaries that correspond to established eye position/head position for general aviation aircraft during actual operations.

Human-centered Automation.

- Provide industry and the FAA guidance addressing training for automated cockpits. These guidelines will encompass the performance difficulties associated with increased coupling, complexity, and autonomy of modern cockpit technology.
- Develop certification guidelines for integrated technology in general aviation cockpits.
- Complete human factors Certification Job Aid, version 3.0 for FAR Part 25 flightdeck displays.

Human Performance Assessment.

- Refine flight and simulator data analysis tools.
 - Provide guidance on the effectiveness of realistic radio communications in line oriented evaluations.
- adequately addressed in the design and certification

- Define general aviation pilot decision-making skills required for training module development.
- Provide expanded APMS methodologies and analysis capabilities in order that air carriers can collect and analyze increasing amounts of flight and simulator data.
- Develop improved human factors guidelines for aircraft accident investigation and reporting systems.
- Examine simultaneous non-interfering operations for visual flight rules (VFR) helicopter and fixed wing visual flight rules/instrument flight rules (VFR/IFR) to determine human performance implications.

Selection and Training.

- Provide guidance to FAA Flight Standards for training regulations on simulator motion requirements for recurrent pilot training.
- Validate training guidelines for seldom practiced flight tasks.
- Develop training guidelines for flight deck error management.
- Distribute advanced analysis methods linking FOQA and simulator data.
- Develop materials to increase general aviation pilot skills to intervene in the causable chain of events leading to accidents.
- Develop proactive error avoidance and prevention strategies to reduce negative responses by aviation maintenance and inspection personnel whether by commission, omission, inadequate training, or timing.
- Demonstrate and validate the effectiveness of the MRM change program.
- Determine the application of military aviation maintenance training and experience based on FAA requirements.

FY 2002 PROGRAM REQUEST:

The program continues to focus on providing technical information and consultation to improve aircrew, inspector, maintenance technician, and aviation system performance. Emphasis is on developing guidelines, tools, and training to enhance error capturing and mitigation capabilities in the flight deck and maintenance environments; and on developing human factors tools to ensure that human performance considerations are

**Federal Aviation Administration
FY 2002 Office of Management and Budget Submission**



of flight decks and equipment.

APPROPRIATION SUMMARY

	Amount (\$000)
Appropriated (FY 1982-2000)	\$137,890
FY 2001 Enacted	10,100
FY 2002 Request	10,023
Future Requirement	TBD
Total	\$158,013

Budget Authority (\$ 000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Contracts					
Flightdeck/Maintenance/System Integration Human Factors	10,365	8,497	6,289	7,038	6,734
Personnel Costs	1,814	1,940	2,367	2,283	2,398
Other Inhouse Costs	371	563	486	779	891
Total	12,550	11,000	9,142	10,100	10,023

OMB Circular A-11, Conduct of Research and Development (\$000)	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Enacted	FY 2002 Request
Basic	-	-	-	-	-
Applied	12,550	11,000	9,142	10,100	10,023
Development (includes prototypes)	-	-	-	-	-
Total	12,550	11,000	9,142	10,100	10,023