Office of Inspector General

Improving Aviation Safety Efficiency, and Security: FAA's Fiscal Year 2001 Request For Research, Engineering, and Development

Federal Aviation Administration

Report Number: AV-2000-054
Date Issued: March 15, 2000

Memorandum

U.S. Department of Transportation
Office of the Secretary of Transportation
Office of Inspector General

Subject: **ACTION**: Improving Aviation Safety, Efficiency, and Security: FAA's Fiscal Year 2001 Budget Request For Research, Engineering, and Development
AV-2000-054

Date: March 15, 2000

Reply To
Attn Of: JA-10:x60500

From: Alexis M. Stefani
Assistant Inspector General for Auditing

To: Federal Aviation Administrator

On March 1, 2000, at a hearing of the Subcommittee on Technology, Committee on Science, U.S. House of Representatives, we provided testimony on the Federal Aviation Administration's (FAA) Fiscal Year 2001 budget request for Research, Engineering, and Development (RE&D). Our testimony focused on four issues– changes in the nature of FAA's research and development efforts and how they are financed; Governmentwide cooperation and coordination on aviation research; aircraft safety research efforts; and the continued need for human factors work in developing new aviation technologies. A copy of our statement is attached for your information.

As you know, FAA is making greater use of prototyping efforts to take a more incremental approach to modernizing the National Airspace System. Free Flight Phase 1, Safe Flight 21, and Data Link initiatives reflect this new approach. In addition to the $184 million FAA is requesting for RE&D, the agency is also requesting $614 million for development work in the Facilities and Equipment account as well as $7.4 million from Airport Improvement Program funds for airport technology initiatives.

Given that FAA is relying more on prototype efforts in different budget accounts, we are making recommendations aimed at providing a clearer picture of FAA's investments in new technology for both the Congress and agency decision-makers.

We recommend that FAA:

1. Clearly identify funding in its annual budget request according to the Office of Management and Budget's definitions of basic research, applied research, and development (including prototypes); and

2. Include a method in the agency's cost accounting system to identify development efforts.

In accordance with the Department of Transportation Order 8000.1C, we would appreciate receiving your response within 30 days. If you concur with our recommendations, please indicate for each recommendation the specific actions taken or planned and target dates for completion of these actions. If you do not concur, please provide your rationale. Furthermore, you may provide alternative courses of action that you believe would resolve the issues presented in this report.

We appreciate the courtesies and cooperation extended by your staff. If I can answer any questions or be of further assistance, please call me at (202) 366-1992 or David A. Dobbs, Deputy Assistant Inspector General for Aviation, at (202) 366-0500.

Attachment

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Before the Subcommittee on Technology,
Committee on Science,
U.S. House of Representatives

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Improving Aviation Safety, Efficiency, and Security: FAA's Fiscal Year 2001 Request For Research, Engineering, and Development

Statement of
Alexis M. Stefani
Assistant Inspector General for Auditing
U.S. Department of Transportation

Madam Chair and Members of the Subcommittee:

We appreciate the opportunity to discuss FAA's Research, Engineering, and Development (RE&D) Program.

FAA and the aviation community are facing a number of important challenges. The demand for air travel has doubled since 1980 and is expected to grow through 2015. Air travelers in the United States are unfortunately experiencing an increase in delays, and consumer dissatisfaction with airline service is high. FAA's air traffic control modernization efforts and airport capacity have not kept pace with the demand for air travel.

Against this backdrop, FAA's RE&D Program plays an important role in developing new technologies for aviation safety, air traffic control capacity enhancement, and security. The RE&D Program has funded many technologies, including data link systems and new automated controller tools, that are expected to play critical roles in moving toward Free Flight and improving the safety and efficiency of the National Airspace System. FAA is requesting $184 million for RE&D funding in Fiscal Year 2001—an increase of almost 18 percent over last year's level of $156 million.

Today, we would like to discuss (1) changes in the nature of FAA's research and development efforts and how they are financed; (2) Governmentwide cooperation and coordination on aviation research; (3) FAA's aircraft safety research efforts; and (4) the continued need for human factors work in developing new safety, capacity, and security technologies.

- **First**, FAA is making greater use of *prototyping* efforts to take a more incremental approach to modernizing the National Airspace System. A central tenet of this approach is the "build a little, test a little" concept of technology development and deployment. FAA's Free Flight Phase 1, Safe Flight 21, and data link communications for controllers and pilots reflect this new incremental approach.

  FAA continues to fund development efforts through its Facilities and Equipment account[1] for purchasing air traffic control equipment. In addition to the $184 million requested for Fiscal Year 2001 for RE&D, FAA is also requesting $614 million for development work in the Facilities and Equipment account. FAA is funding Free Flight Phase 1, Safe Flight 21, and satellite

[1] Within the Facilities and Equipment Account, Engineering, Development, Test, and Evaluation budget activity includes programs that have migrated from the RE&D account or programs that are in the early stages of acquisition. For example, this activity funds work on mission needs analysis and alternative design analysis.

navigation efforts, as well as a new data link for controllers and pilots in this account. These four efforts total more than $300 million in FAA's Facilities and Equipment Fiscal Year 2001 budget request.

Given that FAA is relying on more prototype efforts in different accounts, the agency should identify funding in its budget according to the Office of Management and Budget's definitions of basic research, applied research, and development (including prototypes). This would provide the Congress with a more complete picture of FAA's investments in civil aviation research and development. In addition, including a method to distinguish development efforts in the agency's cost accounting system would provide FAA with a better picture of its investment in new technologies.

- **Second**, close coordination between FAA and the National Aeronautics and Space Administration (NASA) is essential for improving the margin of safety and improving the efficiency of the National Airspace System. Joint FAA and NASA research has produced invaluable capacity technology, and NASA's work on the Center TRACON Automation System (CTAS)—an important new automated controller tool—is part of FAA's Free Flight Phase 1 initiative.

  NASA expects to spend $701 million on aircraft safety and air traffic management research from Fiscal Years 2000 through 2004, exclusive of FAA's RE&D investments. In the fall of 1998, we made recommendations aimed at improving coordination and ensuring that combined resources are used in the most cost-effective manner.[2] In response, FAA and NASA have taken actions to improve coordination. For example, an FAA/NASA executive committee has been strengthened to provide oversight, changes have been made in the composition of advisory committees, and FAA and NASA have entered into a formal agreement for aviation safety research.

  Since we testified last year, FAA, NASA, and the Department of Defense (DOD) have developed a high-level plan for research in aviation safety, security, efficiency, and environmental issues. This plan establishes roles, defines goals, and outlines long-term research needs. FAA has opportunities for leveraging DOD's efforts with respect to new technologies for securing satellite navigation signals from intentional interference and new systems for detecting non-structural aging aircraft problems, particularly with respect to electrical systems.

[2] For additional details, see Report on FAA/NASA Research and Development Coordination Efforts, (OIG Report Number AV-1999-008, October 8, 1998).

An important lesson from FAA's Free Flight Phase 1 initiative is that *technology transfer* from NASA to FAA (and its contractors) requires more attention in the future. There is a need for NASA's expertise in the later stages of development of software-intensive systems with complex human factor issues, particularly when such systems must be customized for specific locations with complex airspace.

- **Third**, at the Science Committee's request, we are reviewing FAA's aircraft safety research program with respect to cost and schedule parameters as well as coordination with other agencies. FAA's aircraft safety research efforts are focused on both preventing accidents and making them more survivable.

  By far, the largest single effort in FAA's aircraft safety research program focuses on aging aircraft. In February 1997, the White House Commission on Aviation Safety and Security recommended that FAA expand its aging aircraft research program to include *non-structural components*, such as wiring, hydraulics, and mechanical systems. A focused research effort is needed because the potential impacts of aging on non-structural components are not well understood.

  After getting a late start, FAA's aging aircraft research program is evolving from looking solely at structural items (aircraft skins) to non-structural components. The bulk of FAA's aging aircraft research funds are currently spent on methods to predict and detect fatigue cracking and corrosion in structural components. NASA's aging aircraft work focuses exclusively on structural research. In Fiscal Year 2000, about $1.3 million or 6 percent of FAA's aging aircraft research funds are budgeted for work on non-structural components. FAA is requesting $4.8 million for non-structural aging aircraft work for Fiscal Year 2001 with funding increases planned through 2004. In our opinion, FAA needs to determine the appropriate mix of its structural and non-structural aging aircraft research.

- **Finally**, our work shows the importance of human factors research in the development of new technology.

  The need for human factors work extends beyond the traditional man-machine interface issues and has important safety and workforce implications. Key emerging issues include the impact on selection and training of controllers as a result of new automated controller tools, the impact on the selection and training of operators of new security equipment, and the impact on pilots of new data link communications and cockpit display technologies.

For example, the importance of human factors issues associated with the new advanced security technologies being deployed at the Nation's airports cannot be underestimated. FAA believes—and we agree—that operators of the new equipment are critical in improving security. FAA test results indicate that new technologies to detect explosives in passenger baggage can correctly identify a potential threat but an operator can make a wrong decision and "clear" the bag. This scenario was confirmed during our reviews of the security of checked baggage.[3]

Since 1997, FAA has invested $21 million in human factors research, including computer-based training, to improve the performance of security personnel. However, we found that the deployment of these new training systems has been slow and better guidance from FAA is needed regarding how to use them. Continued human factors work is needed, particularly on the selection and training of security personnel who operate new devices and data collection and analysis of operator performance.

BACKGROUND

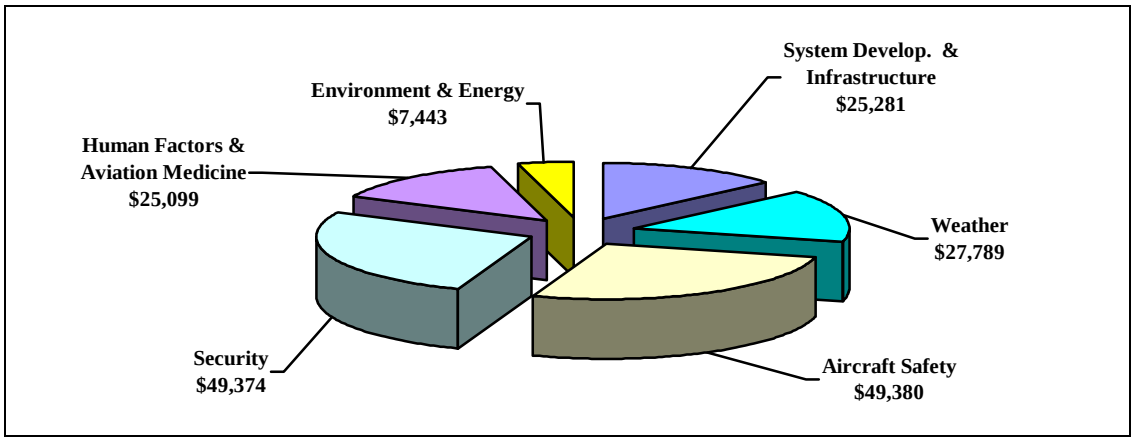
FAA's mission is to provide a safe, secure, and efficient aviation system that contributes to National security. FAA's RE&D Program develops and validates the technologies, systems, designs, and procedures required for the agency's full range of operational and regulatory activities. These activities include the acquisition of new technologies; air traffic services; certification of aircraft, airports, and personnel; civil aviation security; and development of environmental standards for civil aviation. FAA relies on other organizations, such as NASA and DOD, to provide basic research, while it focuses on applications for civilian aviation.

FAA'S FISCAL YEAR 2001 REQUEST FOR RE&D

For Fiscal Year 2001, FAA is requesting $184 million for RE&D, an increase of about 18 percent over last year's spending level of about $156 million. About 26 percent of the funds are used in-house by FAA researchers, while the remaining money is spent on research efforts of FAA contractors and other Government agencies. As we will discuss later, NASA also makes substantial research and development investments in Aviation Safety (including weather research) and Air Traffic Management. Figure 1 shows FAA's RE&D financial plan for Fiscal Year 2001.

[3] For additional details, see Aviation Security: Federal Aviation Administration, (OIG Report Number AV-1999-068, March 24, 1999).

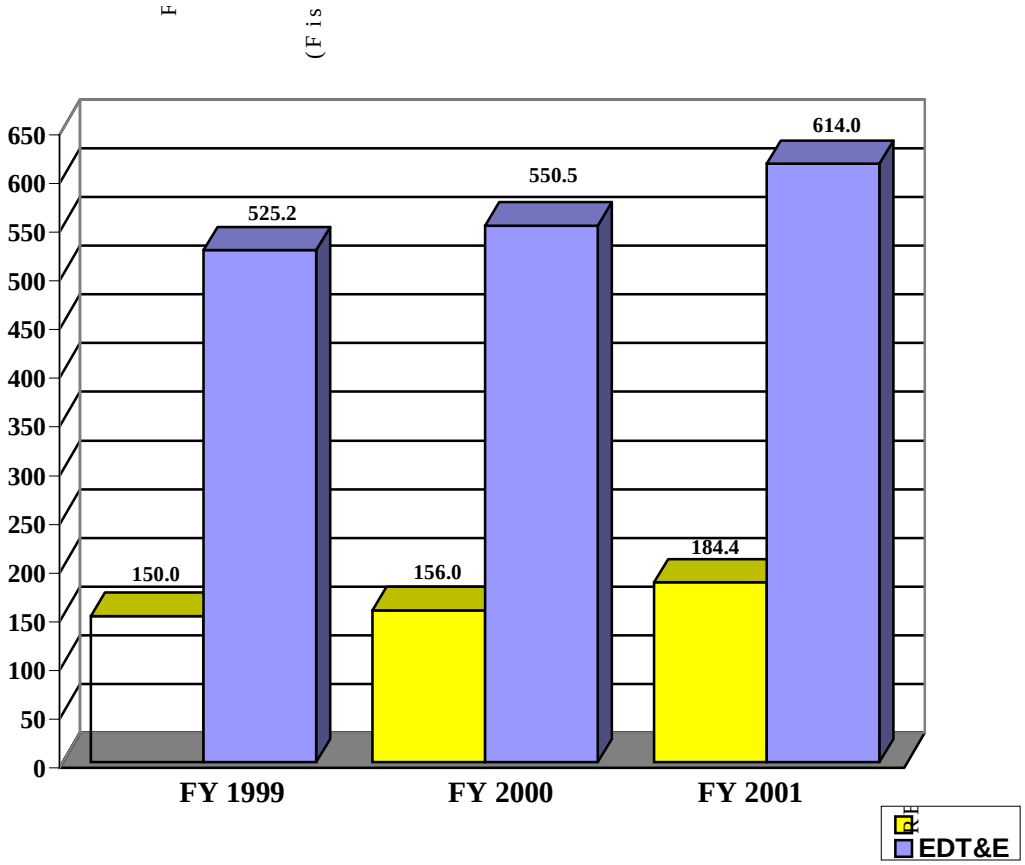
Figure 1 FAA's RE&D Budget Request for Fiscal Year 2001
(Dollars in Thousands)



Source: FAA's Fiscal Year 2001 Budget Submission

As Figure 1 shows, a little over half of FAA's RE&D budget request for Fiscal Year 2001 is for Aircraft Safety and Security. The largest single aircraft safety effort continues to focus on aging aircraft ($22.4 million). FAA is also requesting $25.1 million for Human Factors and Aviation Medicine, $27.8 million for Weather projects, and $25.3 million for System Development and Infrastructure (which includes $5 million for research on information security). FAA is requesting $49.4 million in Fiscal Year 2001 for research and development on Security, which represents a reduction of $773,000 from last year's level of $50.1 million.

FAA continues to fund considerable research and development, totaling hundreds of millions of dollars annually, through its Facilities and Equipment account for purchasing new air traffic control systems. In addition to the $184 million in RE&D requested for Fiscal Year 2001, FAA is requesting $614 million in its Facilities and Equipment account for Engineering, Development, Test, and Evaluation (EDT&E). FAA's Free Flight Phase 1 is funded through this account. Figure 2 illustrates the recent history of the relationship between the two accounts.



Source: OIG Analysis of FAA Data

In addition, FAA is requesting $7.4 million in Fiscal Year 2001 for airport research technology from Airport Improvement Program funds. This includes research on airport safety, pavement, and design. In the past, these efforts were funded through the Facilities and Equipment account.

FAA is making greater use of *prototyping* efforts to take a more incremental approach to modernizing the National Airspace System. A central tenet of this approach is the "build a little, test a little" concept of technology development and deployment. This is intended to limit development efforts to a manageable scope and identify risks. Both Free Flight Phase 1 and Safe Flight 21 reflect this thinking.

Given that FAA is funding prototypes in different accounts, *we are recommending that the agency identify in its budget basic research, applied research, and development, including the development of prototypes as prescribed by the Office of Management and Budget*. This would provide the Congress with a more complete picture of FAA's investments in civil aviation research and development. In addition, including a method to distinguish development efforts in the agency's

cost accounting system would provide FAA with a better picture of its investment in new technologies.

AVIATION RESEARCH—GOVERNMENTWIDE COOPERATION AND COORDINATION

FAA also relies on aviation-related research and development conducted by DOD and NASA. FAA and NASA joint research efforts have a major impact on the future of aviation safety, and on airspace and airport capacity. These joint efforts include research in areas such as aircraft structures, human factors, simulation modeling of the air traffic control system, and weather. Both FAA and NASA support the national safety goal to reduce the fatal aviation accident rate by 80 percent in 10 years and goals to increase the capacity and efficiency of the National Airspace System.

In addition to FAA's research and development efforts from Fiscal Years 2000 through 2004, NASA plans to spend $701 million on aviation research. We note that NASA expects to spend about $65 million for Weather Accident Prevention as part of its safety research. Table 1 summarizes planned NASA investments in Aviation Safety[4] and Air Traffic Management[5] research and development for Fiscal Years 2000 through 2004.

Table 1 NASA Funding on Research and Development

(Dollars in millions)

	Enacted	-------Budget Projections--------			
Fiscal Year	**2000**	**2001**	**2002**	**2003**	**2004**
Aviation Safety Technology	$ 64.4	$ 70.0	$ 70.0	$ 85.0	$ 87.3
Aviation Systems Capacity (Air Traffic Management)	$ 62.9	$ 59.2	$ 77.6	$ 71.6	$ 53.1
Totals	$127.3	$129.2	$147.6	$156.6	$140.4

Source: NASA's Office of Resource Management

While FAA and NASA share a common mission and some aviation safety and air traffic management goals, the two agencies have different research roles. FAA's research is generally short-term to refine existing technology, systems, designs, and procedures that directly support its operational and regulatory responsibilities.

[4] Examples of aviation safety programs are system-wide accident prevention, accident mitigation, and weather accident prevention.

[5] Air traffic management includes advanced air transportation technology, terminal area productivity, and civil tiltrotor.

NASA, on the other hand, conducts primarily basic scientific research that provides long-term research and development in aeronautics and related technologies.

In other words, NASA investigates and demonstrates concept feasibility and possible application of the technology for civil aviation. FAA then carries the project forward from pre-production prototype development to full-scale development and deployment in the National Airspace System.

We recognize that FAA and NASA have different and evolving roles, and separate approaches to achieving shared goals. This makes it critical that the two agencies have a clear agreement on how the research undertaken can meet the demands of a growing air transportation system and improve the margin of safety.

In 1998, we conducted a review with NASA's Inspector General to examine the effectiveness of FAA and NASA efforts and how well work was coordinated. FAA and NASA coordinate research through memorandums of understanding/agreement and through a series of committees. We identified a number of areas where FAA and NASA can take action to enhance efforts and help ensure research resources are used in the most cost-effective manner.

FAA and NASA have taken actions to improve coordination and respond to our recommendations. For example, FAA and NASA signed a new memorandum of understanding that strengthens a joint FAA/NASA Executive Committee to provide executive direction and oversight of joint efforts. FAA and NASA have signed an agreement on Aviation Safety and made recommended changes to their respective Advisory Committees.

In November 1999, FAA, NASA, and DOD published a National plan for aviation research.[6] This plan establishes roles, defines goals, and outlines long-term research needs. A highlight of the plan is DOD's role in aviation research. DOD has played a critical role in developing aerospace technology and concepts, including the Global Positioning System. In addition to FAA and NASA investments, DOD spends over $400 million annually on aeronautics on a wide range of initiatives—roughly 75 percent of which has dual military and civilian applications. *FAA has opportunities for leveraging DOD's efforts with respect to new technologies for securing satellite navigation from intentional interference and new systems for detecting non-structural aging aircraft problems with respect to electrical systems.*

[6] National Research and Development Plan for Aviation Safety, Security, Efficiency, and Environmental Compatibility, (November 1999).

An important lesson from our work on FAA's Free Flight Phase 1 initiative[7] is that *technology transfer* from NASA to FAA (and its contractors) requires more attention in the future. There is a need for NASA's expertise in the later stages of development of software-intensive systems with complex human factor issues, particularly when such systems must be customized for specific locations with complex airspace.

AIRCRAFT SAFETY RESEARCH

FAA has focused its aircraft safety research efforts on both preventing accidents and making them more survivable. FAA's RE&D program includes research in advanced materials, crashworthiness, fire safety, and propulsion and fuel system safety. FAA is requesting $49.4 million in Fiscal Year 2001 for aircraft safety RE&D—an increase of $4.9 million over last year's level. Table 2 summarizes FAA's past and planned investments in aircraft safety research.

Table 2 Aircraft Safety Research Program Budget History and FY 2001 Request (Dollars in Thousands)

Research Program	FY 1999 Appropriated	FY 2000 Appropriated	FY 2001 Request
Aviation Safety Risk Analysis	$ 6,471	$ 6,824	$ 6,657
Fire Safety	4,750	4,750	5,451
Advanced Materials/Structural Safety	1,734	2,338	2,797
Propulsion Systems Research.	2,831	3,126	5,200
Flight Safety/Atmospheric Hazards	2,619	3,844	4,109
Aging Aircraft	14,694	21,594	22,384
Aircraft Catastrophic Failure Prevention	1,787	1,981	2,782
Totals	$34,886	$44,457	$49,380

FAA devotes almost half of its Aircraft Safety RE&D budget to aging aircraft and is requesting $22.4 million for Fiscal Year 2001. Following the Aloha Airlines incident in 1988 in which a Boeing 737 suffered severe structural failure of the

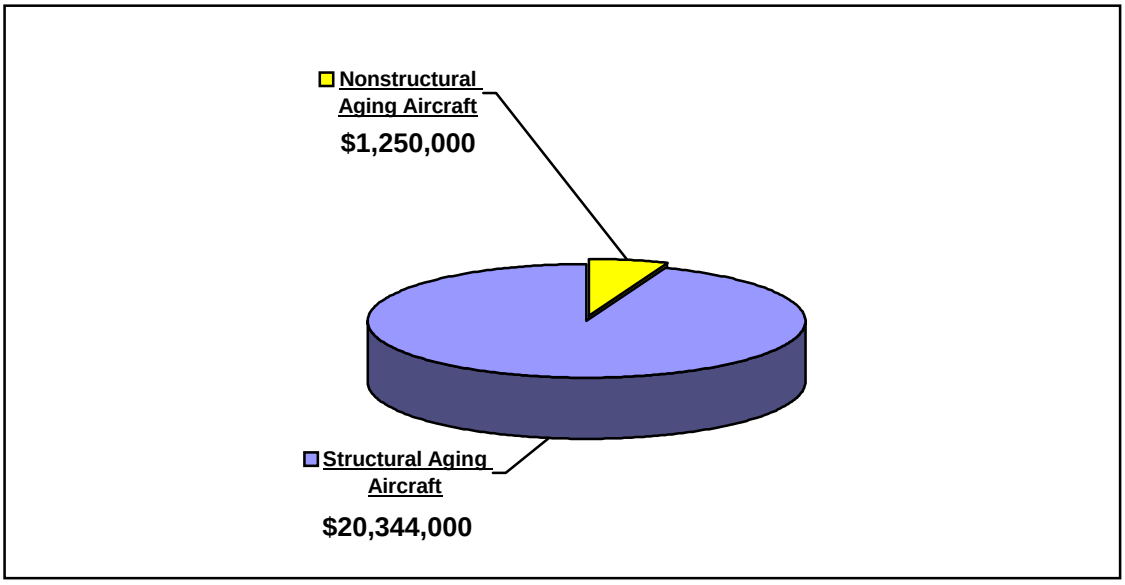
[7] For additional details see Management of Software-Intensive Acquisitions for Free Flight Phase 1: Federal Aviation Administration, (OIG Report Number AV-2000-028, December 21, 1999).

fuselage due to corrosion and disbonding, FAA developed the National Aging Aircraft Research Program.

Three years ago in February 1997, the White House Commission on Aviation Safety and Security recommended that FAA expand its aging aircraft research program to include non-structural components and coordinate its efforts more closely with NASA and DOD. Non-structural components include electrical wiring, hydraulic and fuel lines, and mechanical systems, such as pumps and sensors. A focused research effort is needed because little is known about the potential impacts of aging on non-structural components.

After a late start, FAA's aging aircraft research program began to evolve in 1999 from only looking at structural items, such as aircraft skins, to also covering non-structural components, such as wiring and mechanical systems. FAA continues to spend the bulk of its aging aircraft research funds on methods to predict and detect fatigue cracking and corrosion of aircraft structures. NASA's aging aircraft research focuses exclusively on structural components. FAA is funding eight aging aircraft research projects, two of which focus on non-structural components. As shown in Figure 3, in Fiscal Year 2000, about $1.3 million or 6 percent of FAA's aging aircraft research funds focus on non-structural components.

Figure 3 Non-Structural & Structural Aging Aircraft Research Funding for FY 2000



Source: OIG analysis of FAA budget data

For Fiscal Year 2001, FAA is requesting about $22.4 million for the aging aircraft program, of which $4.8 million is planned for non-structural components. FAA plans continued increases in non-structural research through Fiscal Year 2004.

Over the next year, FAA will continue to work with aircraft manufacturers, airlines, and the U.S. Navy to get a better understanding of aging aircraft non-structural components. A joint Government/industry group is conducting visual inspections of aircraft currently in service, and FAA is conducting teardown evaluations of retired aircraft. FAA plans to conduct laboratory tests of wires taken from out-of-service aircraft, evaluate new inspection devices for wiring, and develop a first generation arc fault circuit interrupter suitable for use in commercial aircraft. Based on the results of these tests and evaluations, FAA needs to determine the appropriate mix of its structural and non-structural aging aircraft research.

HUMAN FACTORS ARE CRITICAL

The need for human factors work extends beyond the traditional man-machine interface issues and has important safety and workforce implications. Key emerging issues include the impact on selection and training of controllers as a result of new automated controller tools and on operators of new security equipment. In addition, research is needed on the impact on pilots from new data link communications and cockpit display technologies. Our work on the Standard Terminal Automation Replacement System (STARS), data link, and advanced security technologies illustrate the importance of human factors in developing new technologies.

Controllers and New Automation

One new automation effort is STARS, a critical modernization project that will replace displays, software, and computers at over 170 terminal air traffic control facilities at an estimated cost of $1.4 billion. STARS was designed to provide the platform necessary to support future software and hardware enhancements, such as data link.

Overall, STARS has experienced considerable cost growth and schedule delays. In September 1998, FAA informed the Congress that an additional $293 million could be needed to complete the program. FAA is now estimating that the total cost growth will be over $460 million. *This amount includes an estimate of $270 million for changes to the system's computer-human interface*. The agency

has developed a new strategy for STARS and the first system (an Early Display Configuration[8]) began operations in December 1999.

An important lesson from the STARS program is that FAA must develop a process to integrate a structured, scientific human factors discipline throughout the acquisition process. Human factors evaluations must be performed early and throughout the entire acquisition process.

The need for human factors evaluations will become more critical as FAA begins to add the collaborative decision-making tools needed for Free Flight, such as Conflict Probe.[9] Under Free Flight, the controller's role could significantly change from a decision-making and communications role to a collaborative and monitoring role. *This will result in major changes in controller workload, training, and selection.* The design of new systems that controllers will use in this new role must be carefully evaluated for human factors in order for these systems to be safe and effective. FAA recognizes that much work needs to be done to make sure that new systems can be implemented without compromising safety.

Data Link

FAA expects to spend $166 million over the next several years on the initial steps to implement a data link for controllers and pilots in domestic U.S. airspace. The human factors issues with data link communications have important safety implications, and represent one of the biggest challenges facing the implementation of the technology.[10] Because voice communications play such a large role in current controller and pilot interactions, experts agree that data link, which is analogous to electronic mail, will fundamentally change the way controllers and pilots communicate with each other.

An important workload related issue is how controllers and pilots will use two distinct communications systems (voice and data link) to share important information. Controllers will be expected to handle both data link and non-data link equipped aircraft in the same airspace. Similarly, pilots will fly in and out of airspace where data link is not universally used. This also has implications for the controller workforce.

[8] Early Display Configuration of STARS consists of new controller displays and maintenance workstations using the existing Automated Radar Terminal System's computer processors and software.
[9] Conflict Probe, also known as the User Request Evaluation Tool, is designed to alert controllers of potential conflicts between aircraft. It will help controllers to evaluate pilot requests for changes in flight paths.
[10] For additional details on Data Link, see FAA's Progress and Plans for Implementing Data Link for Controllers and Pilots, (OIG Report Number AV-1999-057, February 24, 1999).

The amount of "*head down*" time required of pilots and controllers to compose and send, or read and respond to data link messages is a concern. "Head down" refers to the time a pilot's or controller's attention is diverted from primary tasks. For the pilot, there is concern that responding to data link messages will impact time spent on primary flight duties and monitoring the instrument panel.

Since 1997, FAA has invested $80 million on human factors research that examines, among other things, the impacts on controllers and pilots from new Free Flight technologies, such as data link. Early and continued involvement by pilots and controllers in these human factors efforts is essential. Last year we recommended—and FAA agreed—that the agency needed to focus attention and resources on (1) new air traffic control procedures for using data link, (2) controller and pilot training programs, and (3) the design of new data link equipment for displaying and sending messages. FAA's joint research and development work with NASA (Cockpit Automation) and DOD (Team Performance and Decision Making) can help FAA and industry efforts to implement data link.

Advanced Security Technologies

FAA and industry continue to deploy large numbers of advanced security technologies at the Nation's airports. Since 1997, the Congress has provided over $350 million for deployment of advanced security technology over and above the funds provided for research and development. Although advanced security technologies are effective in detecting explosives, each one is ultimately dependent on the human operator.

FAA believes—and we agree—that operators of the new equipment are critical in improving security. FAA test results indicate that new technologies to detect explosives in passenger baggage can correctly identify a potential threat but an operator can make a wrong decision and "clear" the bag. This scenario was confirmed during our reviews of the security of checked baggage.

Since 1997, FAA has invested about $21 million on human factors research, including computer-based training, to improve the performance of security personnel. FAA is currently developing and deploying Computer-Based Training (CBT) systems that provide initial and recurrent training, and Threat Image Projection (TIP) systems that evaluate operator performance. (TIP electronically projects fictitious images of bags containing explosive devices on bulk explosives detection machines.) CBT currently is being used to train operators at many of the Nation's busiest airports. TIP systems are currently installed on deployed FAA-certified bulk explosives detection machines and are being developed for use on checkpoint x-ray machines.

As part of our follow-up audit of the deployment of explosives detection equipment, we found that the deployment of these new training systems has been slow and better guidance from FAA is needed regarding how to use them. Continued human factors work is needed, particularly on the selection and training of security personnel who operate new devices and on data collection and analysis of operator performance.

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Madam Chair, that concludes my statement. I would be happy to respond to questions that you or other members may have.

Attachment 1

Summary of FAA RE&D Budget Activities Fiscal Years 1999 to 2001
(Dollars in Millions)

Research Activity	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Request	FY 2000-2001 Change
System Development & Infrastructure	$15.78	$17.14	$25.28	+$8.14
Weather	18.68	19.30	27.79	+8.49
Aircraft Safety Technology	34.89	44.46	49.38	+4.92
System Security Technology	51.69	50.15	49.38	-0.77
Human Factors & Aviation Medicine	25.07	21.97	25.10	+3.13
Environment & Energy	2.89	3.48	7.44	+3.96
Strategic Partnerships	1.00	0	0	0
Total	$150.00	$156.50	$184.37	+$27.87

Source: OIG Analysis of FAA Data