May 20, 2002

The Honorable Dana Rohrabacher
Chairman
Subcommittee on Space and Aeronautics
Committee on Science
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

As requested, we are providing information on the Federal Aviation Administration's (FAA) Fiscal Year (FY) 2003 budget request for Research, Engineering, and Development (RE&D) to assist your Subcommittee in reviewing agency budgets and plans. Specifically, you asked us to develop a crosswalk to compare the FY 2003 request with previous ones (including research on aircraft safety) and provide perspectives on FAA's efforts to enhance the capacity of the National Airspace System.

In summary, FAA is requesting $126.7 million in RE&D for this coming year—a decrease of almost $70 million from last year's request.

- FAA's FY 2003 budget request is substantially different in terms of format from past ones and reflects changes made in response to the September 11th terrorist attacks. The most visible change is the transfer of security research from FAA (between $40 million and $50 million annually for System Security Technology) to the new Transportation Security Administration, which now has the responsibility for screening airline passengers and their luggage. FAA's FY 2003 request for RE&D also reflects the agency's initial step to transition to a performance-based organization; research lines of effort are now linked to broad goals, such as improving the safety and efficiency of the National Airspace System.

- In addition to the $126.7 million requested for RE&D, FAA intends to make considerable investments in technology development in other agency accounts. Specifically, FAA expects to spend nearly $527 million on developmental efforts from its Facilities and Equipment account for modernizing the National Airspace System. Also, FAA intends to spend $16 million for airport-related research funded through the Airport Improvement Program.

- FAA also leverages research conducted by other Federal agencies, most notably the Department of Defense and the National Aeronautics and Space Administration (NASA). FAA ties are closest to NASA, which makes a significant investment in cutting-edge aviation research and development. NASA expects to invest $541 million in aeronautics research in FY 2003, with the bulk of long-term research on air traffic management.

- FAA needs to be well positioned for when the demand for air travel recovers through a combination of new runways, better air traffic control technology, airline scheduling practices, and greater use of airports other than hubs. FAA's best estimate is that economic conditions and passenger demand will recover within 18 to 24 months, and the agency projects that by 2004 passenger enplanements will return to pre-September 11th levels. FAA has published a plan—the Operational Evolution Plan—for addressing the Nation's capacity problems between now and 2010. The plan needs to be updated to reflect changes in agency priorities and how FAA and industry investments in new systems can be synchronized. FAA intends to publish a revised plan in December 2002.

  There is almost universal agreement that greater attention is needed on what the air traffic system will look like in the 2010 to 2015 time frame and beyond. This is because most of FAA's development work is focused on systems already in the acquisition pipeline and the fact that FAA does very little long-term research on air traffic systems.

  The Department of Transportation has recognized the need for more attention with respect to charting a long-term vision for the National Airspace System. Department officials have initiated discussions with various stakeholders with the goal of bringing all segments of the aviation community together and defining a single vision for the future.

  Irrespective of the technologies selected for development, we see the key elements of the next generation system as being focused on (1) maintaining and improving safety and security, (2) addressing human factors for controllers and pilots, (3) enhancing how the National Airspace System responds and recovers from bad weather, and (4) addressing environmental and noise concerns.

This letter provides details on FAA's request and provides a crosswalk to the format and structure of past RE&D budgets and related efforts as well as perspectives on FAA's capacity enhancing initiatives and key elements of the next-generation air traffic management system.

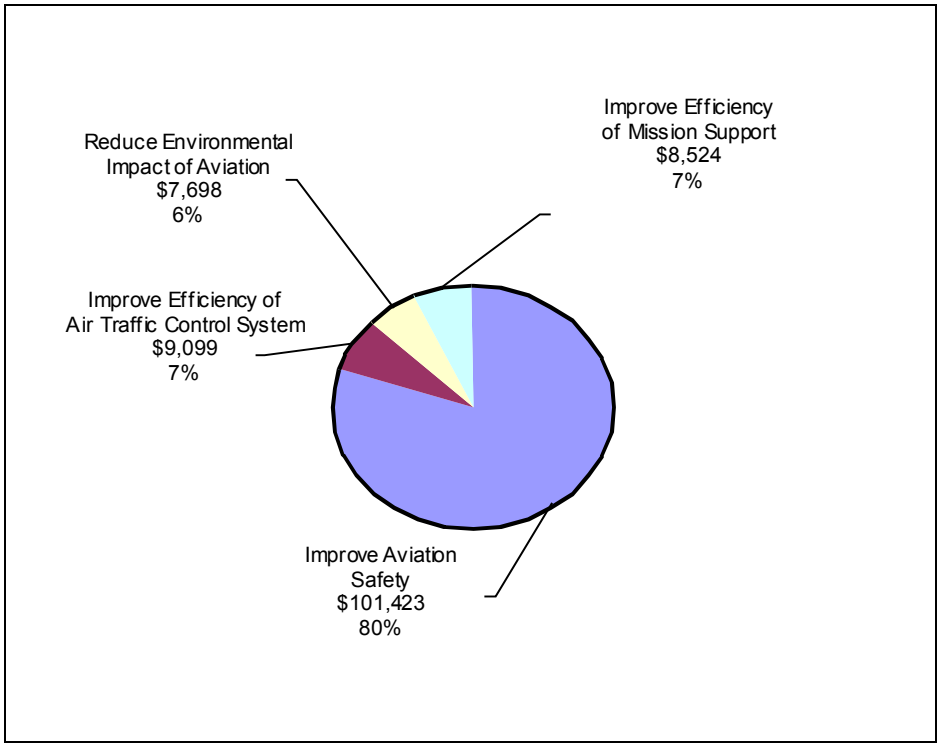
RESULTS

FAA's FY 2003 Budget Request: Recent Changes and Programmatic Shifts

FAA's RE&D Program plays an important part in developing new technologies to help meet the growing demand for air travel and improve the safety of flight. FAA is requesting $126.7 million, which represents a decrease of $68 million from last year's level of $195 million. Most of the decrease between FY 2002 and the FY 2003 request is attributable to the shift in funding for security research from FAA to the new Transportation Security Administration. For comparison purposes, we excluded the one-time $50 million provided in FY 2002 supplemental appropriations following the September 11th terrorist attacks, which boosted the FY 2002 RE&D funding level to $245 million.

FAA has reformatted its budget request to be more reflective of a performance-based organization. Research lines of effort are now linked to broad goals for improving safety, enhancing the efficiency of the air transport system, reducing the environmental impact of aviation, and supporting the agency's mission. Figure 1 shows how FAA's FY 2003 request is aligned to agency goals.

Figure 1: FAA Fiscal Year 2003 RE&D Budget Request (in thousands)



Reformatting the budget request to reflect a performance-based organization has merit, but it makes comparing previous years' funding levels difficult. Table 1 provides a crosswalk between appropriations for FYs 2001 and 2002, as well as FAA's FY 2003 request as if the agency had not reformatted its budget.

Table 1: Federal Aviation Administration Research, Engineering, and Development Program (Dollars in thousands)

Research Budget Line Item	FY 2001 Appropriated	FY 2002 Appropriated[a]	FY 2003 Request	FY 2002-03 Change
System Development and Infrastructure	$ 17,376	$ 16,031	$ 7,914	-$8,117
Weather	24,751	23,668	28,505	+4,837
Aircraft Safety Technology	62,542	63,782	54,686	-9,096
System Security Technology	54,400	44,511	Transferred to TSA	-44,511
Human Factors and Aviation Medicine	24,047	24,527	27,331	+2,804
Environment and Energy	3,473	22,081	7,698	-14,383
Strategic Partnerships	0	400	610	+210
Totals	**$186,589**	**$195,000**	**$126,744**	**-$68,256**

[a]Does not include the one-time $50 million supplemental provided in the Department of Defense and Emergency Supplemental Appropriations for the Recovery From and Response to Terrorist Attacks on the United States (Public Law 107-117), which would boost FY 2002 RE&D funding to $245 million. We excluded the one-time $50 million in supplemental appropriations to make it easer to compare year-to-year funding profiles for the major lines of effort.

Source: FAA, Research and Development Programming and Financial Management Branch

The most visible change in FAA's FY 2003 request is the transfer of security research (between $40 and $50 million annually for System Security Technology, including weapons and explosives detection) to the Transportation Security Administration. FAA has also shifted $18 million[1] from the RE&D account to the Facilities and Equipment account for a range of activities, some of which would have been funded in the past through the "System Development and Infrastructure" category as shown in Table 1.

Aviation Safety Research—Work Is Focused on Preventing Accidents and Making Them More Survivable: FAA will invest about $101 million—or 80 percent—of its FY 2003 budget request for RE&D on safety-related research to reduce commercial and general aviation fatalities as well as improve overall system

[1] The $18 million includes $5 million for Mitre Corporation's Center for Advanced Aviation System Development, $2.5 million for information security projects, and $10.5 million for the FAA Technical Center.

safety. Key initiatives in this area include aging aircraft, fire safety, and weather research. Of the $101 million, $54 million is requested for research specifically related to aircraft and aircraft components. FAA is also requesting funds related to safety for a range of human factors and aviation medicine research.

FAA's aircraft safety research portfolio is diverse and includes work on aging aircraft and fire safety, as well as aircraft engines and fuel systems. Past accidents and congressional action[2] have shaped the scope and direction of FAA's research efforts. Research is focused on preventing accidents and making them more survivable.

Ongoing aircraft safety research covers 21 projects with over 160 tasks. FAA officials told us that some adjustments may occur in aircraft safety research as more is learned about American Airlines Flight 587, which crashed in New York.

As requested, Table 2 provides a crosswalk between appropriations for FYs 2001 and 2002 for aircraft safety and the current FY 2003 request.

Table 2: Investments in Aircraft Safety Research
(Dollars in thousands)

Research Program	FY 2001 Appropriated	FY 2002 Appropriated	FY 2003 Request	FY 2002-03 Change
Aviation Safety Risk Analysis	$ 6,642	$ 5,784	$ 6,926	+$1,142
Fire Safety	4,740	5,242	6,429	+1,187
Advanced Materials/Structural Safety	2,791	2,974	3,053	+ 79
Propulsion Systems Research	8,182	8,568	5,711	-2,857
Flight Safety/Atmospheric Hazards	4,100	6,420	4,430	-1,990
Aircraft Catastrophic Failure Prevention Research	2,776	2,794	1,920	- 874
Aging Aircraft	33,311	32,000	26,217	-5,783
Total	**$62,542**	**$63,782**	**$54,686**	**-$9,096**

Source: OIG analysis of FAA data

[2] The Aviation Safety Research Act of 1988 (Public Law 100-591) mandated that FAA undertake or supervise research to develop technologies and to conduct data analysis of the effects of aircraft design, maintenance, testing, wear, and fatigue on the life of aircraft. The passage of the Aircraft Catastrophic Failure Prevention program under the Omnibus Reconciliation Act of 1990 (Public Law 101-508) further expanded FAA's research mission.

The largest single line of effort in aircraft safety research focuses on *aging aircraft*, which includes work on new inspections systems (commonly referred to as nondestructive inspection technologies) that can detect small cracks in aircraft skins that are difficult to spot with the naked eye or without dissembling major aircraft components. FAA is requesting $26.2 million for aging aircraft research in FY 2003, a decrease of about $6 million from last year's level.

In response to the White House Commission on Aviation Safety and Security, FAA's aging aircraft research has evolved from looking solely at structural issues to also looking at non-structural ones, such as aircraft wire and mechanical systems. To date, FAA's non-structural research has supported the inspection of older aircraft, the refinement of new inspection systems for wire, and development of new "smart" circuit breakers.[3] FAA expects to spend about $8.9 million for non-structural research in FY 2003. As we have noted in the past, the key is finding the right mix of structural and non-structural research.[4]

Considerable Investments in Technology Development Are Made Outside FAA's RE&D Account and by Other Federal Agencies

It is noteworthy that FAA funds considerable development work in other accounts and leverages research conducted by other Federal agencies. In addition to the $126.7 million requested for RE&D, FAA will make a considerable investment in technology development in the agency's Facilities and Equipment (F&E) account.

Most of the development work was performed in the Engineering, Development, Test, and Evaluation (EDT&E) portion of the F&E account.[5] This is where FAA has historically conducted the bulk of its development work on new air traffic control technologies. For example, work on *Automatic Dependent Surveillance-Broadcast*[6] (which can help pilots land in bad weather and, when coupled with moving map displays, can help reduce runway incursions) is funded in the F&E account.

[3] FAA and the U.S. Navy are developing an *arc fault circuit breaker* that can shut down a circuit when it detects sparking wires (an "arc fault"), which can be caused by a breach in wire insulation. Current aircraft circuit breakers are designed to protect against electrical overloads and short circuits but not arc faults.

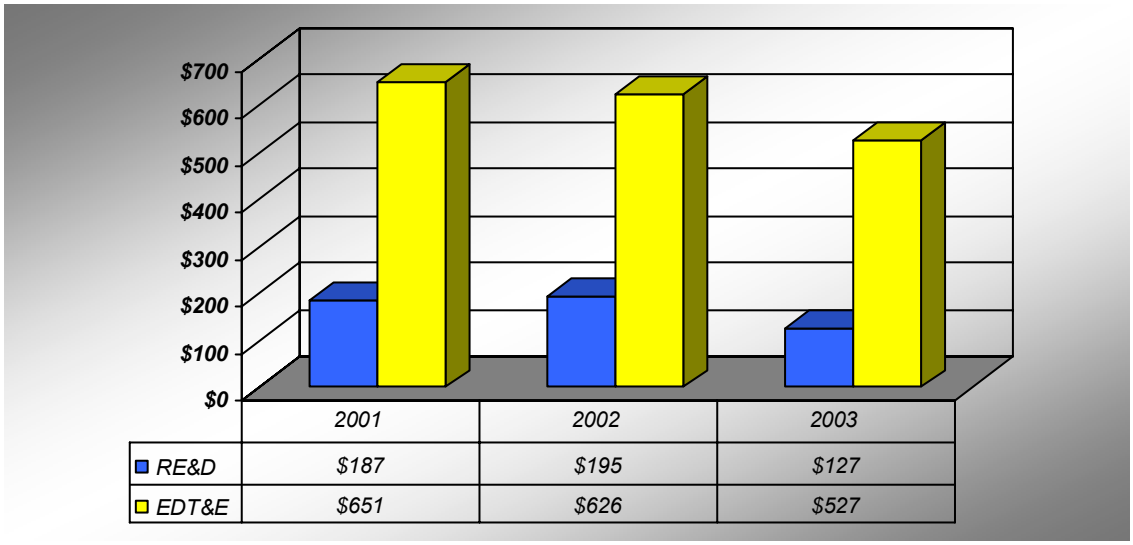
[4] See Observations on Efforts to Address Concerns about Aircraft Wiring (OIG Report Number AV-2001-004, October 27, 2000).

[5] Engineering, Development, Test, and Evaluation budget activity included programs that have migrated from the RE&D account or programs that are in the early stages of acquisition. For example, this activity funded work on mission needs analysis and alternative design analysis.

[6] Automatic Dependent Surveillance-Broadcast, "ADS-B", uses the Global Positioning System. Aircraft equipped with ADS-B avionics transmit position information, along with aircraft identification, altitude, velocity and possible intent data to ground systems and other properly equipped aircraft.

As with the RE&D account, FAA also reformatted the structure and format of its FY 2003 request for F&E. FAA officials indicate that the level of funding for EDT&E for FY 2003 would be $527 million, which represents a $99 million decrease from FY 2002.[7] Figure 2 shows a comparison of RE&D and EDT&E for appropriations in FYs 2001 and 2002 as well as FY 2003 as if FAA had not reformatted its budget.

Figure 2: Budget Trends—RE&D and EDT&E
(FYs 2001 - 2003)
(Dollars in millions)



Note: FY 2002 RE&D figures do not include supplemental appropriations.
Source: FAA, Research and Development Programming and Financial Management Branch.

FAA also intends to fund research through the Airport Improvement Program. FAA is requesting $16.4 million for Airport Technology Research, which will focus on pavement technology, airport lighting and marking, fire and rescue, and wildlife hazard mitigation.

FAA also leverages aviation research conducted by other Federal agencies, including the Department of Defense and NASA. FAA ties are closest to NASA, which makes a significant investment in aviation research and development.

While FAA focuses its research on the near-term, NASA focuses on long-term, cutting-edge technologies. NASA has made invaluable contributions to develop a

[7]The estimate of $527 million does not include F&E funds for Mitre's Center for Advanced Aviation System Development, which functions as a Federally Funded Research and Development Center. FAA is requesting $81 million in FY 2003 for Mitre to, among other things, develop transition plans for satellite navigation and new operational concepts for air traffic management.

new air traffic management system. For example, the Center TRACON Automation System (which helps controllers sequence aircraft for arrival) was pioneered by NASA and is an important element of FAA's Free Flight Phase 1 initiative.[8]

NASA expects to invest $541 million in aeronautics research in FY 2003. NASA now does the bulk of long-term research for air traffic management and is embarking on its *Aviation System Technology Advanced Research*, or "AVSTAR," initiative to research future capabilities for the air transportation system of the 21st century.

Effective coordination between FAA and NASA is critical to reduce duplication of effort and make the best use of scarce research dollars. We have reviewed FAA/ NASA cooperation in the past and made recommendations aimed at improving coordination.[9] In response, both FAA and NASA took action, which included improving oversight by the FAA/NASA executive committee and entering into a formal agreement for aviation safety research. Coordination between FAA and NASA has improved over the years—this is reflected in interagency agreements and joint research plans.

In a hearing before this Subcommittee in March, it was noted that the challenge for FAA and NASA lies in the transfer and adoption of new technologies in an operational environment. A number of steps can be taken to strengthen the relationship, including more exchange of research staff (particularly at the project level), providing details on funding at the project level in joint plans, and greater use of technology readiness levels in program plans and budgets to help frame the maturity of new technologies and determine when they can be implemented.

Being Positioned for When the Demand for Air Travel Rebounds and Perspectives on the Next-Generation Air Traffic Management System

As requested, we are providing perspectives on FAA's efforts to enhance capacity of the National Airspace System. FAA needs to be well positioned for when the demand for air travel recovers through a combination of new runways, better air traffic control technology, airline scheduling practices, and greater use of airports other than hubs. FAA's best estimate is that economic conditions and passenger demand will recover within 18 to 24 months, and the agency projects that by 2004 passenger enplanements will return to pre-September 11th levels.

[8] For additional details, see Free Flight Phase 1 Technologies: Progress to Data and Future Challenges (OIG Report Number AV-2002-067, December 14, 2001).
[9] For additional details, see Report on FAA/NASA Research and Development Coordination Efforts (OIG Report Number AV-1999-008, October 8, 1998).

Last summer, FAA published its Operational Evolution Plan for reducing delays and boosting capacity. FAA projects that this new blueprint will provide a 30 percent increase in capacity over the next 10 years, assuming all initiatives are completed and airspace users equip with a wide range of new avionics. FAA intends to invest $11.5 billion in the plan exclusive of the costs to provide air traffic services, institute new security requirements, and build new runways, but the true cost of the plan is unknown.

The Operational Evolution Plan encompasses a range of efforts to enhance capacity, including "choke point"/airspace redesign initiatives, new procedures, and new technology. While the choke point initiatives and new automated controller tools will enhance the flow of air traffic, new runways provide the largest increases in capacity.

Because most of FAA's development work is focused on systems already in the acquisition pipeline and the fact that FAA does very little long-term research on air traffic systems, many believe the time is right to sharpen the longer term vision for what the National Airspace System will look like in the 2010 to 2015 timeframe and beyond. There is also a need to examine how new technologies can be introduced and integrated with existing systems in the next 5 years. Boeing, NASA, and others have work underway toward refining a vision of the next-generation air traffic management system.

We note that the National Research Council is examining long-term plans and visions for modernizing the National Airspace System including an assessment of near- and long-term goals for aeronautics research. Specific tasks include identifying gaps in planning and the reasonableness of timelines for implementing new technologies. An interim report is planned for late this summer with a final report to follow in 2003.

The Department of Transportation (DOT) has recognized the need for more attention with respect to charting a long-term vision for the National Airspace System. DOT officials have initiated discussions with various stakeholders—both inside and outside of Government—to define a single vision for the future. Once a broad consensus is formed, the Department intends to work toward designing, developing, and evaluating a new architecture for air traffic management.

It is generally believed that the future system will evolve toward satellite-based navigation, digital communications for the exchange of data between controllers and pilots, and greater automation for controllers. The Congress provided FAA with a supplemental of $25 million in FY 2002 for a proof-of-concept demonstration incorporating a global satellite-based communications, navigation,

and surveillance architecture; a highly integrated, secure common information network; and a broadband two-way secure communications capability.[10]

We see several core elements of the next-generation air traffic management system, irrespective of the specific technologies chosen for implementation. We base our observations on our recent work on FAA's Free Flight Phase 1 initiative and other modernization efforts we monitor on a routine basis.

- Maintaining and Improving Safety and Security. The United States operates the safest and most complex aviation system in the world. New technologies are expected to bring about major increases in capacity. For example, new satellite-based systems will provide for more direct routes, can help pilots land in all weather conditions, and help prevent accidents on runways. However, as a 1999 White House report[11] cautioned, technological change can be a two-edged sword and, consequently, continued research is needed to ensure that new systems do not inadvertently introduce new hazards. At the same time, new technologies need to be viewed in context of how new security features (e.g., verifying aircraft location and intent) can be brought to bear during all phases of flight. Security and air traffic control modernization should be viewed in a synergistic manner and pursued as an integrated system.

- Human Factors Research for Both Pilots and Controllers. Related to safety is the need for continued research on a wide range of pilot and controller issues. History has shown that insufficient attention to human factors issues can increase the cost of an acquisition and delay much-needed improvements. The need for human factors research extends beyond the traditional computer-human interface, such as new controller displays, and has important safety and workforce issues. Human factors for pilots and controllers are important because of the nature and extent of the changes envisioned under Free Flight[12] where the focus of control is expected to shift from the controller to the pilot. Key issues focus on the impact of data link communications, new cockpit displays and new automated decision-making tools.

- New Weather Technologies to Predict and Help Recover From Bad Weather. Bad weather is a leading cause of all delays in the National Airspace System,

[10]See Making Appropriations for the Department of Defense for the Fiscal Year Ending September 30, 2002, and for other Purposes (House of Representatives Conference Report 107-350, December 19, 2001).
[11]See National Research and Development Plan for Aviation Safety, Security, Efficiency, and Environmental Compatibility, National Science and Technology Council, Committee on Technology, Subcommittee on Transportation Research and Development (November 1999).
[12]The goal of Free Flight is to increase the capacity and efficiency of the National Airspace System by better managing available airspace. As Free Flight matures, it will provide pilots and controllers with flexibility, under certain circumstances, to fly city to city instead of being restricted to a series of fixed routes that are based on the limitations of ground-based systems, principally radar.

and poor weather, such as thunderstorms, in one part of the United States can have ripple effects nationwide. Making National Airspace System performance on bad weather days resemble performance on good weather days must be a key element of any future system. FAA's Operational Evolution Plan includes new weather technologies for controllers, and both NASA and FAA are funding aviation weather research. We note that NASA's work is focused on weather information displayed in the cockpit, including synthetic vision. Notwithstanding FAA's Operational Evolution Plan, continued research is needed with respect to, among other things, more accurately predicting the time, location, and severity of in-flight icing and thunderstorms and integrating new weather information with air traffic decision-making.

- Environmental and Noise Concerns. The largest capacity increases in the near- and mid-term will come from building new runways, but there is considerable opposition to them. In many cases, airport expansion is limited by concerns about aircraft noise, and local approval is required. Aircraft noise concerns touch on many facets of FAA's capacity efforts, including airspace redesign. In addition to quieter aircraft, FAA and others believe that more precise satellite-based navigation systems could reduce the noise footprint of some airports. We note that the House Conference Report for fiscal year 2002 called for FAA and NASA to collaborate on aircraft noise reduction research and accelerate efforts to introduce noise reduction technologies.[13]

We are also sending copies of this letter to the Chairman and Ranking Member of the Senate Commerce, Science, and Transportation Committee who also requested this work. I would be glad to discuss these issues at your convenience. Please feel free to call me on (202) 366-1992 or David A. Dobbs, the Deputy Assistant Inspector General for Aviation, on (202) 366-0500.

Sincerely,

Alexis M. Stefani
Assistant Inspector General for Auditing

cc: FAA Administrator

[13] See Department of Transportation and Related Agencies Appropriations Bill, 2002, U.S. House of Representatives (Report 107-308, November 30, 2001).