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AVIATION RESEARCH

Actions to Enhance the Effectiveness of FAA's Research Activities

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Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to discuss the Federal Aviation Administration's (FAA) Research, Engineering, and Development (RE&D) Program. FAA is requesting $250 million for RE&D activities in fiscal year 1994. The RE&D Program plays an important role in ensuring the safety, security, and efficiency of the U.S. air transport system. Several systems developed and tested through the program, such as the Traffic Alert/Collision Avoidance System, are finding their way into day-to-day use.

Today, a sense of urgency faces the program. The financial health of the airline industry, growing international competition for aerospace products, and administration's focus on research and development to enhance our competitive position are converging to make increasing demands on FAA's RE&D Program. Although the program alone cannot solve the financial troubles of the airline industry, it can provide critical technologies, such as satellite and data link technologies, that can reduce delays and increase airspace capacity. Today, we will discuss FAA's progress in responding to the Aviation Safety Research Act of 1988, factors that will affect the success of the RE&D Program, the relationship between FAA and the National Aeronautics and Space Administration's (NASA) research programs, and four challenges facing FAA's security efforts. Our testimony is based on prior reports, recent testimony concerning FAA's security research program, and work this Subcommittee specifically requested. In summary:

-- FAA continues to make progress in responding to the Aviation Safety Research Act of 1988. FAA has expanded research in areas directed by the act--such as simulation modeling of the air traffic control system. Similarly, FAA is taking steps to respond to a recommendation we made last year to track long-term research[1]. In addition, FAA has developed an RE&D Plan. However, FAA has not included resource estimates in the plan as mandated by the act. Such information is important because FAA and industry officials estimate that FAA would need a significant funding increase--a 100 percent by fiscal year 1995--to implement the plan. Given the budget deficit, it is not prudent to think that such increases will be forthcoming. Therefore, FAA will have to make careful trade-offs among diverse projects to ensure that important research is funded and completed in a timely manner. This is particularly important in view of the administration's emphasis on enhancing global competitiveness.

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[1]Aviation Research: FAA Could Enhance Its Program to Meet Current and Future Challenges (GAO/RCED-92-180, June 3, 1992.)

BACKGROUND

FAA conducts a wide range of research to ensure the safety, security, and efficiency of the U.S. aviation system. The results of FAA's research programs include prototypes of systems, new procedures, rules, regulations, and certification criteria. Most, if not all, of FAA's research focuses on refining existing technology and equipment. To assist FAA in meeting its long-term challenges, the Congress enacted the Aviation Safety Research Act of 1988. The act directs FAA to (1) submit to the Congress an annual aviation research plan with detailed cost, schedule, and staffing data for each project and a report of accomplishments for the preceding year; (2) undertake research on aircraft structures, fire safety, human factors, aeromedical research, and computer simulation models of the air traffic control system; and (3) establish a research advisory committee. In addition, the act required FAA to allocate not less than 15 percent of its fiscal year 1989 and 1990 budget to long-term research.[3]

In response to the act, FAA is spending more RE&D funds on aircraft structures, simulation modeling, and human factors. (App. I compares funding levels for fiscal years 1988--before the passage of the Aviation Safety Research Act--and 1994 by major research area.) Nevertheless, FAA faces many long-term challenges that will require sustained research over the next few years. These challenges include:

-- Alleviating capacity and congestion problems. In 1992 alone, over 280,000 flights experienced delays in excess of 15 minutes.

-- Developing systems that can detect a wide range of explosives with a high degree of reliability at an affordable cost.

-- Developing tools to detect cracks and corrosion in the nation's aging fleet without grounding aircraft for extended periods of time.

-- Ensuring that the next generation of air traffic control systems, which rely heavily on automation, are engineered so that controllers and pilots can effectively operate and work with the systems.

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[3]The act defined a long-term research project as a discrete project that was unlikely to result in a final rulemaking within 5 years or in initial installation of operational equipment within 10 years after the project began.

mission need statements and the steps that FAA needs to take in the management of the Capital Investment Program.[6] For the RE&D Program, FAA officials are optimistic that mission need statements will help them identify, fund, and deploy promising technologies.

Efforts to Track Long-Term Research are Underway

For many years, the Congress has been concerned that FAA's RE&D Program is not sufficiently future-oriented. According to FAA officials, about 20 percent of the fiscal year 1994 budget is allocated to long-term or future-oriented research. Such research is important because it can identify potential safety problems before they result in catastrophic accidents or incidents and enhance the industry's competitiveness. We previously reported that many projects FAA had classified as long-term were actually short-term or a combination of short- and long-term efforts. We also found that FAA does not track information on the amount of long-term research conducted. Consequently, budget and planning documents do not indicate the level of funds for short- or long-term efforts. Tracking such research would allow FAA to make judgements on the overall direction of the RE&D program, identify trends, and make the necessary adjustments. Therefore, we recommended that FAA develop a mechanism to track long-term research. FAA is exploring ways, including modifying the RE&D information system, to implement this recommendation and expects to have procedures in fiscal year 1995.

FAA's RE&D Efforts are Difficult to Estimate

FAA's total RE&D efforts are difficult to estimate because some research is funded from other sources, including other federal agencies and the facilities and equipment (F&E) account for modernizing the air traffic control system. For example, several important RE&D projects that utilize emerging technologies--such as Terminal Air Traffic Control Automation--receive both RE&D and F&E funds.[7] We previously reported that FAA needed to link its process for acquiring major projects with its budget to enhance project management and reduce the potential for cost growth and schedule delays.[8]

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[6]Air Traffic Control: Justification for Capital Investments Need Strengthening (GAO/RCED-93-55, Jan. 14, 1993).

[7]For additional information on emerging technologies, see Air Traffic Control: Status of FAA's Modernization Program (GAO/RCED-93-121FS, Apr. 16, 1993).

[8]Aviation Acquisition: Further Changes Needed in FAA's Management and Budgeting Practices (GAO/RCED-91-159, July 29, 1991).

efforts. Key areas that might benefit FAA include phased array radar technology, sensor fusion, and software testing. The National Aviation Research and Competitiveness Act of 1993 (H.R. 1229) has been introduced in the House and would require the establishment of a joint program for conducting research on aviation related-technologies.

Third, in such areas as air traffic control and security, an important relationship exists between developing technologies and how the technologies work together (system engineering and integration). For example, in the air traffic control area FAA must ensure the integration of ground-based systems and satellites for communications, navigation, and surveillance functions. Also, as discussed later, FAA must ensure that future security devices can successfully blend several technologies to detect a wide range of explosives. In the past, integration problems and issues have contributed to cost increases. For example, costs increased for the Terminal Doppler Weather Radar System because FAA did not fully consider the need to integrate that system with the Low-Level Windshear Alert System.

Finally, for more than 30 years, human error has contributed to over 65 percent of aviation accidents. As a result, FAA has developed a multi-year plan with NASA that focuses on many aspects of human factors in aviation. By December 1993, FAA expects to complete an evaluation of the plan's priorities and determine the correct balance of short- and long-term human factors research. This work will help identify potential safety issues and maximize efficiency in air traffic control and the operation and maintenance of aircraft.

FAA AND NASA COOPERATION

At the request of this Subcommittee, we initiated a limited examination of the cooperation between FAA and NASA in conducting research activities. With research needs far exceeding what can reasonably be funded, it is paramount that FAA closely cooperate with other federal agencies. NASA makes a substantial investment in aeronautical research upon which FAA could leverage its research dollar and potentially achieve greater research investment returns. For fiscal year 1994, NASA is planning to spend over $1 billion for aeronautics research. (App. III provides information on NASA's fiscal year 1994 R&D investments.) Although some joint projects have had positive results in several areas, NASA research activities can further benefit FAA.

NASA and FAA Work Through Cooperative Agreements

FAA and NASA work closely on a wide range of projects, including aging aircraft, noise, and human factors research through cooperative agreements. According to FAA and NASA officials,

The Terminal Air Traffic Control Automation (TATCA) program illustrates an opportunity that FAA almost lost because of poor coordination. According to FAA and NASA officials, in the early 1980s, NASA suggested that both agencies develop TATCA--a software enhancement to assist air traffic controllers in routing aircraft more efficiently. Although FAA decided not to fund the project, NASA did. FAA now anticipates that TATCA will provide significant capacity improvements. At the end of fiscal year 1992, major components of the TATCA program were delivered to air traffic control facilities for testing.

NASA Can Play a Key Role In Meeting Future Challenges

As discussed above, NASA plays an important role in FAA's research efforts and may be able to play a much larger role in the future. For example, NASA officials told us that they could contribute more research resources to develop satellite technology for the next generation air traffic control system. In addition, FAA's Advisory Committee for RE&D noted that considerable opportunity exists for FAA to harvest prior achievements from the technological investments made by NASA, particularly in the space arena. Moreover, a recent examination by the National Research Council found that NASA could play a key role in helping FAA to significantly increase the capacity of the nation's air traffic control system.[9] To do so, the Council recommended, in part, that FAA, NASA, and industry work together to expedite the development of satellite communications.

FAA has not actively sought NASA's input to help shape the vision of the future national airspace system. Although FAA has developed RE&D Plans, it has not yet developed a transition plan to integrate satellite technology into the future air traffic control system. FAA expects to have a transition plan by December 1994. Since the two agencies coordinate only after a specific problem has been identified, NASA is not involved with FAA's planning effort. Without closer cooperation, FAA will not be able to fully utilize NASA's substantial technology base. FAA and NASA are drafting a satellite navigation memorandum of understanding, but until FAA completes its transition plan, neither FAA nor NASA will be able to maximize the government's investment in aviation research.

SECURITY RE&D PROGRAM FACES SEVERAL CHALLENGES

After the Pan Am Flight 103 tragedy, the Congress directed FAA to, among other things, accelerate its research efforts for bomb detection, and explore ways to enhance aircraft survivability. The

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[9]Aeronautical Technologies for the Twenty-First Century, National Research Council (1992).

directed FAA to conduct a detailed analysis of the trade-offs between survivability and detection. Defining this relationship is important because if FAA finds that an aircraft could be made to withstand an explosion, then devices would not have to be as sensitive as FAA currently requires. Conversely, if an aircraft cannot be made to withstand an explosion, then the devices will have to be as or more sensitive. FAA expects to complete its analysis in 1995.

CONCLUSIONS

FAA is taking some important steps to improve its RE&D Program and respond to our prior recommendations. FAA's plan to use mission need statements in fiscal year 1995 to prioritize research efforts and guide funding decisions is a positive step. However, FAA has not implemented our recommendation to include the requisite budget and staffing information in the RE&D Plan. This information is critically important in today's budgetary environment where FAA will have to be make difficult trade-offs between diverse research areas.

The success of FAA's RE&D Program in meeting current and future challenges rests on integrating RE&D goals into other program areas, leveraging research conducted by other federal agencies, integrating various technologies to meet specific safety and capacity problems, and incorporating human factors into all research. As our limited work on the relationship between FAA and NASA research activities shows, the solution to some of today's most pressing problems may call for greater cooperation between the two agencies.

Mr. Chairman, this concludes our statement. We would be pleased to respond to questions at this time.

FAA's RE&D GOALS

-- Reduce civil aviation fatality rate by all causes by at least 10 percent by 1999.

-- Develop a fire-resistant aircraft cabin.

-- Increase airspace and airport capacity by at least 20 percent by 2000 and an additional 20 percent by 2005, achieving commensurate reductions in delay.

-- Reduce runway incursions by 80 percent by the year 2000.

-- Reduce the number of accidents and incidents attributable to controller, flight crew, and maintenance crew human error by 50 percent by the year 2000.

-- Reduce the number of accidents and incidents attributable to weather by 20 percent in 1997.

-- Eliminate aircraft fires and aging aircraft concerns as significant safety issues by 1996.

-- Provide nonprecision approach capability or better at 95 percent of all U.S. public airports by 1996.

-- Anticipate new threats and implement new security philosophies, technologies, and systems that operate effectively with minimal interference to passengers and carriers.

Joint FAA/NASA Research and Development Project Funding Level, Fiscal Years 1992, 1993, and 1994

Dollars Millions

Program Area	1992	1993	1994[a]
Capacity Air Traffic Management Technology			
FAA	$1.0	$1.0	$1.0
NASA	1.7	1.7	1.7
Communications, Navigation, and Surveillance			
FAA	0.1	0.2	0.3
NASA	0.2	0.2	0.2
Weather			
FAA	1.3	1.1	0.8
NASA	1.4	1.4	1.0
Airport Technology			
FAA	0.1	0.1	0.0
NASA	0.1	0.1	0.0
Aircraft Safety Technology			
FAA	13.0	13.0	13.0
NASA	4.0	6.8	7.7
Human Factors and Aviation Medicine			
FAA	5.9	6.7	6.9
NASA	10.6	5.4	6.5
Environment and Energy			
FAA	1.0	1.2	1.5
NASA	9.0	10.3	11.4
Total			
FAA	22.4	23.3	23.5
NASA	27.0	25.9	28.5
Joint	$49.4	$49.2	$52.0

[a]Requested for fiscal year 1994.
Source: GAO Analysis of FAA and NASA data.

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