U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON SPACE AND AERONAUTICS

HEARING CHARTER

The Federal Aviation Administration's R&D Budgetary Priorities for Fiscal Year 2008

Thursday, March 22, 2007
10:00 a.m. to 12:00 p.m.
2318 Rayburn House Office Building

Purpose:

The purpose of the March 22nd Subcommittee on Space and Aeronautics hearing is to review the FY 2008 budget request for the Federal Aviation Administration's (FAA) research and development (R&D) programs and examine current and potential R&D priorities, including support to the NextGeneration Air Transportation System (NextGen). On March 29th, the Subcommittee will examine the NextGen initiative, which is being planned and developed by the interagency Joint Planning and Development Office (JPDO).

Witnesses:

The witnesses scheduled to testify at the hearing include the following:

Ms. Victoria Cox
Vice President for Operations Planning
Air Traffic Organization
Federal Aviation Administration

Dr. R. John Hansman
Co-Chair, FAA Research, Engineering and Development Advisory Committee
Professor of Aeronautics and Astronautics
Director, MIT International Center for Air Transportation

Dr. Donald Wuebbles
Chair, Workshop on the Impacts of Aviation on Climate Change
Department Head and Professor
Department of Atmospheric Sciences
University of Illinois-Urbana Champaign

Mr. Steve Alterman
President, Cargo Airline Association
Chairman, Environment Subcommittee,
FAA Research, Engineering and Development Advisory Committee

BACKGROUND

Potential Issues

The following are some of the issues that could be raised at the hearing:

- *Are the content and priorities of FAA's R&D program appropriate, and have adequate resources been allocated to the program?*

- *Has FAA's R&D program been appropriately aligned with the needs of the next generation air transportation system (NextGen) initiative?*

- *What impact is NASA's restructuring of its aeronautics program having on FAA's R&D program?*

- *What has been the impact of FAA's R&D program on the aviation industry's operations?*

- *What role, if any, should FAA play in addressing the R&D challenges associated with the impact of aviation on climate change?*

- *Since FAA certification has become more difficult as new technologies and systems become more complex, is there any R&D that could improve the certification process?*

Overview

Aviation is a vital national resource for the United States. It supports commerce, economic development, law enforcement, emergency response, and personal travel and leisure. It attracts investment to local communities and opens up new domestic and international markets and supply chains. Aviation and aerospace activities make up as much as nine percent of America's Gross Domestic Product and also represent the fastest growing source for technological exports.

Research and development (R&D) is central to maintaining and improving the nation's aviation system so that it can respond to changing and expanding transportation needs. Civil aviation research and development is carried out both by NASA and by the FAA.

FAA R&D Activities

FAA has undertaken a wide range of aviation-related R&D, including such categories as the following:

- R&D in support of the next generation air transportation system (NextGen) initiative
- R&D to improve airport capacity and safety
- R&D on aviation-related environmental concerns, such as noise and emissions
- R&D on aviation weather (aviation weather is a major source of delays in the nation's air transportation system)
- R&D on wake turbulence (wake turbulence has a major impact on the spacing/separation of aircraft, which has an impact on the efficiency of operations)
- R&D on air traffic control and flight deck human factors
- R&D on aging aircraft, fire safety, safety risk analysis
- R&D on General Aviation (GA) directed at reducing GA accidents
- R&D on Unmanned Aircraft Systems and their integration into the national airspace

As can be seen from the above list, the R&D portfolio at FAA is broad. However, two caveats should be noted. First, the R&D at FAA tends

to be near-term and more operationally focused than the aeronautics R&D conducted at NASA—they are intended to be complementary efforts. Up until NASA restructured its aeronautics program over the past year, NASA had typically carried its aviation-related R&D to a level of technical maturity that enabled the FAA to pick it up, complete its development, and implement it in the national airspace system. Second, FAA's research budget for individual research areas can be very small—on the order of several millions of dollars in some cases—with the total R&D being on the order of $260 million in the FY 2008 budget request.

Mechanisms for Conducting FAA R&D

FAA R&D is carried out by means of a variety of mechanisms. For example, the FAA maintains a Technical Center in Atlantic City, NJ where a range of R&D activities and test facilities are located. In addition, the FAA has maintained a contractual relationship with the Center for Advanced Aviation Systems Development (CAASD) at MITRE Corporation, a Federally Funded R&D Center (FFRDC) where a variety of R&D efforts related to air traffic management are carried out.

The FAA has also entered into a number of partnerships with other federal agencies, most notably with NASA and DOD—and it has formal cooperative agreements with both agencies. FAA also participates with a number of other federal agencies on various interagency initiatives.

Other research mechanisms include the following:

- Cooperative Research and Development Agreements (CRDAs) with industry
- Small Business Innovation Research (SBIR) Grants
- Joint University Program for Air Transportation Research (Ohio University, MIT, and Princeton)
- Aviation Research Grants to Universities
- Air Transportation Centers of Excellence (involving 70 academic institutions throughout the U.S.)
- Airport Cooperative Research Program
- Technology Demonstrations with industry

Relationship to NASA's Aeronautics R&D Program

As noted above, FAA and NASA's R&D programs are intended to be complementary, not duplicative. The FAA describes NASA as *"the FAA's closest R&D partner in the federal government."* In a number of key areas, NASA has traditionally conducted both basic research *and* more applied "transitional research," with the latter R&D having the goal of achieving a level of technological maturity that enables the FAA to pick it up and implement it in the national airspace system. As a result, an aeronautics program at NASA that has insufficient resources or that is unable to carry research to the point at which it can be picked up by the FAA will eventually impact the R&D options available to the FAA. A number of organizations have raised concerns about that potential outcome. For example, in the area of aviation safety, the REDAC (FAA's R&D advisory committee) stated in its June 20, 2006 review of the FY 2008 FAA R&D program plans:

"The FAA needs to make an assessment of the impact of the budget cuts in NASA's aeronautics R&D. Subcommittee on Aircraft Safety is concerned that there may be inadequate resources in the FAA's budget for taking on safety-related research that NASA used to perform in the past but won't be funded to cover in the future."

The Government Accountability Office (GAO) made the following statement in its November 2006 report on the Next Generation Air Transportation System (NGATS):

"…The Joint Planning and Development Office [JPDO] faces challenges with some planning and expertise gaps. For example, NASA is moving toward a focus on fundamental research and away from demonstration projects. Many experts told us that this creates a gap in technology development."

Recommendations of External Advisory Committees

REDAC

The FAA has an advisory committee called the Research, Engineering and Development Advisory Committee (REDAC) that is tasked with monitoring the agency's R&D activities. One of the witnesses,

Dr. Hansman, has been a long-time member and leader of the REDAC, and he will be able to outline the concerns and recommendations of that advisory committee. Some of its most recent recommendations include the following:

- *"Research should be conducted on advanced materials and joining processes being introduced on new aircraft; on new wiring technologies and on large bypass engines. Also on aircraft modifications designed to mitigate the risk of MANPADS, on fires due to non-HAZMAT-declared shipments, on expanding operational deployment of unmanned aerial vehicles [UAVs] and on reversing the trend toward a dwindling pool of qualified Aviation Maintenance Technicians [AMTs]."*
- *"[REDAC Environment and Energy] subcommittee members expressed widespread concern that we need to be proactive in addressing fuel availability/energy independence [and] recommend that the Administrator…work with DOE, DOD, and NASA to identify commercial needs and leverage research to commonly address this challenge."*
- *"We need an R&D program that assesses the impact of integrating unmanned aircraft systems into the national airspace system. The funding for RE&D related to unmanned aircraft systems in FY 08 and beyond does not reflect the complexity of the technical and operational issues associated with their routine integration into civil airspace."*
- *"In anticipation of the acceleration of technology deployments required to realize [the next generation air transportation system] the committee recommends that FAA assess the costs of [next generation system] deployments and apply sufficient funds to accelerate the technology transfer and implementation."*
- *"[The FAA needs to] establish an R&D program that will lead to consistent and safe reduction of [aircraft] separation standards…"*

National Academies' Decadal Survey

In 2006, the National Academies completed a "Decadal Survey" of civil aeronautics and aviation research priorities. One of the research priorities identified in the Survey related to the certification process:

"Certification is the demonstration of a design's compliance with regulations. For example, before it can be operated by U.S. airlines, a new aircraft must be shown to comply with U.S. federal aviation regulations. As systems become more complex and nondeterministic, methods to certify new technologies become more difficult to validate…NASA, in cooperation with the Federal Aviation Administration (FAA), should anticipate the need to certify new technology before its introduction, and it should conduct research on methods to improve both confidence in and the timeliness of certification."

Aircraft Energy and Emissions Issues

With respect to energy, in the last year or so there has been increased interest by both the military and by commercial users in securing a stable supply of fuel. That has led to efforts to develop alternative fuels for aviation. Those alternative fuels would at first be used to supplement petroleum-based products and eventually potentially replace them. The FAA has convened workshops to look at alternative fuels and has been developing an "alternative fuels roadmap," but it is unclear how far FAA intends to proceed on alternative fuels R&D.

With respect to emissions, an announcement late last year by the European Union that it intended to impose penalties in 2012 on non-European air carriers that pollute too much has focused increased attention on the issue of aircraft emissions—particularly of greenhouse gases. The European move has been criticized and moves are underway to attempt to block it, but there is growing consensus that aviation operations will be a growing source of greenhouse gases and other undesirable compounds unless technological or operational fixes are made. Both NASA and FAA have undertaken research on aircraft emissions and mitigation technologies in the past, but more needs to be done. One of the witnesses, Dr. Wuebbles, last year chaired an FAA-sponsored workshop on the impact of aviation on climate change, and he will discuss some of the research needs identified by that workshop. Mr. Alterman of the Cargo Airline Association is serving as the current chairman of the REDAC's Environment Subcommittee and can also discuss these issues.

Budgetary Information

In FY 2008, the FAA plans to invest a total of $259,194,000 in R&D. This investment spans multiple appropriations for the FAA and includes: $140,000,000 in Research, Engineering and Development; $90,354,000 in ATO Capital; $128,000 in Safety and Operations; and $28,712,000 in the Airport Improvement Program.

In general, the R,E&D account funds R&D programs that improve the national airspace system (NAS) by increasing its safety, security, productivity, capacity, and environmental compatibility to meet the air traffic demands of the future. The AIP account generally funds airport improvement grants, including those emphasizing capacity development, and safety and security needs; and funds grants for aircraft noise compatibility planning and programs and low emissions airport equipment. It also funds administrative and technical support costs to support airport programs. The ATO capital account and the Safety and Operations account are new account designations in the FY 2008 budget request. They replace the former Facilities and Equipment (F&E) and Operations accounts.

A breakdown of 2008 R&D project funding is presented in Table 1, with applied research projects listed first, followed by development projects.

Table 1
FAA R&D Program Budget by Research and Development Category

Program	Account	2007 President's ($000)	2008 President's ($000)	2009 Planned ($000)	2010 Planned ($000)	2011 Planned ($000)	2012 Planned ($000)
Applied Research							
Fire Research and Safety	R,E&D[1]	6,638	7,350	8,457	8,546	8,815	8,957
Propulsion and Fuel Systems	R,E&D	4,048	4,086	4,050	4,075	4,150	4,201
Advanced Materials/Structural Safety	R,E&D	2,843	2,713	2,686	2,700	2,747	2,780
Atmospheric Hazards/Digital System Safety	R,E&D	3,848	3,574	3,568	3,608	3,687	3,749
Aging Aircraft	R,E&D	18,621	14,931	14,683	14,688	14,903	15,013
Aircraft Catastrophic Failure Prevention Research	R,E&D	1,512	2,202	2,158	2,153	2,181	2,192
Flightdeck /Maintenance/System Integration Human Factors	R,E&D	7,999	9,651	37,499	36,967	39,245	39,869
Aviation Safety Risk Analysis	R,E&D	5,292	9,517	8,349	8,334	8,446	8,493
Air Traffic Control/Technical Operations Human Factors	R,E&D	9,654	10,254	10,323	10,471	10,715	10,919
Aeromedical Research	R,E&D	6,962	6,780	6,932	7,149	7,390	7,630
Weather Program	R,E&D	19,545	16,888	19,336	19,286	19,638	19,643
Unmanned Aircraft Systems Research	R,E&D	1,200	3,310	4,238	4,236	4,295	4,323
Joint Planning and Development Office	R,E&D	18,100	14,321	13,979	13,844	13,961	13,945
Wake Turbulence	R,E&D	3,066	10,755	10,560	10,412	10,471	10,418
Environment and Energy	R,E&D	16,008	15,469	35,039	34,678	34,811	34,926
System Planning and Resource Management	R,E&D	1,234	1,184	1,847	1,827	1,836	1,759
William J. Hughes Technical Center Laboratory Facility	R,E&D	3,430	3,415	3,548	3,644	3,758	3,868
Subtotal R,E&D		130,000	136,400	187,252	186,618	191,049	192,685

Center for Advanced Aviation System Development	ATO Capital[2]	30,100	22,854	26,180	27,720	35,112	36,652
Subtotal ATO Capital		30,100	22,854	26,180	27,720	35,112	36,652
Airport Cooperative Research Program – Capacity	AIP[3]	5,000	2,000	5,000	5,000	5,000	5,000
Airport Cooperative Research Program – Environment	AIP	0	3,000	5,000	5,000	5,000	5,000
Airport Cooperative Research Program – Environment	AIP	5,000	5,000	5,000	5,000	5,000	5,000
Subtotal ATO AIP		10,000	10,000	15,000	15,000	15,000	15,000
Commercial Space Transportation Safety	S&O[4]	63	64	64	64	64	64
Subtotal S&O		63	64	64	64	64	64
Applied Research		170,163	169,318	228,496	229,402	241,225	244,401
Percent Applied Research		71.9%	65.3%	56.0%	56.1%	57.3%	59.2%
Development							
GPS Civil Requirements	R,E&D	0	3,600	3,469	3,416	3,432	3,411
Subtotal R,E&D		0	3,600	3,469	3,416	3,432	3,411
Runway Incursion Reduction	ATO Capital	8,000	5,000	5,000	5,000	2,000	0
System Capacity, Planning and Improvement	ATO Capital	5,500	6,500	6,500	6,500	6,500	6,500
Operations Concept Validation	ATO Capital	3,000	3,000	3,000	3,000	3,000	3,000
General Aviation and Vertical Flight Technology	--	2,000	0	0	0	0	0
Safer Skies	--	3,600	0	0	0	0	0
NAS Weather Requirements	ATO Capital	800	1,000	1,000	1,000	1,000	1,000
Airspace Management Lab	ATO Capital	4,000	4,000	4,000	4,000	4,000	0
Airspace Redesign	ATO Capital	2,800	5,000	3,000	3,000	3,000	3,000
Wind Profiling and Weather Research Juneau	ATO Capital	1,100	4,000	0	0	0	0
Wake Turbulence	ATO Capital	1,000	3,000	1,000	1,000	1,000	1,000
Local Area	ATO	0	1,000	0	0	0	0

Augmentation System (LAAS)	Capital						
Safe Flight 21 – Alaska Capstone	ATO Capital	16,800	15,000	20,000	20,000	20,000	13,300
NextGen Demonstration	ATO Capital	0	20,000	12,000	12,000	12,000	12,000
NextGen System Development	ATO Capital	0	0	102,000	102,000	105,000	106,700
Subtotal ATO Capital		48,600	67,500	157,500	157,500	157,500	146,500
Airports Technology Research – Capacity	AIP	8,503	8,907	8,907	8,907	8,907	8,907
Airports Technology Research - Safety	AIP	9,367	9,805	9,805	9,805	9,805	9,805
Subtotal AIP		17,870	18,712	18,712	18,712	18,712	18,712
Commercial Space Transportation Safety	S&O	63	64	64	64	64	64
Subtotal S&O		63	64	64	64	64	64
Development		66,533	89,876	179,745	179,692	179,708	168,687
Percent Development		28.1%	34.7%	44.0%	43.9%	42.7%	40.8%
TOTALS		$236,695	$259,194	$408,241	$409,094	$420,933	$413,088

1 R,E&D: Research, Engineering and Development
2 ATO: Air Traffic Organization Capital
3 AIP: Airport Improvement Program
4 S&O: Safety and Operations
NB: FY 2007 levels refer to the President's request for FY 2007.