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

A Review of the Federal Aviation Administration's Research and Development Program

Wednesday, February 16, 2011
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Purpose

The purpose of the February 16 Subcommittee on Space and Aeronautics hearing is to review the Federal Aviation Administration's (FAA) portfolio of research and development programs, and examine priorities and challenges.

Witnesses

Ms. Victoria Cox, Senior Vice President, NextGen and Operations Planning, Air Traffic Organization, Federal Aviation Administration

The Hon. Calvin Scovel, III, Inspector General, U.S. Department of Transportation

Dr. R. John Hansman, Chair, FAA Research, Engineering and Development Advisory Committee; Professor of Aeronautics and Astronautics; Director, MIT International Center for Aviation

Mr. Peter Bunce, President and CEO, the General Aviation Manufacturers Association (GAMA)

Background

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. During calendar year 2009, the FAA estimates that our nation's commercial aviation industry accounted for 5.6% of U.S. Gross Domestic Product ($1.3 trillion in economic

activity). Additionally, aerospace products represent the fastest growing source for technological exports.

Research and Development is an essential component of FAA's ability to provide solutions to emerging industry challenges and create new capabilities. The FAA's R&D mission is to "Conduct, coordinate and support domestic and international R&D of aviation-related products and services that will ensure a safe, efficient and environmentally sound global air transportation system."

Our nation's civil aviation research and development is carried out both by FAA and NASA. Their efforts are complementary, not duplicative. FAA R&D focuses on near-term strategic needs enabling the agency to address industry challenges primarily related to aviation safety, environmental compliance, and implementation of the Next Generation Air Transportation Management Systems (NextGen). NASA's R&D efforts are more long-term, pursuing high-risk, high-reward technologies in the areas of aviation safety, airspace systems, and fundamental aeronautics.

Broadly speaking, FAA's research portfolio has two major thrusts – (1) safety and capacity R&D projects needed to support day-to-day operations of the national airspace system, and (2) technologies needed to enable and implement the Next Generation Air Transportation System ("NextGen").

Examples of research programs include:

- Advanced Materials/Structural Safety R&D. Develops analytical and testing methods to understand how design, load, and damage can affect composite structures and by developing maintenance and repair methods.
- Fire Research and Safety R&D. Develops technologies, procedures, and test methods that can prevent accidents caused by fires and fuel tank explosions and improve survivability during a post-crash fire.
- Unmanned Aircraft Systems Research. Ensures safe integration of unmanned aircraft systems (UAS) into the nation's aviation system. It also provides certification procedures, operational requirements, and safety oversight activities for UAS civil applications and operations.
- NextGen – Alternative Fuels for General Aviation R&D. Current GA piston aircraft rely exclusively on leaded gasoline. This program researches the use of alternative and renewable fuels for GA to lessen aviation environmental impacts by developing data and methodologies to support their certification.
- Air Traffic Control/Technical Operations Human Factors R&D. Identifies and analyzes trends in air traffic operational errors and technical operations incidents. It also manages human error hazards, their consequences, and recovery methods

in early stages of system design or procedural development and technology to modernize workstations and improve controller performance.

For a complete listing of FAA's R&D activities and their associated funding levels, see attachment.

NextGen and the Joint Planning and Development Office (JPDO)

NextGen is the agency's high priority program to modernize our nation's air traffic control system. Its goals are to triple the capacity of our national airspace system by 2025 (using 2004 as the baseline), to make the system safer and more secure, and to mitigate aviation's impact on the environment. NextGen is an ambitious, long-term and expensive undertaking, and will require sustained investments by government agencies responsible for managing and protecting our airspace system and infrastructure. It will also require large investments by air carriers to equip their fleets with the technologies that will enable them to fully exploit NextGen's capabilities.

The FAA's Joint Planning and Development Office (JPDO) was created to coordinate interagency planning for those federal stakeholders participating in NextGen, including the Department of Transportation, Department of Defense, Department of Homeland Security, Department of Commerce, NASA, the White House Office of Science and Technology Policy, and the FAA. The JPDO also works with industry and academia.

Research and Development Goals

FAA has established ten high-level goals for its full suite of R&D activities. They are:

1. **Fast, Flexible, Efficient**. A system that safely and quickly moves anyone and anything, anywhere, anytime on schedules that meet customers' needs;
2. **Clean and Quiet**. A reduction of significant aerospace environmental impacts in absolute terms.
3. **High Quality Teams and Individuals.** The best qualified and trained workforce in the world.
4. **Human-Centered Design.** Aerospace systems that adapt to, compensate for, and augment the performance of the human.
5. **Human Protection**. A reduction in fatalities, injuries, and adverse health impacts due to aerospace operations.
6. **Safe Aerospace Vehicles.** A reduction in accidents and incidents due to aerospace vehicle design, structure and subsystems.
7. **Separation Assurance**. A reduction in accidents and incidents due to aerospace vehicle operations in the air and on the ground.

8. **Situational Awareness.** Common, accurate and real-time information on aerospace operations, events, crises, obstacles, and weather.
9. **System Knowledge.** A thorough understanding of how the aerospace system operates, the impact of change on system performance and risk, and how the system impacts the nation.
10. **World Leadership.** Globally recognized leader in aerospace technology, systems, and operations.

The William J. Hughes Technical Center, located at the Atlantic City, NJ airport, is the FAA's principal research facility. It houses a number of laboratories, cockpit simulators, and systems integration facilities that support research in the fields of capacity and air traffic management; communications, navigation and surveillance; NextGen concept validation; weather; airport technology; aircraft safety; information security; and environment and energy.

Through a contractual relationship with the Mitre Corporation, the FAA also funds the Center for Advanced Aviation Systems Development (CAASD), a Federally Funded Research and Development Center located in McLean, VA. CAASD performs air traffic management research.

FAA's Research Budget

FAA funds R&D from each of the agency's four budget accounts. The Research, Engineering and Development Account is fully dedicated to R&D; the other accounts (ATO Capital Account; Airport Improvement Program; and Operations) have portfolios of which R&D is but a fraction. For Fiscal Year 2010 enacted, FAA R&D programs were funded at $346.3 million.

With the exception of Operations, FAA's accounts are fully funded by the Aviation Trust Fund, which is capitalized through a series of taxes imposed on the flying public, the largest being a 7.5% tax assessed on the purchase of airline passenger tickets. The Operations account receives funding from both the Aviation Trust Fund and General Treasury revenues.

External Advisory Committee

Research, Engineering, and Development Advisory Committee (REDAC). The REDAC advises the FAA Administrator on management of its R&D activities, their performance and content, and ensures FAA research activities are coordinated with other government agencies and industry. A long-time REDAC member and current committee chair, Dr. R. John Hansman, will appear as a witness.

In a letter sent to the Administrator last fall, the REDAC made several observations. The following are excerpts:

- *The REDAC is concerned that there does not appear to be a clear high level Research and Development plan for NextGen that articulates the critical NextGen needs and links them to the R&D portfolio.*
- *As noted in prior recommendations the FAA has a unique need for expertise in key areas such as critical software and digital systems and human factors both for certification and acquisition. The REDAC reiterates its concern that there has been inadequate progress in developing the core competency and technical workforce in this and other key areas.*
- *The REDAC applauds progress in defining a clearer path forward toward certification and routine operation of UAS in the National Airspace System (NAS). In light of the significant community pressure on the FAA to accelerate the safe integration of UAS in the NAS, the REDAC questions if the research is sufficient to address the complexity of the operational, technical and policy changes associated with safe integration of UAS and whether the timeline could be accelerated if additional resources were available.*

Planned R&D Budget by Research Category

Program	Appropriation Account	2010 enacted ($000)	2011 Planned ($000)	2012 Planned ($000)	2013 Planned ($000)	2014 Planned ($000)	2015 Planned ($000)
Applied Research							
Fire Research and Safety	R, E&D	7,799	7,231	7,350	7,475	7,580	7,689
Propulsion and Fuel systems	R, E&D	3,105	2,332	2,357	2,383	2,399	2,416
Advanced Materials/Structural safety	R, E&D	4,935	2,566	2,596	2,628	2,650	2,672
Atmospheric Hazards-Aircraft icing/Digital system safety	R, E&D	4,482	6,635	6,675	6,715	6,722	6,730
Continued Airworthiness	R, E&D	10,944	10,801	10,856	10,911	10,909	10,906
Aircraft Catastrophic failure prevention research	R, E&D	1,545	1,165	1,171	1,177	1,177	1,176
Flight deck/maintenance/ system integration human factors	R, E&D	7,128	7,174	7,253	7,336	7,390	7,446
System Safety Management	R, E&D	12,698	11,907	11,913	11,915	11,841	11,765
Air traffic control/ technical operations human factors	R, E&D	10,302	10,475	10,633	10,799	10,934	11,073
Aeromedical Research	R, E&D	10,378	11,217	11,390	11,570	11,718	11,870
Weather Program	R, E&D	16,789	16,505	16,377	16,233	15,952	15,662
Unmanned Aircraft Systems Research	R, E&D	3,467	3,694	3,710	3,725	3,720	3,715
NextGen-Alternative fuels for general aviation	R, E&D	0	2,000	2,004	2,007	1,999	1,990
Joint planning and development office	R, E&D	14,407	14,292	14,420	14,563	14,640	14,722
NextGen- Wake Turbulence	R, E&D	10,631	10,685	10,742	10,799	10,800	10,801
NextGen-air ground integration human factors	R, E&D	5,688	10,614	10,656	10,692	10,670	10,648

Program	Appropriations Account	2010 enacted	2011 Planned	2012 Planned	2013 Planned	2014 Planned	2015 Planned
NextGen- Self separation human factors	R, E&D	8,247	9,971	10,009	10,043	10,022	10,000
NextGen- weather technology in the cockpit	R, E&D	9,570	9,312	9,360	9,407	9,406	9,404
Environment and Energy	R, E&D	15,522	15,374	15,335	15,287	15,131	14,969
NextGen Environmental research- aircraft technologies, fuels, and metrics	R, E&D	26,509	20,600	20,691	20,778	20,752	20,726
System planning and resource management	R, E&D	1,766	1,733	1,717	1,700	1,668	1,634
William J Hughes Technical Center Laboratory Facility	R, E&D	4,588	3,717	3,785	3,857	3,920	3,986
	Subtotal R, E&D	190,500	190,000	191,000	192,000	192,000	192,000
Center for advanced aviation system development	F&E	23,944	23,564	23,594	24,148	24,703	33,872
	Subtotal F&E	23,944	23,564	23,594	24,148	24,703	33,872
Airport cooperative Research- capacity	AIP	5,000	5,000	5,000	5,000	5,000	5,000
Airport cooperative research- environment	AIP	5,000	5,000	5,000	5,000	5,000	5,000
Airport cooperative research-safety	AIP	5,000	5,000	5,000	5,000	5,000	5,000
	Subtotal AIP	15,000	15,000	15,000	15,000	15,000	15,000
Commercial space transportation safety	Ops	73	83	83	83	83	83
	Subtotal Ops	73	83	83	83	83	83
	Applied Research	229,517	228,647	229,676	231,231	231,786	240,955
	Percent Applied Research	66.3%	62.5%	60.3%	60.3%	57.6%	58.3%

Program	Appropriation Account	2010 enacted	2011 planned	2012 planned	2013 planned	2014 planned	2015 planned
Development							
Runway incursion reduction	F&E	11,000	5,000	3,000	3,000	3,000	3,000
System Capacity, planning and improvment	F&E	4,100	4,100	6,500	6,500	6,500	6,500
Operations concept validation	F&E	8,000	4,000	8,000	6,000	6,000	6,000
NAS weather requirements	F&E	1,000	1,000	1,000	3,300	3,400	3,400
Airspace Management Program	F&E	3,000	1,000	5,000	5,000	5,000	5,000
Wake turbulence Research	F&E	1,000	0	0	0	0	0
NextGen- ATC/Tech OpsHuman Factors (controller efficiency and air ground integration	F&E	10,000	10,000	10,000	10,000	10,000	10,000
NextGen- environment and energy- environmental management systems and advanced noise and emissions reduction	F&E	7,000	15,000	18,000	18,000	18,000	18,000
NextGen- new ATM requirements	F&E	13,200	23,000	31,200	32,000	50,100	51,900
NextGen- operations concept validation- validation modeling	F&E	10,000	10,000	10,000	10,000	10,000	10,000
NextGen- system safety management transformation	F&E	16,300	18,000	18,000	18,000	18,000	18,000
NextGen- Wake turbulence- Re-categorization	F&E	2,000	3,000	3,000	3,000	3,000	3,000

Program	Appropriation Account	2010 enacted	2011 planned	2012 planned	2013 planned	2014 planned	2015 planned
NextGen- Operational Assessments	F&E	7,500	10,000	10,000	10,000	10,000	10,000
NextGen- Staffed NextGen towers	F&E	0	6,000	0	0	0	0
NextGen- Initial Operation Test & Evaluation	F&E	100	0	0	0	0	0
	Subtotal F&E	94,200	110,100	123,700	124,800	143,000	144,800
Airports Technology Research- capacity	***AIP***	***10,596***	***12,930***	***12,930***	***12,930***	***12,930***	***12,930***
Airports Technology research- safety	AIP	11,876	14,287	14,287	14,287	14,287	14,287
	Subtotal AIP	22,472	27,217	27,217	27,217	27,217	27,217
Commercial Space transportation safety	Ops	73	83	83	83	83	83
	Subtotal Ops	73	83	83	83	83	83
	Development	116,745	137,400	151,000	152,100	170,300	172,100
	Percent Development	33.7%	37.5%	39.7%	39.7%	42.4%	41.7%
	Total	346,261	366,046	380,676	383,330	402,085	413,054