A REVIEW OF THE FEDERAL AVIATION ADMINISTRATION'S RESEARCH AND DEVELOPMENT PROGRAM

HEARING

BEFORE THE

SUBCOMMITTEE ON SPACE AND AERONAUTICS

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

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A REVIEW OF THE FEDERAL AVIATION ADMINISTRATION'S RESEARCH AND DEVELOPMENT PROGRAM

WEDNESDAY, FEBRUARY 16, 2011

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON SPACE AND AERONAUTICS,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:02 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Steven Palazzo [Chairman of the Subcommittee] presiding.

Subcommittee on Space and Aeronautics

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

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

HEARING CHARTER

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON SPACE AND AERONAUTICS
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

Chairman PALAZZO. The Subcommittee on Space and Aeronautics will come to order. Good morning. Welcome to today's hearing entitled, "A Review of the Federal Aviation Administration's Research and Development Programs". In front of you are packets containing the written testimony, biographies, and Truth in Testimony disclosures for today's witness panel.

Before we get started, this being the first meeting of the Space and Aeronautics Subcommittee for the 112th Congress, I would like to ask the subcommittee's indulgence to introduce myself, and welcome back returning Members. It seems to be a little empty because there are a lot of competing interests this morning for Members' time, but they will be coming and going. I would also like to introduce new Members on our side of the aisle. Afterwards, I will recognize Ms. Fudge to do the same.

It is an honor and a privilege for me to chair the Space Subcommittee for this Congress, and it is a position I do not take lightly. I want all Members of the subcommittee to know that my door is always open, and that I will endeavor to serve all Members fairly and impartially. I will work to serve the best interests of Congress and all Americans, to ensure that the agencies and programs under our jurisdiction are worthy of the public support.

In the last Congress this chair was held by Representative Gabrielle Giffords, an extraordinary lady and leader who is a fierce advocate of our nation's space program. I ask all in this room to keep Representative Giffords in their thoughts and prayers, as she continues to recover from her wounds.

Since there is not really anyone to welcome back on this side, we will skip this part, and I would like to go ahead and let Ms. Fudge introduce her Members.

Ms. FUDGE. Okay.

Chairman PALAZZO. At this time I recognize myself for five minutes for an opening statement.

Good morning. I would like to welcome everyone to today's hearing. We have a distinguished panel of witnesses before us who will discuss the Federal Aviation Administration's Research and Development Program, and at the outset I wish to extend a sincere thank you to each of our witnesses for taking the time and effort to appear before us today. Please know that your testimony and wisdom will be of immense help to the Members of this Committee.

Our National Air Transportation System plays a critical role in every American's daily life, enabling aviation services to conveniently reach into virtually every corner of our nation. For cities and towns, large and small, aviation has become essential to sustaining commerce, public safety, and leisure. It is a capability that has enabled our society to flourish in many ways, and while economists have often spoken about the incalculable benefits that were enabled by the development of the interstate highway system, there is no doubt that aviation has had a comparable effect, stitching together virtually all regions and communities of our nation. Without a robust commercial air transportation system, many forms of commerce and intercity travel would be significantly diminished.

With that in mind, the Federal Aviation Administration's role of safely managing and regulating our national airspace system and its users is an enormous enterprise. Demand on the NAS has in

recent past strained FAA's ability to efficiently manage the system, in part due to the limitation of the current radar-based system. We cannot afford to continue in this way. It simply can't absorb additional traffic that will surely come once our economy rebounds.

Just yesterday the FAA released its annual forecast, predicting that air travel will double over the next two decades. FAA also predicts that the system will move one billion passengers annually by the year 2021, just ten years from now.

In the safety arena, FAA is confronting a wide spectrum of challenges such as developing the knowledge to ensure safe operations of aging aircraft, understanding the performance and failure modes of new materials used in aircraft structures, new automation systems, understanding man/machine interfaces, and human factors, and researching and certifying new fuels for piston and turbine power plants, just to name a few examples.

It is critical that FAA meet these challenges and to do so it must have a robust and well-managed research and development program that enables the agency to accommodate growth and accommodate new technologies.

This morning's hearing will give us an opportunity to hear from industry experts and senior agency officials to help us understand the successes and obstacles FAA must confront as it continues to advance our nation's air transportation system. It is critically important that FAA and its industry partners provide good rationale for agency-supported research projects and activities and to justify the level of funding. These are uncertain times. Congress is facing enormous pressure to reduce the size of our budget deficit, and every federal activity will come under intense scrutiny, no matter how meritorious you and I might think they may be.

Thanks again to our witnesses.

With that I now recognize the gentlelady from Ohio, Ms. Fudge, for her opening statement.

[The prepared statement of Chairman Palazzo follows:]

PREPARED STATEMENT OF CHAIRMAN STEVEN M. PALAZZO

Good morning. I'd like to welcome everyone to today's hearing. We have a distinguished panel of witnesses before us who will discuss the Federal Aviation Administration's research and development program. And at the outset I wish to extend a sincere thank you to each of our witnesses for taking the time and effort to appear before us today. Please know that your testimony and wisdom will be of immense help to the Members of this Committee.

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decades. FAA also predicts that the system will move one billion passengers annually by the year 2021, just ten years from now.

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Thanks again to our witnesses. With that, I now recognize the gentleman from Illinois, Mr. Costello, for his opening statement.

Ms. FUDGE. Thank you very much, Mr. Chairman, and I want to thank the staff. As you know, I am sitting in for someone who is standing in. Mr. Costello is actually the acting Ranking Member, and I am standing in for him today because he is at another hearing, and we are both just doing all we can to hold down the fort until our friend Gabby Giffords returns to assume this position as Ranking Member of the subcommittee. So I thank you.

Mr. Chairman, thank you for holding this hearing today to review the Federal Aviation Administration's Research and Development program. Mr. Costello has asked me to sit in the Ranking Member's chair as the Transportation and Infrastructure Committee is marking up the FAA bill as we speak. I ask that his prepared remarks be inserted for the record.

[The prepared statement of Mr. Costello follows:]

PREPARED STATEMENT OF REPRESENTATIVE JERRY F. COSTELLO

- Mr. Chairman, thank you for holding today's hearing to review the Federal Aviation Administration's (FAA's) research and development programs.
- I look forward to working with you and continuing the cooperative, bipartisan spirit of this Subcommittee.
- I would like to start by saying a few words about Congresswoman Giffords, my good friend and a true champion of our nation's space program.
- Following Congresswoman Giffords' election as Ranking Member of this Subcommittee, I was asked by the leadership of the Science, Space, and Technology Subcommittee to serve in her absence as she recovers.
- I am encouraged by her ongoing progress, including the announcement this week that she was speaking and communicating with her doctors and family. My thoughts and prayers are with her, her husband Mark, and their family as she recovers. I look forward to her return, and I am honored to serve as Acting Ranking Member during her recovery.
- When I chaired the Aviation Subcommittee, the House and Senate came very close to delivering a strong, balanced and bipartisan FAA reauthorization bill in the last Congress. Today in the Transportation and Infrastructure Full Committee, we are marking up our FAA titles. The legislation under discussion is a four-year bill that includes several provisions with which I agree but also contains many controversial provisions. We intend to offer amendments to improve the legislation, and I am hopeful we can do so before the measure comes to the floor.
- In the last Congress, I included language in the Federal Aviation Research and Development Title to the FAA Reauthorization to establish a Center of Excellence in Aviation Employment, which would focus on research and train-

ing across the civil aviation industry. It is imperative that as we continue to improve the civil aviation industry, we ensure we have the most skilled and competitive workforce possible.

- In addition, we are moving forward with implementing NextGen, which is essential to moving from a radar system to a satellite-based system. I strongly support continued funding of NextGen's R&D program over which this committee has jurisdiction. I believe we must continue to fund these efforts and move forward with its implementation.
- In addition, we must continue to invest in the development of lower-emission and unleaded aviation fuels through the Avgas program. I will work with you, Chairman Palazzo, to ensure our title of the FAA bill directs the agency to work in cooperation with NASA, industry representatives, manufacturers, fuel producers, and other stakeholders to develop a roadmap for achieving emission reduction goals.
- Finally, I recognize the importance of reducing our federal spending and addressing our deficit. However, we should not make cuts that compromise the safety and security of the flying public and the competitiveness of the aviation and aerospace industry.
- I thank our witnesses for being here to testify today, and I look forward to working with all interested parties to develop a strong, fiscally-responsible, and forward-looking FAA bill.

Chairman PALAZZO. Without objection.

Ms. FUDGE. Thank you. I would like to welcome the new Members who are not here, but I will tell you who they are. The gentlewoman from Alabama, Ms. Sewell, and the gentlewoman from Florida, Ms. Wilson. We look forward to their participation on this subcommittee.

Aviation is a vital part of the U.S. economy, making up as much as nine percent of America's GDP and representing the fastest-growing source for technological exports. R&D is an important component, and FAA's contribution is vital. In particular, FAA's implementation of NextGen is essential to moving from a radar system to a satellite-based system.

The Science, Space, and Technology Committee has jurisdiction over the research and development for NextGen, and I am hopeful we can provide adequate funding for this vital program. Some Members of Congress have suggested we reduce or eliminate funding for NextGen and other FAA R&D programs. I am convinced cutting these programs now would present major concerns for aviation safety in the coming years and push our aviation industry backwards instead of moving us forward.

Further cutting funding now would actually eliminate future opportunities for FAA to save billions of dollars through the agency's facility consolidation efforts, reductions in fuel consumption, and decreases in engine emissions.

I recognize the need to reduce federal spending and address our deficit. However, I believe we cannot jeopardize the safety and security of the flying public or the future of the American economy in the process. I will work with you, Chairman Palazzo, to ensure our Title of the FAA bill reflects our interests.

I thank our witnesses for being here to testify today, and I look forward to working with all interested parties in developing a strong, fiscally-responsible, and forward-looking FAA bill.

I yield back, Mr. Chairman.

[The prepared statement of Ms. Fudge follows:]

PREPARED STATEMENT OF REPRESENTATIVE MARCIA L. FUDGE

I would like to welcome the new Democratic members of the subcommittee. The gentlewoman from Alabama, Ms. Terri Sewell, and the gentlewoman from Florida, Ms. Frederica Wilson. We look forward to your participation on this subcommittee.

Aviation is a vital part of the U.S. economy, making up as much as 9 percent of America's GDP and representing the fastest-growing source for technological exports. R&D is an important component, and FAA's contribution is vital. In particular, FAA's implementation of the Next Generation air transportation system, also known as NextGen, is essential to moving from a radar system to a satellite-based system.

The Science, Space, and Technology Committee has jurisdiction over the research and development for NextGen, and I am hopeful we can provide adequate funding for this vital program. Some members of Congress have suggested we reduce or eliminate funding for NextGen and other FAA R&D programs. I am convinced cutting these programs now would present major concerns for aviation safety in the coming years and push our aviation industry backwards instead of moving us forward.

Further cutting funding now would actually eliminate future opportunities for FAA to save billions of dollars through the agency's facility consolidation efforts, reductions in fuel consumption, and decreases in engine emissions.

I recognize the need to reduce federal spending and address our deficit. However, I believe we cannot jeopardize the safety and security of the flying public or the future of the American economy in the process. I will work with you, Chairman Palazzo, to ensure our Title of the FAA bill reflects our interests.

I thank our witnesses for being here to testify today, and I look forward to working with all interested parties in developing a strong, fiscally-responsible, and forward-looking FAA bill.

Chairman PALAZZO. Thank you, Ms. Fudge. If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

I would like to mention that our Chairman, Mr. Hall, is here. Thank you for coming. Do you have anything you would like to say?

Mr. Rohrabacher is here. He is a returning Member.

At this time I would like to introduce our panel of witnesses. We will proceed to hear from each of them in order. Our first witness is Ms. Victoria Cox. She is Senior Vice President of NextGen Operations Planning in the Air Traffic Organization, and with the Federal Aviation Administration. Next we will hear from the Hon. Calvin Scovel, Inspector General of the U.S. Department of Transportation. Following Mr. Scovel we will hear from Dr. John Hansman, Chairman of the Research, Engineering, and Development Committee of the Federal Aviation Administration, and a Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology. Our final witness will be Mr. Peter Bunce, President and CEO of the General Aviation Manufacturers Association. Thanks, again, to our panel for being here this morning.

Mr. ROHRABACHER. Mr. Chairman, I would like to ask for a motion for personal privilege here. I would like to have the opportunity to ask one question before the testimony begins that could be followed up on after the testimony.

Chairman PALAZZO. Hearing no objections? All right. You are granted.

Mr. ROHRABACHER. I would like the witnesses to be thinking about this question. They could give it some thought, and give us a serious answer. I would like you to tell me what you believe the number one priority the FAA and that we should have in this arena. What is the number one priority, and also, most important, tell us what the lowest priority should be. So when we have to bal-

ance budgets, we will have some direction from you. I needed to ask that before to give them time to think about it.

So thank you very much for granting me that one minute.

Chairman PALAZZO. As our witnesses should know, spoken testimony is limited to five minutes each. After all witnesses have spoken, Members of the Committee will have five minutes each to ask questions.

I now recognize our first witness, Ms. Victoria Cox, Senior Vice President, Federal Aviation Administration.

STATEMENT OF MS. VICTORIA COX, SENIOR VICE PRESIDENT, NEXTGEN AND OPERATIONS PLANNING, AIR TRAFFIC ORGANIZATION, FEDERAL AVIATION ADMINISTRATION

Ms. COX. Thank you. Good morning, Committee Chairman Hall, Subcommittee Chairman Palazzo, Congresswoman Fudge, and Members of the Subcommittee.

Chairman PALAZZO. Please pull the microphone closer. Thank you.

Ms. COX. I am Victoria Cox, Senior Vice President for NextGen and Operations Planning Services in the Air Traffic Organization of the Federal Aviation Administration. It is a pleasure to meet the new Members of the Subcommittee today, and I look forward to working with all of you. It saddens me that Congresswoman Giffords is not here, having appeared before her last year. We at the FAA join the rest of the Nation in keeping her recovery in our thoughts.

Research and development has been essential and necessary to aviation, since its very beginning. Where would we be without the Wright Brothers' studies and experiments on the dynamics of flight? The FAA's Research, Engineering, and Development, or RE&D Programs, carry this legacy forward as aviation continues to thrive and change.

Aviation is a vital national resource for the United States. The aviation industry alone directly employs 1.1 million people, and the industry supports more than 11 million jobs in related industries through spending by direct aviation employees. Altogether, this direct support represents six percent of the gross domestic product of the United States.

In addition to the support it provides for commerce, jobs, and economic development, we cannot forget aviation's integral role in law enforcement, emergency response, national defense, and security of the homeland. These benefits of the aviation industry require that America's air transportation system remain the best in the world.

But being the best has a price. To maintain leadership requires constant introduction of new technologies and procedures, innovative policies, and advanced management practices into the aviation system. In order to do that, we need to make sustained investments in advanced research and technology development. A robust RE&D Program allows for cost-effective implementation of vital new technologies and capabilities through concept development, testing, early risk identification, and mitigation.

There is often an incomplete understanding of what the Next Generation Air Transportation System, or NextGen, is and what it

can do. The concept is simple. NextGen is a set of technologies, processes, procedures, and policies that together will revolutionize how people fly. It is a radical departure from the ground-based radar of years gone by, and a shift towards satellite control and navigation. It is a game changer for the controller, the pilot, and the passenger.

With the technology and procedures of NextGen, we will vastly improve the safety, efficiency, and overall performance of air transportation. However, we are well aware that this is not the whole story. If we want to get maximum return on the investment. If we want to support unconstrained market growth in aviation, we must take an aggressive approach to upgrading our infrastructure to maximize the benefits of NextGen.

At some point, keeping legacy systems going becomes more costly than replacing them with new technology. To that end, we have developed a research portfolio that will address today's needs while laying the foundation to address the needs of the future of NextGen. The FAA's research and development is geared to practical applicability. While we are developing NextGen with an eye towards long-term transformation of the air traffic control system, we are also evolving the system in the near to mid-term as well.

FAA's research portfolio is divided into related fields. Our core NextGen RE&D funding includes research that supports aviation, safety, and regulatory processes. Other research and development activities are aimed at introducing innovative new technologies into the air transportation system that will deliver future operational capabilities envisioned for NextGen.

My written statement provides examples of our ongoing efforts, and their importance to our overall success. I would be remiss if I did not point out that we are not alone in our efforts. We are committing to working smartly and more leanly, and to that end we are partnering with others to leverage their knowledge and resources to augment ours. We engage with industry via advisory boards and with a multitude of international organizations.

The Joint Planning and Development Office, or JPDO, facilitates partnerships across government agencies including: FAA, NASA, and the Departments of Defense, Commerce, and Homeland Security. The JPDO supports a future vision for NextGen by developing the long-term research plan for improvements that extend beyond the mid-term planning window of the FAA.

Our approach to research and development is focused on maintaining our leadership in aviation, while leveraging our partnerships to the maximum extent possible. I believe this approach is bearing fruit. As the aviation industry continues to evolve and change, it is vitally important that our country leads the world in this sector.

I look forward to working with this Congress to ensure that we do. This concludes my prepared remarks. Thank you again. I will be happy to answer questions.

[The prepared statement of Ms. Cox follows:]

PREPARED STATEMENT OF VICTORIA COX

Good morning, Chairman Palazzo, Congressman Costello, and Members of the Subcommittee. I am Victoria Cox, Senior Vice President for NextGen and Operations Planning Services in the Air Traffic Organization of the Federal Aviation Ad-

ministration (FAA). It is a pleasure to meet the new Members of the Subcommittee today and I look forward to working with all of you. It saddens me to miss Congresswoman Giffords here, having appeared before her last year, and we at the FAA join the rest of the nation in keeping her recovery in our thoughts.

Research and development has been essential and necessary to aviation since the beginning. Where would we be without the Wright Brothers' studies and experiments on the dynamics of flight? The FAA's research, engineering and development (RE&D) program carry this legacy forward as aviation continues to thrive and change.

Aviation is a vital national resource for the United States. The aviation industry alone directly employs 1.1 million people and supports more than 11 million jobs in related industries and through spending by direct aviation employees. Altogether, this represents 6% of the Gross Domestic Product (GDP). In addition to the support it provides for commerce, jobs, and economic development, we cannot forget aviation's integral role in law enforcement, emergency response, and in the national defense and security of the homeland. These benefits of the aviation industry require that America's air transportation system remains the best in the world.

But being the best has a price. To maintain leadership requires constant introduction of new technologies and procedures, innovative policies, and advanced management practices into the aviation system. In order to do that, we need to make sustained investments in advanced research and technology development. A robust RE&D program allows for cost-effective implementation of viable new technologies and capabilities through concept development, testing, early risk identification and mitigation.

There's an incomplete understanding of what the Next Generation Air Transportation System (NextGen) is and what it can do. The concept is simple: NextGen is a set of technologies, processes, procedures and policy that together will revolutionize how people fly. It is a radical departure from the ground-based radar of years gone by, a shift toward satellite control and navigation. It is a game changer for the controller, the pilot, and the passenger. With the technology and procedures of NextGen, we can help turn that around. But we are well aware that is not the whole story. If we want to get maximum return on the investment, if we want to support unconstrained market growth in aviation, we must take an aggressive approach to upgrading our infrastructure to maximize the benefits of NextGen. At some point, keeping the legacy systems going becomes more costly than replacing them with new technologies.

To that end, we have developed a research portfolio that will address today's needs while laying the foundation to address the needs of the future for NextGen. The FAA's research and development is geared to practical applicability. While we are developing NextGen with an eye towards the long-term transformation of the air traffic control system, we are evolving the system in the near-to mid-term as well, as my testimony will highlight later. FAA efforts focus on the period between now and 2018.

FAA's research portfolio is divided into related fields. Our core and NextGen RE&D funding includes research that supports aviation safety and regulatory processes. Other research and development activities are aimed at introducing innovative new technologies into the air transportation system that will deliver future operational improvements envisioned for NextGen.

Our Advanced Technology Development and Prototyping (ATD&P) work is funded in the Facilities and Equipment (F&E) appropriation. It further develops products resulting from FAA RE&D investments as well as research transitioned from the National Aeronautics and Space Administration (NASA) and other sources of basic and fundamental research. ATD&P activities include development of detailed mid-term operational concepts, concept validation studies, human factors analyses and requirements for individual systems based on those concepts, and validation prototypes and demonstrations.

NextGen System Development is funded in the F&E appropriation and supports the transition from RE&D to advanced technology development through activities such as concept modeling, system level requirements development, assessments of human performance and integration with technologies, and development of environmental management methodologies.

Research and development performed by MITRE's Center for Advanced Aviation System Development (CAASD) directly supports needs of FAA research and development programs that can uniquely be provided by this Federally Funded Research and Development Center (FFRDC).

Finally, research and development is also funded by the Airport Improvement Program (AIP). There are two components: first the Airport Technology Research Program addresses the research and development needs of the Office of Airports in

the areas of airport pavement, rescue and firefighting, wildlife hazard mitigation, runway surface technology, and visual guidance. The results of this research are used to update guidance material, manuals, and technical specifications that airports rely on when expending AIP funds. Second, the Airport Cooperative Research Program (ACRP) is funded by the Airport Improvement Program (AIP). ACRP is an industry-driven, applied research program that develops near-term, practical solutions to problems faced by airport operators. The FAA sponsors ACRP, and the Transportation Research Board (TRB) of the National Academies manages the program. Contractors who are selected on the basis of competitive proposals conduct the research.

FAA takes seriously the need to continue to improve environmental performance in order to sustain aviation growth. The FAA and aviation industry agree that environmental impacts will constrain NextGen if they are not effectively managed and mitigated. Technological advances in engine, airframe, and fuels technologies offer the greatest improvements and will keep the U.S. globally competitive. We have partnered with industry in our Continuous Lower Energy, Emissions and Noise (CLEEN) technology program to develop new technologies to reduce aircraft noise, emissions, and fuel burn, and to advance sustainable alternative aviation fuels.

Engine and airframe technologies will offer the greatest long term benefit but these new technologies must be coupled with efficient procedures, particularly in the near term. Thus, we are implementing new Optimized Profile Descents (OPDs) at nine locations including Los Angeles, Atlanta, Phoenix, San Diego, Honolulu and Anchorage. In addition, eight OPD projects are presently under development in the NAS including Seattle, St. Louis, Louisville, Charlotte and Memphis. Traditional approaches require a plane to follow a stair-step pattern of arrival—descending and leveling off several times before landing. Each time a pilot has to stop descending and resume level flight, they have to throttle up the engines. These OPDs allow planes to continually descend to the airport from high altitudes without having to level off, or step down, at interim altitudes. This process of continuous descent results in significant fuel savings and a reduction in radio communications—especially, in complex, busy airspace around major airports.

Sustainable alternative fuels development and deployment offer prospects for environmental improvements, energy security, and economic stability for aviation. We're working cooperatively with the industry through the Commercial Aviation Alternative Fuels Initiative (CAAFI) to develop "drop-in" fuels. We achieved approval of a synthetic fuel in 2009 (ASTM D7566), the first new fuel standard in decades. We are on track to achieve a fuel standard that will allow a 50% blend of a synthetic fuel with jet fuel this year.

We do want to point out that we are not alone in these efforts. We are committed to working smarter and more leanly, and to that end, we are partnering with others to leverage their knowledge and resources to augment ours. We engage with industry via advisory boards and with a multitude of international organizations. The Joint Planning and Development Office (JPDO) facilitates partnerships across the government agencies including FAA, NASA and the Departments of Defense, Commerce and Homeland Security. The JPDO supports the future vision for NextGen by developing the long-term research plan for improvements that extend beyond the 2018 planning window that is FAA's focus.

Through our coordination with our internal and external partners, we have been able to identify research gaps, reduce duplication of efforts, and leverage available resources. One of our most important research partners is, of course, NASA. That agency's contributions to our research and development are of such vital importance that, as of January 2011, we have assigned an FAA liaison to NASA's Aeronautics Research Mission Directorate (ARMD) to identify research and development collaboration opportunities and ensure stronger and timely coordination between FAA and NASA.

One of the many ways we partner with NASA under the auspices of the JPDO is on a series of Research Transition Teams (RTT). Four pilot RTTs were initiated in 2007 to ensure that research and development needed for NextGen implementation is identified, conducted, and effectively transitioned to the implementing agency. These include:

- Integrated Arrival/Departure/Surface
- Efficient Flow into Congested Airspace
- Dynamic Airspace Configuration
- Flow-Based Trajectory Management

Both NASA and FAA collaborated through these RTTs to conduct joint research, simulation, and field trials of NextGen technologies. Through this interaction se-

lected algorithms have been transferred from NASA to the FAA, along with research results to inform the implementation process of the given technologies.

We are also partnering with NASA on our NextGen Human Factors Research Coordination Plan. Our work began in September 2010 and we anticipate that the final product will be published this month by the JPDO. This product will describe key coordination activities recommended by Government Accountability Office (GAO) and the Department of Transportation's Office of the Inspector General, namely: identification of initial focus areas for research, establishment of methods for leveraging past and current human factors research, and creation of an inventory of existing facilities for human factors research. The coordination process leverages GAO-recommended best practices to help enhance and sustain collaboration among Federal agencies. This is an aggressive renewed effort to formalize existing human factors research coordination process between FAA and NASA, and begins an annual coordination process between our two agencies to review planned research efforts, identify gaps, monitor and evaluate progress, and report results.

NASA also is a vital collaborator with the FAA in its Partnership for Air Transportation Noise and Emission Reduction (PARTNER) Center of Excellence supporting development of aviation technologies and operational procedures to reduce fuel burn and environmental impacts due to noise and emissions.

On the Department of Defense side, we have an Air Force Research Lab (AFRL) Liaison to FAA for NextGen. In 2010, the Air Force assigned a NextGen research liaison to FAA to work closely with researchers to identify opportunities to leverage relevant research, laboratory capabilities and expertise available within AFRL. Our joint goal is to advance the air traffic management research and technology required for FAA to implement our National Airspace System (NAS) mid-term capabilities as defined in the Enterprise Architecture and the NextGen Implementation Plan (NGIP). The ARFL Liaison partnership, in particular, has helped advance Human Factors, Unmanned Aircraft Systems (UAS) and sustainable alternative fuels work.

Finally, we work closely with the JPDO to continue to define our future needs and priorities. The JPDO works to mitigate research and development risk for 2025 by analyzing various issues, such as:

- UAS and other advanced technologies that will require careful transition and ultimately lead to NAS integration
- Trajectory Based Operations
- Potential environment constraints.

The JPDO works with FAA to coordinate development of information data sharing standards, models, and integration of advanced aviation weather forecasts into air traffic control tools. I am pleased to report that our efforts have been paying off. In Fiscal Year 2010, we have completed several research and development efforts in the safety arena. In partnership with the National Oceanic and Atmospheric Administration's National Weather Service, FAA has developed the Weather Research and Forecasting (WRF) Model, an operational next-generation numerical weather prediction system designed to serve both operational aviation forecasting and atmospheric research needs. FAA-funded researchers also developed the Graphical Turbulence Guidance (GTG) product which provides contours of weather turbulence potential out to 12 hours. The current product, GTG2, operationally implemented on Aviation Digital Data Service in FY 2010, provides forecasts for clear air turbulence from 10,000–45,000 feet. The Congressional Joint Economic Committee estimates that air traffic delays cost the U.S. Economy over $41 billion in 2007, of which 70% are related to adverse weather—and as the demand for air traffic grows, air traffic delays and the associated economic toll will only increase. We have determined that 2/3rds of these weather related delays are avoidable with more accurate and better integrated weather information for decision-making, potentially reducing the number of delays by 46% and saving $19 billion annually. The FAA, NOAA and other partners are working to realize these savings and accommodate the expected demand growth.

In partnership with the Air Transport Association's Human Factors Committee and Alaska Airlines, we completed beta testing of new training material and procedures to improve safety in Airline Maintenance and Ramp Operations. FAA developed *Front Line Manager Best Practices Quick Reference Guide* (FLM QRG) to assist air traffic front line managers in preventing errors through performance management. FLM QRG provides helpful information on topics such as communications, improving performance, training, and leadership.

In the NextGen arena, we have completed a Wake Turbulence Separation Safety Risk assessment to reclassify all B757s in the same weight class and harmonize the weight boundary between the US Heavy and Large from 255,000 to 300,000 lbs,

thus harmonizing with ICAO. This successful change was implemented April 8, 2010. The completion of the Wake Turbulence Safety Risk assessment for the B787 Dreamliner has been submitted to the FAA Safety Management System for adoption. and we have ongoing work with the B747–8 and A380 in response to satisfying the NTSB recommendation A–94–056. These efforts address the need to mitigate the risk for wake turbulence through the development of safe wake separation standards prior to entry into service of new aircraft and to continue this evaluation early in the service life.

We have completed Human-in-the-Loop Simulations and flight trials for the 4-Dimensional (4D) Flight Management System (FMS) Trajectory-Based Operations (TBO) and partnered with Alaska Airlines to conduct 4D FMS TBO Initial Flight Trials at Seattle. In response to the RTCA Task Force 5 recommendations, FAA has partnered with Federal Express and Delta Airlines to field test the Collaborative Departure Queue Management surface management system at Memphis and Orlando. We completed initial investigations, including Human-in-the Loop simulations, into application of Data Communications in the terminal domain, and conducted Staffed NextGen Tower proof-of-concept field demonstrations at Dallas Fort Worth Airport in August 2010. Finally, in partnership with Customs and Border Protection (CBP), we conducted flight trials with CBP's Predator UAS system at Cape Canaveral to investigate potential solutions to help with integration into the NAS. This is the first in a series of progressive demonstrations that are planned for next year, with an expanding list of partners. Each of these accomplishments takes us step-by-step closer to realizing the full benefits of NextGen.

In the airport environment, I am pleased to report that we have developed a new FAA Wildlife Website/Database with a cell phone application for reporting wildlife strikes. Additionally, we have installed a pilot Runway Status Light (RWSL) system at Boston-Logan Airport aimed at investigating RWSL applicability for intersecting runways. We conducted Human-in-the-Loop simulations using Converging Runway Display Aid (CRDA) at Newark Airport. Finally, we have recently completed installation of prototype Low Cost Ground Surveillance systems at Spokane, WA; Manchester, NH; and San Jose, CA. These cost effective systems offer the potential to provide an added layer of safety by giving air traffic controllers basic ground surveillance for aircraft and vehicles operating on runways and adjacent taxiways, where current radar-based ground surveillance is not available.

As our recent accomplishments illustrate, our approach to research and development with an eye toward maintaining our leadership in aviation while leveraging our partnerships to maximum effect is bearing fruit. As the aviation industry continues to evolve and change, it is vitally important that our country leads the world in this sector. I look forward to working with this Congress to ensure that we do.

This concludes my prepared remarks. Thank you again for the opportunity to appear before you. I would be happy to answer any questions that you might have.

BIOGRAPHY FOR VICTORIA COX

As the Air Traffic Organization's Senior Vice President for NextGen and Operations Planning, Vicki Cox provides increased focus on the transformation of the nation's air traffic control system by providing systems engineering, research and tech-

nology development, and test and evaluation expertise. She is also responsible for the NextGen portfolio and its integration and implementation.

Within the FAA, Cox has served as the Director of the ATO's Operations Planning International Office, the Director of Flight Services Finance and Planning and the Program Director of the Aviation Research Division.

Prior to joining the FAA, Cox was Director of International Technology Programs in the Office of the Director of Defense Research and Engineering in the Office of the Secretary of Defense. She has an extensive research and development and program management background, having supported the Deputy Undersecretary of Defense for Science and Technology as the DOD Laboratory Liaison. She also worked as a Program Manager for a number of ballistic missile defense technology programs for the U.S. Air Force. A physicist, Cox served as Chief of Physics and Scientific Director of the European Office of Aerospace Research and Development in London. She also worked as a scientist responsible for thermal vacuum conditioning and testing of the Hubble Telescope for NASA.

Cox graduated from Converse College and received a Master's degree from East Carolina University. She has a certificate in U.S. National Security Policy from Georgetown University and is a DOD Level III Certified Acquisition Professional in Systems Planning, Research, Development and Engineering. She also earned her private pilot's license in 1985.

Chairman PALAZZO. Thank you. I now recognize Mr. Calvin Scovel, Inspector General, U.S. Department of Transportation.

STATEMENT OF HON. CALVIN SCOVEL III, INSPECTOR GENERAL, U.S. DEPARTMENT OF TRANSPORTATION

Mr. SCOVEL. Mr. Chairman, Ranking Member Fudge, Members of the Subcommittee, thank you for inviting me here today to testify on FAA's NextGen efforts.

NextGen aims to fundamentally transform our aviation system to better manage air traffic and reduce congestion over the next several decades. Since FAA launched this complex effort in FY 2004, we have reported on the management challenges FAA faces in delivering NextGen's promised benefits.

Today I will discuss two areas that could impact FAA's ability to meet long-term NextGen goals. First, schedule delays and cost increases with the En Route Automation Modernization Program or ERAM and second, coordination gaps with FAA's partner agencies on key research and development efforts. I will also highlight actions needed to strengthen FAA's management of NextGen initiatives.

ERAM is NextGen's primary tool for processing flight data and serves as the hub system for achieving some of its most beneficial capabilities. Without ERAM other programs intended to provide more efficient data sharing and airspace routes will not be possible.

FAA originally planned to fully deploy ERAM by the end of 2010, at a cost of $2.1 billion, but significant software problems at the initial test sites have pushed deployment out by four years. FAA estimates that overall ERAM delays will cost an additional $330 million. Our work in a recent MITRE analysis, however, suggests total cost growth could be significantly more, as much as $500 million.

FAA will also incur other costs to sustain aging equipment longer than planned and to retrain controllers on both legacy and ERAM systems. Cost escalations of this magnitude could affect FAA's capital budget and crowd out other projects.

In addition to keeping key programs on track, FAA must address research and development gaps with its partner agencies, such as the Department of Defense. Multi-agency coordination on NextGen

is not only mandated by law, but it is needed to achieve key capabilities and stay on track with NextGen's cost, schedule and performance goals.

These key research gaps concern integrating weather information into advanced automated systems, establishing joint surveillance requirements to securely track aircraft, incorporating unmanned aircraft systems into domestic airspace, and assessing NextGen's human factors impact on pilots and controllers.

As we reported last June, FAA's delayed decisions on critical requirements have impacted other agencies' R&D plans and NextGen's overall progress. For example, FAA has yet to determine how much responsibility to delegate to pilots versus controllers and ground systems to track aircraft. Another major factor in NextGen cost planning will be the degree to which FAA consolidates or eliminates air traffic facilities.

At the same time, FAA continues to lack an integrated budget document to track partner agencies' involvement in NextGen and align resources. FAA has been working toward this for over four years. While FAA's partner agencies support NextGen, some have not adjusted their R&D budgets and programs specifically for NextGen efforts. It is, therefore, difficult for FAA and Congress to determine if FAA is leveraging the right research, if funding is adequate for specific efforts, or if projects will improve the air transportation system and at what cost.

To strengthen the multi-agency approach and better manage long-term NextGen initiatives, there are five key areas where the FAA needs to take action. First, clarify FAA's Joint Planning and Development Office's responsibilities for critical NextGen development areas such as simulation and modeling, technology transfer, prototype development, and policy formulation.

Second, finalize performance goals and matrix for NextGen. Until FAA moves beyond the broader goals that it has laid out, it will be difficult to assess short and long-term efforts for improving airport arrival rates, reducing fuel burn, or decreasing FAA operating costs.

Third, complete efforts to establish an integrated NextGen budget document. Fourth, fully leverage DOD's expertise. While DOD contributes to NextGen in an advisory capacity, FAA has not yet fully assessed DOD's vast research and development portfolio or technology that could help reduce risk with the precision landing systems envisioned for NextGen.

Finally, secure a workforce with the skill sets needed to execute NextGen. While FAA recently completed an initial acquisition workforce plan, the plan contains no specifics on the method or timing of this effort. We have work underway to examine FAA's plans for determining its acquisition workforce needs, and its progress in addressing them.

Mr. Chairman, this concludes my prepared statement. I would be happy to address any questions you or Members of the Subcommittee may have.

[The prepared statement of Mr. Scovel follows:]

PREPARED STATEMENT OF CALVIN L. SCOVEL III

Before the Committee on Science, Space, and Technology
Subcommittee on Space and Aeronautics
United States House of Representatives

For Release on Delivery
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Actions Needed To Meet FAA's Long-Term Goals for NextGen

Statement of
The Honorable Calvin L. Scovel III
Inspector General
U.S. Department of Transportation

Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to testify today on the Federal Aviation Administration's (FAA) efforts to develop and transition to the Next Generation Air Transportation System (NextGen). As you know, NextGen is a central issue in reauthorizing a wide range of FAA programs, including the Agency's research and development efforts and capital budgets. FAA is developing NextGen to meet anticipated future air travel demands. The NextGen effort involves a significant overhaul of the National Airspace System (NAS) to shift from a ground-based to satellite-based air traffic management system. This will require considerable research and development and successful transfer of technology between Federal agencies and the private sector.

Since the effort began in fiscal year 2004, we have reported on the cost and schedule risks as well operational and management challenges that FAA must address to successfully implement NextGen. Today, I will discuss two areas that have significant impact on FAA's ability to meet long-term NextGen goals: (1) the status of the En Route Automation Modernization (ERAM) program, a key modernization effort that could affect the pace of NextGen, and (2) FAA's efforts to coordinate and reach consensus with partner agencies on key research and development efforts. I will conclude with actions needed to strengthen FAA's management of long-term NextGen initiatives.

SUMMARY

FAA's key long-term goals for NextGen, such as increasing airspace capacity and reducing flight delays and congestion, depend on the successful implementation of ERAM—a $2.1 billion system for processing flight data. However, software problems with ERAM have caused significant delays that will affect FAA's NextGen plans and costs. NextGen's success also relies on a strong, multi-agency approach to develop safe and effective aviation technologies. While FAA has made progress in coordinating its partner agencies' diverse Federal research and long-term plans, it has not reached consensus on fundamental issues that will materially affect the cost, schedule, and capabilities of NextGen. We have identified several management actions that FAA can take now to clarify roles, set performance goals, and align research priorities so that NextGen delivers the promised benefits to FAA and airspace users.

BACKGROUND

In 2003, Congress mandated that FAA establish the Joint Planning and Development Office (JPDO) and create and carry out a plan for implementing NextGen by 2025.[1] Congress also required the JPDO to coordinate diverse research efforts of other Federal agencies, including the Departments of Defense (DOD), Commerce, and Homeland Security (DHS) and the National Aeronautics and Space Administration (NASA). Since 2006, our reports and testimonies have identified NextGen as a high-risk effort and one of the Department's top management challenges for fiscal years 2008 through 2011. We have made numerous recommendations to help FAA achieve its NextGen goals. While initial planning for NextGen focused on implementing improvements through 2025, FAA has more recently emphasized initiatives for the near and midterm, defined as between 2015 and 2018.

DELAYS IN ERAM'S IMPLEMENTATION HAVE COST AND SCHEDULE IMPLICATIONS FOR NEXTGEN

As the primary NextGen tool for processing en route[2] flight data across the NAS, ERAM's implementation is fundamental to achieve the mid- and long-term benefits envisioned for NextGen. ERAM will replace all the existing hardware and software at air traffic facilities that manage high-altitude traffic. FAA originally planned to deploy ERAM to 20 en route facilities by the end of 2010 at a cost of $2.1 billion. However, due to software problems at its initial operating sites, ERAM is experiencing major schedule slips and cost increases. These delays could significantly impact the cost and pace of NextGen—without ERAM, the key benefits of several other programs, such as more efficient data sharing and advanced airspace routes, will not be possible.

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[1] Vision 100—Century of Aviation Reauthorization Act, Pub. L. No. 108–176 (2003).

[2] En route airspace is typically above 10,000 feet where aircraft reach their cruising altitudes and fly as direct a route as possible between their points of departure and destination.

ERAM Software Problems Have Caused Schedule Delays and Cost Overruns

Although ERAM passed testing at FAA's Technical Center and achieved Government acceptance,[3] testing at initial operating sites in Salt Lake City and Seattle revealed significant software-related problems that have pushed schedules well beyond original completion dates and increased cost estimates by hundreds of millions of dollars. These problems include interface issues between the key sites and other air traffic facilities, radar processing failures, errors that tag flight data to the wrong aircraft, and hand-off problems between controllers. To compensate for these problems, controllers relied on workarounds that increased their workload and fatigue and diverted them from managing air traffic. As a result of these issues, FAA postponed its plans to fully deploy ERAM at the initial sites—originally scheduled for December 2009.[4]

Last March, FAA placed a moratorium on further operational ERAM testing at the 2 initial sites to fix the more than 200 problems identified, reassess its efforts, and develop a new course of action. FAA has since resumed testing, and senior FAA officials state that they are improving system stability, continuing testing at additional sites, and seeing progress in conducting continuous operations without the need to fall back to the legacy system. FAA now plans to complete ERAM in 2014—a schedule slip of 4 years—with the next major milestones focused on getting the Salt Lake City and Seattle sites fully operational.[5] However, FAA and its contractor plan to add new capabilities while attempting to resolve problems identified in earlier software versions, which could cause further schedule delays. Updated software releases have already exhibited new problems, including inter-facility interface issues that lock up the system and a significant software failure that resulted in Seattle falling back to the legacy system for several weeks.

While FAA estimates that delays with ERAM will translate into an additional $330 million to complete deployment, our work and a recent MITRE analysis suggest the total cost growth could be as much as $500 million.[6] Cost escalations of this magnitude in today's fiscally constrained environment will affect FAA's capital budget and crowd out other projects. Further, FAA will incur additional costs to sustain aging equipment longer than planned and retrain controllers on both the legacy and ERAM systems. A driving factor behind potential future delays and additional cost overruns will be ERAM's performance at large locations, like Chicago and New York Center. The MITRE analysis cautions that FAA's initial corrective action plan for ERAM was not comprehensive and that additional time and resources will be necessary to accommodate site-specific operational differences.

Continued Problems With ERAM Will Impact Other NextGen Efforts

Continued problems with ERAM will affect both the cost and pace of FAA's other NextGen efforts. Our work has shown critical interdependencies between ERAM and three of five NextGen technologies that are key to fundamentally changing how air traffic is managed (see table 1).[7] These three technologies have already been allocated more than $500 million to integrate and align with ERAM.

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[3] Government acceptance (GA) of ERAM by the FAA Technical Center requires meeting specific criteria established for the project baseline. These criteria include successfully completing developmental testing activities per the Statement of Work, listing all problem trouble reports, demonstrating that all contractual requirements are satisfied, and completing both functional and physical configuration audits. At GA, the Government (i.e., FAA with ERAM) assumes full control and responsibility of the system.

[4] FAA delayed the in-service (ISD) and operational readiness decisions. An ISD authorizes deployment of a system into the operational environment. It occurs after demonstration of initial operational capability at the key test site. The ISD is based on testing to verify performance and establishes the foundation for operational readiness to be declared at key site and subsequent sites following completion of joint acceptance and inspection by the operating service organization and certification of compliance with information security requirements. For ERAM, the Operational Readiness Demonstration (ORD) is the final certification required for the system to become operational and for FAA to no longer retain the HOST Computer system as a backup.

[5] Independent Operational Assessment, formally called Independent Test and Evaluation (IOT&E), is an assessment of a new system's operational effectiveness and operational suitability performed by an Air Traffic Service (ATS) Test Team on systems designated for IOT&E by ATS.

[6] MITRE Corporation and Massachusetts Institute of Technology/Lincoln Laboratory Report, Independent Assessment of the ERAM Program, October 15, 2010. For official use only and not approved for public release.

[7] These programs include the Automatic Dependent Surveillance–Broadcast (ADS–B), System-Wide Information Management (SWIM), NextGen Data Communications, National Airspace System Voice Switch, and NextGen Network Enabled Weather.

Table 1. ERAM Interdependencies With Key NextGen Programs

Program Description	*ERAM Interdependencies*
Automatic Dependent Surveillance-Broadcast (ADS-B)	
Uses aircraft avionics and ground-based systems to provide information on aircraft location to pilots and traffic controllers.	FAA plans to provide the ERAM program with as much as $50M to display ADS-B data for use by controllers in the high-altitude environment.
Data Communications (DataComm)	
Provides two-way data communication between controllers, automation platforms, and flight crews. DataComm is intended to supplement rather than replace voice communications in all phases of flight.	FAA plans to provide the ERAM program with as much as $400M to develop an interface that provides controller-pilot message processing and displays information to controllers in the en route centers.
System-Wide Information Management (SWIM)	
Provides a more agile exchange of information through a secure, NAS-wide information web that will connect FAA systems and improve interaction with other agencies, air navigation service providers, and airspace users.	FAA plans to provide the ERAM program with as much as $117.7M (for SWIM Segment 1 only) to modernize and enhance its flight data processing and external interfaces with terminal air traffic control and the Traffic Flow Management systems.

Source: OIG analysis of FAA documents

In addition to these programs, FAA enterprise architecture documents acknowledge that ERAM delays will also affect FAA's development of trajectory-based operations[8] and the transition to a common automation platform for terminal and en route operations. Prolonged delays with ERAM could also impact future software enhancements for new NextGen capabilities, such as flexible and dynamic airspace that will allow controllers to shift segments of airspace to other controllers based on weather and changes in traffic patterns. These future enhancements are currently estimated to cost $1 billion.

LACK OF COORDINATION BETWEEN FAA AND PARTNER AGENCIES ON KEY RESEARCH AND DEVELOPMENT EFFORTS WILL IMPACT NEXTGEN'S LONG-TERM COST, SCHEDULE, AND PERFORMANCE

Leveraging other agencies' research is key to achieving the capabilities envisioned for NextGen since FAA conducts little long-term air traffic management research. In June 2010, we reported that while FAA is working to coordinate with the Department of Commerce, DOD, DHS, and NASA on NextGen plans, it has yet to make critical design decisions or address research and development gaps with these partner agencies that will affect NextGen's cost, schedule, and performance.[9] Unresolved issues include integrating weather information into advanced automated systems, determining joint surveillance requirements to track aircraft, incorporating Unmanned Aircraft Systems (UAS), and assessing NextGen's human factors impact.

FAA Has Not Made Key Decisions About the Design of the Long-Term NextGen System

FAA has delayed critical decisions on how key NextGen capabilities will be designed and integrated. Continuing to delay these decisions will slow NextGen's overall progress and impact NASA's and other agencies' research and development efforts. According to FAA, decisions on the following will determine NextGen capabilities, timing, and costs:

[8] Trajectory-based operations focus on more precisely managing aircraft from departure to arrival with the benefits of reduced fuel consumption, lower operating costs, and reduced emissions.

[9] OIG Report Number AV–2010–068, "Timely Actions Needed To Advance the Next Generation Air Transportation System," June 16, 2010. OIG reports and testimonies are available on our website: *www.oig.dot.gov*.

- **Division of responsibility** delegated to pilots in the cockpit and to controllers and FAA ground systems for tracking aircraft.
- **Level of automation** needed to support division of responsibility, ranging from today's largely manual flight management to a primarily automated system centered on machine-to-machine exchanges with little controller involvement.
- **Number and locations of air traffic facilities** needed to support NextGen—the degree to which FAA eliminates or consolidates air traffic facilities is a major factor in both capital and operating costs for NextGen.

FAA has stated that NextGen is one of the most complex systems ever developed by the U.S. Government. As a result, FAA will need to obtain a workforce with the specific skill sets to develop and execute new NextGen technologies and manage the transition from legacy systems. In response to a recommendation we made in February 2007, FAA commissioned the National Academy of Public Administration (NAPA) to assess the skill sets needed for NextGen implementation.[10] In its September 2008 report, NAPA identified 26 competencies needed to execute NextGen that FAA lacks.[11] These include program management, software development, contract administration, and systems engineering with an emphasis on human factors considerations. FAA has developed a segmented Acquisition Workforce Plan, an important first step, but to meet the goals set out in the NAPA study, the plan will need to evolve further with a more defined strategy to acquire the needed skill sets for NextGen.

A NextGen portfolio analysis, commissioned by JPDO, concluded that some NextGen automated air and ground capabilities originally planned for 2025 may not be implemented until 2035 or later and could cost the Government and airspace users significantly more than the projected cost estimate of $40 billion.[12] JPDO officials recently stated that research priorities need to be established as well as an executable path from the near and midterm to the long term.

Disagreements Between FAA and the Department of Commerce Impact NextGen Weather Systems

Technical disagreements between FAA and Commerce over how to synchronize national applications of observed, forecast, and disseminated weather data may delay NextGen's weather data system beyond its scheduled 2013 completion date. Commerce has the lead role in developing the 4D Weather Cube, which is expected to provide a common picture of weather for the entire country that airspace users may view and apply directly in flight planning and responding to inclement weather.[13]

JPDO's analysis of ongoing weather efforts identified policy, funding, and technical issues, including defining requirements and who pays for what capabilities. Officials in Commerce's National Oceanic and Atmospheric Administration (NOAA) indicated that their work on the 4D Weather Cube focuses exclusively on Commerce's requirements. Additionally, NOAA expects FAA to provide funding or reimbursement for costs to support development of aviation-related NextGen requirements.

To address these issues, FAA, Commerce, and DOD have developed a NextGen Weather Plan. In addition, JPDO created and hosts the NextGen Executive Weather Panel to improve coordination between the three agencies; members include the FAA Senior Vice President for NextGen and Operations Planning and the NOAA Assistant Administrator for Weather Services. However, much work remains for the agencies to better define their roles and expectations regarding costs and implementation. This year, the Office of Management and Budget tasked FAA and Commerce to revalidate 4D Weather Cube requirements and review cost and performance parameters. As part of these efforts, Commerce was asked to define what its requirements would be to develop the Cube without including FAA's aviation costs.

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[10] OIG Report Number AV–2005–031, "Joint Planning and Development Office: Actions Needed To Reduce Risks With the Next Generation Air Transportation System," February 12, 2007.

[11] Report by a panel of the National Academy of Public Administration, "Identifying the Workforce To Respond to a National Imperative—The Next Generation Air Transportation System (NextGen)," September 2008.

[12] The analysis is referred to as the NextGen portfolio or "trade space" analysis. FAA is continuing to update and revise the analysis. The study sought to examine the costs, risks, and benefits of the JPDO Integrated Work Plan targeted for 2025.

[13] The 4D Weather Cube is to be a distributed, national database of gridded and interpolated weather observations and automated analyses, scaled consistently over time for any location above the continental United States. It is expected to provide observations with respect to latitude, longitude, altitude, and time.

Partner Agencies Have Not Established Joint Surveillance Requirements

FAA, DOD, and DHS have not established joint surveillance requirements, which are needed to track aircraft and achieve the integrated surveillance capabilities envisioned for NextGen. This will require a collaborative effort to develop approaches and requirements to meet the surveillance needs of all partners. Each of these agencies have the need for surveillance data but they do not all share the same requirements. Without closer coordination and agreement about surveillance requirements, there is potential for duplicative efforts and gaps in airspace coverage.

Thus far, DOD and DHS have not identified any budgets or programs specifically to support NextGen, but joint surveillance requirements are one of their main concerns in maintaining security coverage for the United States. This includes tracking aircraft designated as potentially non-cooperative targets, a capability currently provided by FAA through long and short range radar.[14] Moreover, when FAA implements ADS–B, it plans to decommission a number of unneeded secondary radar systems.[15] If DOD or DHS should determine that some of these radar must remain in service, these agencies would have to assume the responsibility for the maintenance and replacement costs. Therefore, FAA, DOD, and DHS must focus more attention on finalizing requirements, prioritizing research and development efforts to achieve a secure next generation surveillance system, and identifying individual partner agency responsibilities.

Cross-Agency Attention Is Needed To Safely Incorporate Unmanned Aircraft Systems Into the National Airspace System

Addressing unmanned aircraft system (UAS) operations has been a recurring issue in JPDO's annual cross-agency gap analysis. A number of safety issues must be addressed, such as risks of UAS operations near populated areas and potential collisions with manned aircraft. FAA currently authorizes Government UAS operations on a limited basis but is developing a regulatory framework to address the unique characteristics of UAS. As recognized in FAA's annual analysis, this will require new cross-agency standards and procedures to assess the impact of UAS on air traffic operations and safety, which will also impact how FAA develops NextGen procedures. As a result, NASA has included an additional $30 million in its fiscal year 2011 budget request to develop technologies that will allow unmanned aircraft to have routine access to the NAS. This effort will focus initially on Government-owned and -operated UAS aircraft, followed by private-sector UAS aircraft.

FAA Has Not Developed a Cross-Agency Plan To Identify and Address NextGen Human Factors Issues

The NextGen concept of operations calls for significant changes to the roles of controllers and pilots. A focused "human factors" research effort on the impact of such changes, such as how highly automated systems will affect controllers, will ensure that new concepts and technologies can be safely implemented. However, as we have noted in the past, FAA continues to lack a cross-agency research plan that (1) establishes an agreed-upon set of initial focus areas for research, (2) inventories existing facilities for research, and (3) capitalizes on past and current research.

FAA's inadequate attention to such research when implementing the Standard Terminal Automation Replacement System (STARS) resulted in significant cost increases and schedule slips.[16] JPDO officials state that they are developing a cross-agency human factors plan and plan to complete it later this year.

ACTIONS NEEDED TO STRENGTHEN FAA'S MANAGEMENT OF LONG-TERM INITIATIVES

In closing, I would like to highlight a number of areas where FAA needs to take action to strengthen the multi-agency approach to developing NextGen, better leverage resources, and prevent duplicative efforts.

Clarify the Role of the JPDO: There is confusion within FAA and industry about JPDO's role in advancing NextGen. FAA has reorganized its NextGen efforts

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[14] The term "non-cooperative targets" refers to aircraft that are not transmitting flight information to FAA ground systems.

[15] A secondary radar operates on the coded reply sent from the airborne radio beacon transponder in an aircraft in response to an interrogation signal sent from the ground station.

[16] STARS was designed to provide the software and hardware platform necessary to support future air traffic control tools. In 1996, FAA selected STARS as the centerpiece of its strategy to modernize controllers' terminal automation systems. However, due to technological problems and costs that far exceeded original estimates, FAA delayed deploying STARS as planned. Over the last several years, FAA has deployed the Common Automated Radar Terminal System (Common ARTS) hardware and software to facilities where FAA intends to deploy STARS.

several times in the last 4 years, most recently placing JPDO under the Deputy Administrator, separate from the primary office overseeing NextGen implementation. While Department and FAA officials recognize the need to better define JPDO's mission, no definitive action has been taken to determine what role, if any, JPDO will play in critical NextGen development issues, such as simulation and modeling, technology transfer, prototype development, or NextGen policy issues.

Finalize Performance Goals and Metrics for NextGen: While FAA has established broad goals for NextGen, it has not identified clear goals for performance capabilities or metrics for NextGen initiatives. This was a major concern recently reported by a Government-industry task force on implementing NextGen in the near term.[17] As NASA and FAA officials point out, performance goals and metrics for NextGen may differ for long-term efforts; this includes requirements and priorities for future research and development. Until FAA provides clarification, it will be difficult to assess short- and long-term efforts for improving airport arrival rates, reducing fuel burn, or decreasing FAA operating costs.

Establish Research Priorities and Develop an Integrated NextGen Budget Document That Aligns Partner Agency Resources: FAA and JPDO have been working on a NextGen integrated budget document (similar to the Office of Management and Budget Exhibit 300[18]) for over 4 years with little to show for the effort. This tool is important to track partner agencies' involvement in NextGen and to align resources. While generally supportive of NextGen, some partner agencies have not adjusted their research and development budgets and programs or changed requirements to accommodate NextGen efforts. The lack of progress with the integrated budget document is traceable to a number of factors, including complexity, the lack of a common method to identify NextGen-related budget items, and FAA's focus on running and maintaining the existing air traffic system. Without an integrated budget document with clear priorities, it is difficult for both FAA and Congress to determine if FAA is leveraging the right research, if funding is adequate for specific efforts, or if projects will improve the air transportation system and at what cost.

Leverage DOD Research and Development for NextGen: Currently, DOD contributes to NextGen as a member on various committees, boards, and work groups. DOD has also taken the lead in network-centric operations efforts and is working with FAA and JPDO on surveillance issues.[19] However, neither FAA nor JPDO have done a complete assessment of DOD's vast research and development portfolio and already derived capabilities. DOD's experience with enterprise architecture development, large-scale systems integration, and overall management of high-risk efforts could prove useful. Moreover, FAA could leverage DOD technology on a satellite-based Joint Precision Approach and Landing System to help reduce risk with precision landing systems envisioned for NextGen.[20] In response to our June 2010 recommendation, FAA agreed to develop a plan to effectively review and identify DOD research and technologies that could be used for NextGen and establish mechanism to coordinate and transfer the information to FAA. According to JPDO officials, efforts are underway to assess DOD's research base and should be completed this year.

Secure Necessary Expertise To Execute NextGen: FAA recently completed an initial acquisition workforce plan to address recommendations in the NAPA study—an important first step. However, the plan requires more development and clarification to be useful. For example, the plan does not specify how or when FAA will actually secure the necessary skill sets and expertise. We have work under way to examine FAA's plans for determining its acquisition workforce needs and progress in addressing them—including an assessment of FAA's oversight of its System Engineering 2020 support service contracts worth $7 billion.

That concludes my statement, Mr. Chairman. I would be happy to address any questions that you or other Members of the Subcommittee may have.

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[17] RTCA, "NextGen Mid-Term Implementation Task Force Report," September 9, 2009.

[18] The Office of Management and Budget Exhibit 300 is designed to ensure that the business case for investments is made and tied to agency mission statements and long-term goals.

[19] DOD's Network-Centric Operations is a robust networking of information for geographically dispersed forces.

[20] The Joint Precision Approach and Landing System (JPALS) is a satellite-based system that will allow aircraft to land on any suitable land or sea-based surface worldwide, while minimizing the impact to airfield operations because of a low ceiling or poor visibility.

BIOGRAPHY FOR CALVIN L. SCOVEL III

Mr. Scovel is the sixth Inspector General of the U.S. Department of Transportation. He was nominated by President George W. Bush, confirmed by the Senate, and sworn in on October 27, 2006. Mr. Scovel is responsible for leading the efforts of 400-plus staff in support of DOT's priorities of transportation safety and effective program delivery and performance. Recent audit and investigative activities including congressional testimony have addressed the Department's implementation of the American Recovery and Reinvestment Act; safety and financing issues in multi-billion dollar highway and transit programs; and the Federal Aviation Administration's oversight of aviation safety and efforts to develop the Next Generation Air Transportation System.

Mr. Scovel joined the Department of Transportation after 29 years of active service in the U.S. Marine Corps, from which he retired as a Brigadier General. His last military assignment was as a senior judge on the U.S. Navy-Marine Corps Court of Criminal Appeals. He previously served as Assistant Judge Advocate General of the Navy for Military Justice—the principal advisor to the Secretary of the Navy and the Judge Advocate General—on all criminal justice policy matters. He also commanded a military police battalion, which provided all security and law enforcement services for the Marine Corps Base in Quantico, Virginia.

Mr. Scovel served as senior legal advisor for the 4th Marine Expeditionary Brigade, which included all Marine amphibious forces in Operation Desert Storm and later in a NATO exercise above the Arctic Circle in Norway. A Marine judge advocate, Mr. Scovel served as prosecutor, defense counsel, or judge in 250 courts-martial that included charges of murder, rape, child sexual assault, and drug trafficking.

His personal military awards include the Legion of Merit (four awards) and the Combat Action Ribbon. Mr. Scovel is also the recipient of the Secretary of Transportation's Gold Medal for Outstanding Achievement. This award was for his leadership of the OIG in supporting the Department of Transportation's recovery effort after the 2007 collapse of the I–35 West Bridge in Minneapolis.

Mr. Scovel received a Bachelor of Arts degree from the University of North Carolina at Chapel Hill and a Juris Doctor degree from Duke University. He also received a Masters degree from the Naval War College.

Chairman PALAZZO. Thank you. I now recognize our next witness, Dr. John Hansman, Chairman of the FAA Research, Engineering, and Development Advisory Committee.

STATEMENT OF DR. R. JOHN HANSMAN, CHAIR, FAA RESEARCH, ENGINEERING, AND DEVELOPMENT ADVISORY COMMITTEE, PROFESSOR OF AERONAUTICS AND ASTRONAUTICS, DIRECTOR, MIT INTERNATIONAL CENTER FOR AVIATION

Dr. HANSMAN. All right. As you can see I have some slides here, Chairman Palazzo. Thanks for the opportunity to talk, and members, faculty members can't talk without slides.

I want to motivate first why we are doing the modernization of the system. So if you haven't seen this, this is a movie produced by NASA looking at the U.S. system. It starts in the afternoon period, if you look now, we are going into the overnight period. You can see the transcontinental flights and the flights going into and out of the cargo hubs.

As dawn hits the East Coast, you can see the traffic expand and blossom. At the peak midday period in the system, we are tracking about 4 to 5,000 airplanes in the system. So this is a highly dynamic system that is totally integrated.

Now, this is a picture of the system when it works well. Let me show you a picture on a day when weather hits New York. This is just flights going into the New York airports. You can see the weather in the upper right. You can see when the weather starts to hit New York, the airplanes are going into holding patterns. You

can see that as the weather hits, airplanes start to go into holding patterns all the way across the U.S. You also see them go down the East Coast.

So when we have a perturbation in the system that is so tightly coupled, these perturbations propagate through the system and result in delays throughout the entire system.

So if we look at why we are doing modernization, why we do research and development. There are a number of drivers, but there are four key drivers. The first is safety, and we have actually done a remarkable job in safety. You can see this is data from Boeing looking into commercial fatal accident rates. You can see it has gone down tremendously. We have an incredibly safe system.

We have also been worried about, in recent years, capacity and delay as the demand on the system comes up, as we get the types of growth that we have had, delays have gone up. You can see in the bottom left the delay data. You can see the drop after September 11, and you can see the delays built up again afterwards. You can see that the delays have gone down in the past couple of years in part due to the demand coming off the system with the economy in the downturn. It is our expectation that when the demand comes back up, the system will again reach its capacity constraints, and we will have significant delay in the system. Which is why we need to modernize.

Now, there are two other really new drivers or emerging drivers that have occurred in recent years. One is the concern on fuel availability and cost. In the upper right you can see the rapid run up in fuel costs. There is a recent drop, but they have run up again. This has really driven up the need for more efficiency in the operation of the system.

You can also see that there is increasing concern about environmental impact and in particular, greenhouse gas emissions. Today, aviation represents about between two and three percent of the manmade anthropogenic greenhouse gas emissions. As pressure comes to reduce greenhouse gas emissions, other emitters, particularly ground-based emitters, have much easier alternatives to go to low-carbon alternatives. So the percentage of contribution from aviation in the future is going to rise. There will be increasing pressure on aviation to reduce these gas emissions.

So these are drivers for why we are doing the research.

Now, I want to just get to the questions that were asked and try to address them quickly. First is what are the REDAC's chief concerns about the agency's R&D initiatives with regard to content and funding or the gaps. If so, what are they? The REDAC is generally supportive of the content of the R&D programs. There are some gaps. In particular, there is a concern about the complexity of the NextGen research and development plans, which actually make it hard to evaluate if there are gaps.

There is a real need for processes to accelerate NextGen implementation. I will address that more in the next question, and there is a well-known problem of how to introduce unmanned aircraft systems in terms of their operations and our national airspace system.

Another concern which was voiced previously is the level of technical expertise in key areas. In particular, areas of digital systems

and software, which is very hard for the FAA to compete for talent in the open market.

In terms of how well does the agency's research portfolio support timely implemention of NextGen, I would say the technology is not the issue. The challenge is actually in the operational approval of NextGen capabilities and procedures. It is very difficult to prove that this new thing that we are going to do is safe enough that it won't degrade the safety of the system that results in significant delay.

Finally, how would you assess the role and effectiveness of the JPDO as the FAA's long-range planning office? JPDO has not been effective recently as a long-range planning office for the FAA. It was effective in the initial definition of NextGen, but its effectiveness has waned over the past years. I am happy to talk more about it in the questions.

[The prepared statement of Dr. Hansman follows:]

PREPARED STATEMENT OF R. JOHN HANSMAN, JR.

Chairman Palazzo and Members of the Subcommittee:

Thank you for the opportunity to comment on the Federal Aviation Administration's research and development capability. I am a Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology and the Co-Chair of the FAA Research and Development Advisory Committee (REDAC). The REDAC is a Congressionally mandated committee which advises the FAA Administrator on research and development.

The role of research and development in the FAA is to support current and future operational requirements as well as the agency's mission of providing a safe, secure, and efficient air transportation system.

The U.S. still has one of the safest and highest performance air transportation systems in the world, but the system is under stress due to increased demand (Figure 1) and emerging issues such as fuel costs (Figure 2), environmental concerns, ageing infrastructure, as well as others. The Congress, the FAA, and other government and community stakeholders have recognized the need to address these issues and responded through a number of initiatives including NextGen.

Fig. 1. Passenger Demand Trends (ICAO)

Fig. 2 Fuel Price Trends (EIA, ATA)

The system has run well in the past few years, although this cannot yet be attributed to NextGen. The accident rate and delays (Figure 3) are both down over the past 2 years although we are still experiencing congestion at the large hubs. This is, in part, a result of the reduction in the number of flights due to high fuel prices (Figure 2) and the weak economy. While the FAA has done a better job at managing delay in the system, it is likely that delay will increase as the economy strengthens and traffic levels rise.

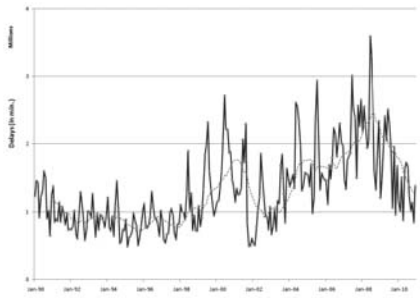

Figure 3. U.S. Delay Data (FAA OPSNET)

At the time NextGen was initiated, delay was the key issue motivating system improvement with assumptions of a three fold increase in traffic. Today, increasing fuel efficiency to reduce fuel costs and Green House Gas (GHG) emissions, as well as the integration of Unmanned Aircraft Systems (UAS) in the NAS, have emerged as key drivers of system evolution, and the projections on the rate of traffic have been reduced.

I will comment briefly on the specific questions you have asked me to address.

1. What are the REDAC's chief concerns about the agency's R&D initiatives with regard to content and funding? Are there any gaps, and if so, what are they?

The REDAC has been generally supportive of the specific content of the FAA's R&D programs. However, there are several areas where the REDAC has expressed concern.

Complexity of NextGen Research and Development Plans—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. The REDAC understands the challenge of defining such a plan for a complex system such as NextGen. However, the plans and roadmaps that have been presented to the REDAC do not articulate a high level vision and are so detailed and complex that they are intractable.

This makes it difficult to evaluate if the necessary R&D is being accomplished and how R&D results will be used. The REDAC has recommended that a high level R&D plan be developed from the existing more detailed plans and enterprise architecture in order to articulate the R&D vision and identify the critical path of R&D for NextGen.

Research and Development Gaps—The REDAC has identified several areas where strengthened R&D, as well as agency commitment, would significantly enhance future NAS performance. These include research to support: the implementation of NextGen enabled capabilities including new approaches to safety and environmental review process; certification and routine operation of UAS in the NAS; and mitigation of adverse environmental effects of aviation.

Level of Technical Expertise in Key Areas—The FAA has a unique need for expertise in key areas such as critical software and digital systems design, and human factors for both certification and acquisition. The REDAC has long been concerned that there has been inadequate progress in developing the core competency and technical workforce in these and other key areas. The problem is recognized by the agency but progress has been limited due to the FAA's inability to compete on the market for highly desirable talent.

2. In your view, how well does the agency's R&D research portfolio support timely implementation of NextGen? How effectively are new technologies being transitioned from research to implementation?

There are fundamental issues which will make the effective implementation of NextGen much more difficult than is generally appreciated. The issues are not with technology development, but rather stem from the ability of the FAA to assure, in a timely way, that fundamentally new operational procedures do not compromise safety or result in adverse environmental performance. The current operational ap-

proval processes are not equipped to deal with the magnitude of change envisioned in NextGen.

It is extremely challenging and time consuming to evaluate the impact of a major NextGen change requiring fundamentally new safety and environmental impact reviews. It is much easier, and faster, to receive operational approval for changes which do not significantly alter the current operational procedures. As a consequence, there is the risk that NextGen technologies will only be used to fly today's procedures thereby severely limiting the operational benefit from NextGen and making it difficult for operators to justify the significant investment in aircraft equipment that NextGen will require.

The REDAC as well as the RTCA Task Force 5 have noted this concern. The FAA has responded by initiating a lean process analysis of their current operational approval and certification processes for Instrument Flight Procedures (IFP). The NavLean report was issued last week and is a good first step in addressing these issues, however, even if fully implemented, it will only solve part of the problem.

Research is needed in fundamental and applied areas to support the implementation of NextGen enabled capabilities. Fundamental research in procedure development, such as human-automation roles or the change in the roles between pilots and controllers, will guide effective procedure design. Also, more research is needed to support procedure development and testing in ways that supports future certification and environmental approval. The REDAC has noted some good work in this area, specifically in operational concept validation and modeling, but it is a small fraction of the research portfolio and only covers a limited set of the proposed NextGen operational changes. In addition, the REDAC notes the need for research in safety analysis, transition processes, and innovative approaches to environmental impact assessment.

Finally, as noted above, the complexity and obscurity of the NextGen plans make it difficult to identify the critical research and development issues that will impede timely implementation of NextGen.

3. How would you assess the role and effectiveness of the JPDO as the FAA's long-range planning office? How engaged are the JPDO's partner agencies?

The JPDO has not been effective as a long-range planning office for the FAA.

In its early stages the JPDO played an important and effective role in identifying the need for NAS modernization, coordinating input from the community and its partner agencies resulting in the initial NextGen Integrated Plan, as well as the Operational Concepts and Operational Improvements which have come to define NextGen. After this initial surge the JPDO lost its focus and did not effectively engage the partner agencies, in particular the operational elements of the FAA who would be responsible for implementing NextGen.

The NextGen plan stagnated with the JPDO unable to add substantive detail (e.g. the definition of a 4D Trajectory), to adapt the plan to emerging requirements (e.g. rising fuel costs or increasing environmental concerns), or to clearly define research needs at a specific level. Instead of focusing on long-range planning, much of the JPDO activity over the past few years was devoted to developing and managing a complex accounting system to track responsibility for integrated work plan elements. There are a few areas where strong JPDO working groups have made substantial progress notably in ATC–Weather Integration and Avionics.

The engagement of the partner agencies has varied. Most of the partners, with the possible exception of the DOD, were heavily engaged with the initial JPDO efforts, with the DOT, FAA, NASA and Department of Commerce strongly involved in defining the initial NextGen Concept of Operations. The engagement of many of the agencies has waned over time although there is some recent evidence of improved collaboration under the leadership of the new JPDO Director. For example, the DOD has recently increased its engagement with the JPDO in the areas of Net-Centric operations and integration of UAS in the NAS.

BIOGRAPHY FOR R. JOHN HANSMAN, JR.

R. John Hansman is a Professor of Aeronautics & Astronautics MIT, where he is the Director of the MIT International Center for Air Transportation. He conducts research in the application of information technology in operational aerospace systems. Dr. Hansman holds six patents and has authored over 250 technical publications. He has over 5300 hours of pilot in-command time in airplanes, helicopters and sailplanes including meteorological, production and engineering flight test experience. Professor Hansman chairs the US Federal Aviation Administration Research & Development Advisory Committee (REDAC) and is a member of the NASA Advi-

sory Committee for Aeronautics as well as other national and international advisory committees. He is a Fellow of the AIAA and has received numerous awards including the AIAA Dryden Lectureship in Aeronautics Research, the ATCA Kriske Air Traffic Award, a Laurel from Aviation Week & Space Technology, and the FAA Excellence in Aviation Award.

Chairman PALAZZO. Thank you. I now recognize our final witness, Mr. Peter Bunce, President and CEO, General Aviation Manufacturers' Association.

STATEMENT OF MR. PETER BUNCE, PRESIDENT AND CEO, THE GENERAL AVIATION MANUFACTURERS ASSOCIATION

Mr. BUNCE. Chairman Palazzo, Congresswoman Fudge, Chairman Hall, and other distinguished Members of the Subcommittee, thanks for the opportunity to come talk to you today. I am an active jet and piston pilot, flying in the system every day, so everything that my government colleagues talked about today about NextGen is very sacred to me. I want to talk about a part of the research and development budget that is particularly important to a segment of the industry that I represent.

GAMA, General Aviation Manufacturers Association, represents 70 of the world's leading producers of manufactured aircraft engines, avionics, and as we move to NextGen we are moving much of the system from a ground-based system up to avionics that are installed in the air so that we can better handle traffic as my colleagues have mentioned.

So I have responsibility for everything from Boeing business jets down to aircraft like small Cessnas and Pipers, and that part of the industry, the piston part of the industry, is in a tough shape right now. Economically we have lost a lot of jobs, over 20,000 since the economic downturn happened, and about 45 percent of the product that we were producing back in 2008 is gone.

But with all that said, our companies are heavily invested in R&D and looking for, as the economic conditions start to pick up, an ability to go and produce even more fuel-efficient products.

But on the piston end we are being squeezed between the Environmental Protection Agency on one side, and the FAA on the other, and that is in the area of leaded avgas. Now, piston aircraft operate on a fuel that was developed primarily during World War II, and all our engines were developed to be able to use the lead content which is in that fuel. They are designed to very close tolerances, and when you start to take the lead out, you get what is called detonation. You might recall when we switched to unleaded fuel in a lot of our cars, we got knocking, but a car, one, you can pull over to the side of the road, and, two, it has got a very robust engine block. Aircraft engines don't work like that. If you have detonation cylinders blow off, and people get hurt.

So we have the EPA on one side saying you have to get the lead out of the fuel. We have the FAA regulator on the other side saying that the only way we can get product to market, the only way we can change the fuel, is it has to go through the FAA. They have to certify the new fuel. I am talking low dollar amount. It is about $2 million for each year of this reauthorization bill that we are talking about. There is a tech center up in Atlantic City where we provide some of the engines for them to be able to research the new fuels that we develop, and we fix the engines when they break. We

have to have this because it is the only way we can convert to an unleaded fuel. We can't just use auto gas. Seventy percent of our aircraft out there could not use auto gas. You would have the same problems. You would have engines falling apart.

The only way we can get to a new fuel, which our different companies and our industry is developing, is to have that capability up in Atlantic City. So, Mr. Rohrabacher talked about what my number one priority, small dollars but it is truly my number one priority because of the squeeze that we have—that we feel right now in our ability to convert the industry.

There are other things for general aviation that become very important, and my colleagues have talked about NextGen which is extremely important to us. Being able to leverage our universities that are out there, there is an acronym called CGAR that basically is our Centers of Excellence—it is called the Centers for General Aviation Research, and we have that at Embry-Riddle University, Florida A&M, University of North Dakota, University of Alaska, and a couple other great, great institutions out there that have great aviation programs. We leverage these smart people that really understand software, and they are able to go and try to figure out how we are going to take the satellite-based system that we are going to, and integrate it with the avionics to be able to have more and more capability delivered out there so that we can go and address these congestion issues that, again, my colleagues have addressed.

Also important to us in the R&D program is the CLEEN Initiative. The Continuous Low Energy Emissions and Noise Initiative that basically is our ability to make engines and airframes and also the materials that we use on aircraft, to make them lighter and be able to leverage all of that technology to be able to go and reduce our fuel burn. Because when we reduce our fuel burn, we go and cut emissions, but we also have the capability to cut noise, and noise as we all know is an important issue, much more important in Europe but very important here in the states.

So all of these initiatives play into NextGen so we can do things on the aircraft manufacturing side, but we also can do the way we operate aircraft on the operational side to be able to go ahead and reduce emissions out there. So we think that the program that we are able to leverage with the universities is very important to us, the CLEEN Initiative, and of course, what we are doing in NextGen as well.

Thank you, and I look forward to your questions.

[The prepared statement of Mr. Bunce follows:]

PREPARED STATEMENT OF PETER J. BUNCE

Chairman Palazzo, Ranking Member Costello, my name is Pete Bunce and I am the President and CEO of the General Aviation Manufacturers Association (GAMA). GAMA's sixty-eight member companies are the world's leading manufacturers of general aviation airplanes, engines, avionics, and components. Our member companies also operate aircraft fleets, airport fixed-based operations, pilot training and maintenance facilities worldwide. On behalf of our members, I appreciate you convening this important hearing and providing me with the opportunity to testify before the Subcommittee about the Federal Aviation Administration (FAA) reauthorization bill and its research title.

Overview of General Aviation

General aviation is an essential part of our transportation system that is especially critical for individuals and businesses that need to travel and move goods quickly and efficiently in today's just-in-time market. General aviation is also an important contributor to the U.S. economy, supporting over 1.2 million jobs, providing $150 billion [1] in economic activity and, in 2009, generating nearly $5 billion [2] in exports of domestically manufactured airplanes. We are one of the few remaining manufacturing industries that still provide a significant trade surplus for the United States.

Our industry, like others, is struggling due to the recession. Due to the economic downturn, our member companies have seen more than 20,000 layoffs over the last two years. Our deliveries have declined significantly—by 45% between 2008 and 2009 and almost 15% between the first three quarters of 2010 as compared to the first three quarters of 2009.

Despite these tremendous economic challenges, our member companies have responded by continuing to innovate and invest in new products to take advantage of market opportunities as the recession ends. We believe the market is stabilizing as we see an increase in orders in some segments of our industry. We also believe that this Subcommittee has a key role to play in helping our industry take full advantage of their investments and innovations.

Importance of FAA's R&D program

Research and development at the FAA is conducted within two separate programs: the research, engineering and development program (RE&D), and the facilities and equipment (F&E) program. My testimony will focus on the FAA's RE&D program, but I will reference other issues as well which are relevant to your oversight responsibilities.

The FAA focuses its research activities on aviation safety, air traffic control modernization, and the environment to advance agency policies, guide future technologies, and understand safety issues facing the aviation system. The FAA's research program has become more important recently as the National Aeronautics and Space Administration's (NASA) aeronautics budget has been cut dramatically over the past ten years. As a result, some policymakers have debated shifting all federal aeronautics research to the FAA.

GAMA opposes this idea because the two agencies have quite different capabilities, missions, and goals. Moreover, during debate on its FAA reauthorization bill earlier this month, the Senate voted overwhelmingly against commissioning a study to determine the feasibility of transferring NASA's aeronautics program to the FAA. However, with respect to air traffic control modernization and other areas, it is very important that the two agencies coordinate their research programs and work closely together.

FAA Research Centers

As the committee knows, the FAA conducts much of its research at the William J. Hughes Technical Center (Tech Center) in Atlantic City, New Jersey and the Civil Aero Medical Institute in Oklahoma City, Oklahoma. Both facilities bring unique capabilities to support the FAA's mission, and are globally recognized as world class research centers for aviation safety, technology and environment.

An issue of great importance to the general aviation industry and the U.S economy is the FAA's evaluation and safety certification of alternative fuels which is primarily done at the Tech Center. GAMA and all other key industry stakeholders are currently involved in a joint public-private initiative to develop an unleaded aviation gasoline for piston engine aircraft and renewable fuels for turbine engine aircraft.

Alternative Unleaded Avgas Research

One of the most important and critical FAA research activities for general aviation is to identify the information necessary to develop, approve and deploy an unleaded aviation gasoline (avgas) to replace the current 100 low-lead avgas (100LL). Environmental actions by the Environmental Protection Agency (EPA) and global economic factors threaten the continued availability of leaded avgas. However, lead is the only known additive for avgas which can protect high performance piston engines from detonation, sometimes referred to as "knock," which completely destroys an engine.

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[1] General Aviation Contribution to the US Economy, Merge Global 2006.

[2] 2009 General Aviation Statistical Databook and Industry Outlook, GAMA 2010.

The FAA plays a critical role in industry initiatives to develop alternative fuels as only the FAA can determine the performance and airworthiness standards for the safety certification of new fuels. The FAA is partnering with our industry as we begin the long, complex effort to develop and approve an unleaded avgas and transition the existing U.S. fleet of nearly 190,000 piston engine aircraft. The Subcommittee's leadership will be absolutely essential this year and in the future to make certain that this transition is done in a way that ensures aviation safety is maintained, is technically and economically viable, and has the least impact on the existing fleet of GA aircraft and operators.

We respectfully request that the Subcommittee include two key provisions in the FAA reauthorization bill with respect to avgas. The first is to authorize $2 million annually over four years in the FAA's research and development budget for *Alternative Fuels for General Aviation*. The FAA requested this funding level in the FY2011 budget and we expect the same request level for FY2012. This research program will help develop FAA performance and certification methodologies necessary for qualification and certification of alternative fuels.[3]

The testing that will be performed at the FAA's Tech Center in New Jersey will include different unleaded avgas formulations being developed by industry as well as possible piston engine modifications to ensure that they can be used safely in aircraft. In addition, this FAA activity is needed to ensure technical and safety cooperation with EPA as it pursues regulatory actions under the Clean Air Act to address lead emissions from general aviation. Support for this research will be an absolutely critical part of the process to identify and transition to a replacement unleaded avgas with the least impact on the existing piston-engine aircraft fleet.

Secondly, we hope the Subcommittee will include the provisions of a bill (H.R. 549) introduced by Chairman Sam Graves of the Small Business Committee and Rep. John Barrow which will create a public-private partnership to collect data; identify criteria for a viable avgas; develop fuel emissions and airworthiness standards; and certify the modifications made to the general aviation piston fleet. This partnership will use the research data from the Tech Center to support the development of standards, guidance and processes necessary for safety certification and an efficient transition. In a move consistent with this bill, the FAA recently chartered an Unleaded Avgas Transition Aviation Rulemaking Committee (UAT–ARC) comprised of the key industry and government stakeholders to identify issues relating to the transition to an unleaded avgas and to recommend the tasks necessary to investigate and resolve them.

An alternative unleaded avgas will require FAA approvals for tens of thousands of aircraft and certification of any engine modifications necessary to ensure that existing high-performance aircraft will be able to safely operate. This will require FAA policies and procedures to be in place as well as engineering resources available at aircraft certification offices in order to address the significant technical complexity and potential safety implications of transitioning the existing fleet of piston aircraft to an unleaded aviation gasoline.

Our entire industry stands ready to work with you on this important initiative. We have formed a General Aviation Avgas Coalition comprised of general aviation manufacturers, operators, airport distributors and fuel producer industry groups to ensure the long-term viability of general aviation. GAMA companies have heavily invested in fuels research and engine development activities and participate actively in FAA research and Tech Center activities including the provision of engineering expertise, testing capabilities, and the provision of engine hardware and airworthiness maintenance support for the Tech Center test facility.

Your Subcommittee's support is needed for FAA and industry to continue all the necessary unleaded avgas activities. It is our hope that a required or necessary transition to an unleaded avgas can be done in a way that effectively balances environmental improvements with aviation safety, technical feasibility and economic impact related to issues surrounding the production, distribution and cost of fuel.

CLEEN

A number of GAMA member companies also participate in the FAA's public-partnership research program known as CLEEN, or Continuous Lower Energy, Emissions and Noise. The manufacturers engaged in CLEEN match or exceed the government funding under CLEEN, thus leveraging the public contribution. CLEEN is working on concrete solutions to increase the environmental efficiency of aircraft

[3] *NextGen Alternative Fuels for General Aviation A11.m Research Plan FY 2011–2015*. FAA Aviation Fuel and Engine Test Facility (AFETF), William J. Hughes Technical Center AJP–6352. September 30, 2010.

through research into promising new engine technologies, airframe and materials research, and alternative fuels. CLEEN technologies in some cases can be retrofitted to the existing fleet of aircraft thereby accelerating benefits to the public. Through collaboration with other research agencies and initiatives such as the Commercial Aviation Alternative Fuels Initiative or CAAFI, CLEEN is a key element of our industry's aggressive efforts to mature and demonstrate the benefits of "drop-in" alternative fuels for aviation.

Important Role of Centers of Excellence

The FAA has several Centers of Excellence (COE) that were established by Congress to leverage academia in support of the FAA's research priorities. GAMA works closely with the Center for General Aviation Research (CGAR), which is a consortium of leading aviation universities and flight schools including Embry-Riddle, Florida A&M, the University of North Dakota, the University of Alaska, and Wichita State University.

The CGAR consortium is celebrating its ten-year anniversary this year of supporting the FAA's research mission. Its successes include:

- The development, evaluation and establishment of training standards and testing standards for "glass cockpit" avionics in light general aviation.
- Use of Automatic Dependent Surveillance Broadcast (ADS–B) technology to track training flights.
- Evaluation of the use of data recorders in general aviation flight operations at flight schools such as Embry-Riddle.
- The development of Safety Management System concepts for general aviation and how they fit within current regulations.
- Accident trend analysis for general aviation operations that is helping to guide the FAA's general aviation safety program, the General Aviation Joint Safety Committee (GAJSC).

One hundred and ninety-two graduate and undergraduate students have directly participated in these and other research projects sponsored by the FAA and CGAR. GAMA believes strongly in this type of foundational research and, more importantly, this research has a clear link to introducing new technologies or policies that have direct benefit to improving safety or capacity in our industry.

The FAA reauthorization bill that passed the House in the last Congress included language to change the cost sharing criteria for FAA research projects. The bill capped the federal share at 75 percent for COE programs and, if justified, allowed for a 90 percent federal share in some cases. The feedback that GAMA has received from the CGAR program is that this new structure would further expand the ability of the program to support FAA's research mission through a shared cost structure. GAMA supports this change because of its ability to strengthen public-private research projects and encourages its inclusion in the new FAA bill.

NextGen Research

Air traffic control modernization, or NextGen, will transform the National Airspace System (NAS) by using modern technologies to make air travel safer and expand capacity. We believe that the current impediment to accelerating NextGen is not a lack of technology but the inability to develop processes and procedures that will support the technology. To do this, FAA must leverage its research resources through both the RE&D budget and the F&E account. During the past two years, with direction from Congress, the FAA has undertaken specific initiatives to support the deployment NextGen. I would like to highlight two of them.

In late 2008, the FAA announced a $9.3 million research award to develop and conduct flight demonstrations for an ADS–B "In" application called Enhanced Traffic Situation Awareness on the Surface with Indications and Alerts (or "SURF–IA"). The SURF–IA application is a priority of the FAA as it would address safety enhancements recommended by the National Transportation Safety Board (NTSB). This research and evaluation was carried out successfully and identified specific technical areas that require additional attention from the FAA. The FAA shared the results of these projects with the ADS–B In Aviation Rulemaking Committee (ARC) which in turn endorsed a strategy to resolve any issues with this application so that it can be deployed. We believe this is an example of the FAA effectively leveraging timely research for needed NextGen deployments. We encourage more targeted NextGen research of this type in the future.

Another ADS–B In application that will enhance safety in general aviation is called "Traffic Situational Awareness with Alerts (TSAA) and would provide an

evolved traffic collision avoidance system for light general aviation. As the Subcommittee may know, the FAA has struggled to identify benefits for general aviation from ADS–B and funding to develop this application is welcomed by GAMA. The contract has been awarded to MIT and the research plan is designed to develop ADS–B technical standards over the next three years. We encourage more targeted NextGen research to be undertaken in a manner similar to these two projects.

Finally, we believe that NextGen research should benefit all segments of the aviation system. Although much work has been done to support key NextGen technologies like ADS–B, data communications, and System Wide Information Management, not enough work has been done to evaluate human factors issues relative to the deployment of these technologies, especially for general aviation operations. We believe it is important for the FAA to continue to engage with our community through forums such as the Research, Engineering and Development Advisory Committee to help guide its future research activities for NextGen. We especially want to make sure that issues within general aviation, like single pilot operations, are not overlooked when technologies such as data communications are developed toward deployment.

The Role of the Joint Planning Development Office (JPDO) in Guiding Research

The JPDO was established by Congress in the Vision 100–Century of Aviation Revitalization Act of 2003. Its role is to coordinate activities between the various federal agencies that have a stake in NextGen including NASA and the Department of Defense. In addition, the JPDO also plays a role in ensuring that research essential to the deployment of NextGen is completed.

GAMA believes that the JPDO must do three key things to be successful in achieving its research goals:

- Better integrate and coordinate with the FAA's NextGen office
- Develop both short and long term plans that complement the FAA's plans for NextGen so that they are seamless and unified
- Step up coordination between stakeholder agencies to ensure research goals are met

Since there are several different NextGen research and advisory committees, we urge this Subcommittee to evaluate the management of all these different institutional arrangements to ensure they are not duplicating efforts or a failing to establish clear areas of responsibilities.

Software Research

Lastly, we have frequently voiced concern about the FAA's ability to develop and certify policy for software. We have championed this area over the past decade and within the research area we endorsed recommendations last spring for the software and digital systems program.

GAMA has engaged the FAA over the past decade about the importance of building internal technical expertise on the staff level as well as to conduct targeted research in the area of software and digital systems. As the subcommittee knows, the NextGen program makes onboard avionics part of the ATC infrastructure as opposed to today's ground based radars and other equipment.

As this ATC evolution begun, industry raised concerns over the FAA's internal capability to support this technology development through policy. Specifically, we believe that software and digital systems research and development should be given additional emphasis by the FAA including adequate staffing and funding. Industry has also called for the FAA to develop a comprehensive software and digital systems research plan that integrates with future policy and rulemaking needs.

The FAA took some steps during 2010 to develop a research plan, but concerns remain about the level of resources. GAMA is encouraged that the FAA is listening to industry about this important area of NextGen and wants to ensure that appropriate levels of funding are provided to maintain internal expertise and advance research in the area of software and digital systems.

Conclusion

Mr. Chairman, the FAA's research and development program is a critical part of the agency's mission and it's important that Congress continue to provide it with the resources it needs to meet the challenges I outlined in my testimony. GAMA stands ready to work with you and the other members of this Subcommittee to advance NextGen, support the transition to an unleaded avgas, and meet critical environmental goals. Thank you for allowing me to testify.

BIOGRAPHY FOR PETER J. BUNCE

Biography

Pete Bunce

President & CEO, General Aviation Manufacturers Association

In April 2005, Peter (Pete) Bunce became President and CEO of the General Aviation Manufacturers Association (GAMA) which is headquartered in Washington, D.C. with additional offices in Brussels, Belgium. He and the GAMA staff travel worldwide engaging regulators, policymakers and elected officials to promote general aviation and advance the interests of GAMA's international membership of more than 65 airframe, avionics, engine and component manufacturers.

Pete retired from the United States Air Force in March 2005, with his last assignment as the Director of the Air Force Congressional Budget and Appropriations Liaison. During his 26 year Air Force career, Pete flew F-15s and A-10s, while commanding several large operational fighter units.

A Wisconsin native, Pete learned to fly as a teenager in the skies over southern Wisconsin. He entered the Air Force in 1979 as an honor graduate of the United States Air Force Academy. He received his master's degree in International Affairs from Troy State University in 1988 and was an International Affairs Fellow at Harvard University in 1996-97.

Pete is an active pilot with more than 5,800 hours in military fighter and training aircraft as well as civil piston, turboprop and business jet aircraft. He holds an FAA airline transport certificate in addition to seaplane and business jet type ratings. Pete serves on the board of directors of the Veterans Airlift Command, the International Council of Airshows, the Aviation Accreditation Board International and Build a Plane. He is also a trustee of the Air Force Academy Falcon Foundation.

Pete was named the 2007 Aviation Industry Leader of the Year by the Living Legends of Aviation. In December 2009, Pete was awarded the ICAS Sword of Excellence, the air show industry's premier annual award. In January 2010, he was inducted as one of the seventy Living Legends of Aviation. Pete and his wife Patty reside in Arlington, Virginia and have six children.

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Chairman PALAZZO. I thank the panel for their testimony. Reminding Members that committee rules limit questioning to five minutes. The Chair will at this point open the round of questions. The Chair recognizes himself for five minutes.

Dr. Hansman and Mr. Scovel, given the research and development projects and activities being undertaken by FAA, how would

you characterize the level of resources being provided by the agency. Are resources commensurate with the R&D projects, goals, and schedules?

Dr. HANSMAN. Over the past years I would say the resources have been good and have been commensurate with the general need. With the ramp up to NextGen in some sense it was hard to figure out what needed to be done, and there was a little bit of scrambling, but I say the first order the resources have been appropriate.

Mr. SCOVEL. Mr. Chairman, I would concur. We think that funding over the past number of years targeted towards NextGen has generally been adequate. We have noted, as I stated in my opening statement, execution or implementation problems on FAA's part carrying out the programs that have been approved and some of which have been mandated by Congress. We see room for improvement in the multi-agency efforts, specifically with regard to weather and the Department of Commerce, DOD and DHS on surveillance, Department of Defense with unmanned aircraft systems, and finally NASA perhaps on human factors.

FAA and its agency partners can do a much better job in those areas.

Chairman PALAZZO. Mrs. Cox, FAA's budget will come under intense scrutiny now and for the foreseeable future. If research and development funding were reduced, where do you believe the cuts would be taken, and how would FAA manage its R&D portfolio?

Ms. COX. Sir, our National Aviation Research Plan has long-reaching effects into the implementation of NextGen for the future. As such, it is an extremely important investment that not only advances innovative ideas, but it helps us to make the better decisions for where we need to be going forward. So in the long run an investment in research, engineering, and development can lower the cost of more mature programs down the road.

The RE&D program is a rather small part of the NextGen portfolio that falls under my overall purview, although it has been rather healthier in the last few years than it has been in the past.

So we have intricate plans developed for moving forward. Dr. Hansman has made a reference to those. We need to take a look at the impact of our investments, use those plans to see what the long-term impact would be.

The question about what would you cut versus what you keep, it is not that simple because of the interdependencies across these programs. So any decisions about funding need to take into account those long-term interdependencies.

Chairman PALAZZO. Mr. Bunce, once a new additive is approved, what is the scope of work involved to certify the use of new avgas formulation into the existing general aviation fleet? Will it be as simple as certifying each type of power plant, or will certification involve approving the fuels used in every model of airplane in the fleet today? Also, how likely is it that engines and fuel systems may have to be modified to accept a new fuel?

Mr. BUNCE. Mr. Chairman, we are hopeful that the fuel that we are developing right now is a fuel that all of these engines can use. However, each one of those different models does have to be certified. So, heretofore, what the FAA did was basically we had the

set fuel, and they certified engines to be able to operate on it. Now we are changing that whole paradigm, and the FAA hasn't done that before. They have got to certify the fuel to fit into these 200,000 plus airplanes that are sitting out there to be able to go ahead and use it.

So it is a huge project because there are so many different engines that are on those aircraft, and each one of those has a substantial investment. To replace an engine right now is about, for a small piston, it is in excess of $300,000, and a lot of those airplanes just aren't worth that kind of money.

So we have to be able to go and certify each one of those engines, and we have an investment of over 5,000 general aviation airports around this country that are public-use airports. The commercial airlines use about 500 of them, so everything that we provide, from getting people airlifted to medical centers, to angel flight, to organ transfer, and just the commerce that is created from small and mid-sized communities out there. Then, of course, not to mention all agricultural business or the fact that Alaska just survives on general aviation. There is no way that Alaska can function without piston aircraft being able to deliver supplies because there is no other way to get there, particularly in the winter.

So we have got to get this right, and it is a huge, huge problem.

Chairman PALAZZO. Thank you. I now recognize Ms. Fudge.

Ms. FUDGE. Thank you, Mr. Chairman, and thank all of you for your testimony today.

Ms. Cox, GAO, GAMA, and DOT Inspector General have all identified the need for NextGen performance metrics that hold FAA accountable and give Congress and the industry the ability to measure progress.

What is the status of FAA's efforts to develop these metrics, and secondly, do any of the other panel members wish to comment after Ms. Cox?

Ms. COX. Thank you. We have metrics in place to track our programmatic milestones and are doing that in great detail. The more difficult measure is how well are we doing overall with our NextGen investments.

We have a group within the FAA that is focusing on developing those metrics in support of our future flight plan strategic goals, but it is not just the performance of the FAA that we have to measure. We have to measure the performance of our stakeholders, the operators in the system.

So FAA has tasked the RTCA NextGen Advisory Committee to work with us in developing metrics not only for the FAA but for the operators to measure how NextGen is benefiting their performance.

Mr. BUNCE. Congresswoman Fudge, I just would like to comment. We think metrics becomes very important, and I think Mr. Scovel pointed out that we have saying that the FAA has used out there like, best equipped, best served. So if our operators go and equip with certain technologies, we have to get a return on that investment, and the things that we would like to see from industry being able to measure is if we go and do new approaches out there, and we are—and we go and equip and have these new approach designs out there, okay, how are we going to start to use them, and

when we start to use them we need to start measuring how many people want to go ahead and use these styles of approaches where we can pull the power back at altitude, descend on down on approach, and not burn the fuel that we burn on the way we do approaches today.

Now, there are a lot of elements to that. We have asked the T&I Committee to help us to go and work with the NEPA process, working with the Environmental Protection Agency to streamline the way we design approaches. Right now we build approaches and then they just overlay old existing type of approaches. We don't have to design them that way anymore. We can design very curvilinear type approaches that brings it very short and allows us to save a lot of gas coming down from altitude. That reduces emissions, and it also reduces noise.

So if we can put some rigor into what the FAA means by best equipped, best served, and get the FAA to sponsor getting pilots and controllers together, to say how best can we crack this nut to be able to go and make sure we make maximum efficient use of the system, I think we can go a long way.

Ms. FUDGE. Thank you. Let me just follow up, Ms. Cox. When do you believe that you will provide the metrics to us?

Ms. COX. The committees are working on deliverables in the September, 2011, timeframe. So I think that in the very short term we will have some matrix available to follow. Meanwhile, the FAA is also introducing new capabilities in the system to respond to a previous taskforce recommendations.

To Mr. Bunce's point, we are looking to provide benefits to operators who are already equipped, today. With that in mind we are going out and looking at metroplex areas where we could introduce these kinds of fuel-saving capabilities that he has alluded to. And, our first study teams have completed their assessment of the Washington DC metro area and the north Texas metro areas and have come up with some specific recommendations that will benefit operators there.

And, we are moving on to address 21 total metroplex areas.

Ms. FUDGE. Thank you very much. Mr. Scovel, you state that although ERAM passed testing at FAA's Technical Center and achieved government acceptance testing, initial operating sites in Salt Lake City and Seattle revealed significant software-related problems and that has pushed schedules well beyond original completion dates.

Can you clarify the meaning of those test results, and what does this variation say about the robustness of FAA software testing?

Mr. SCOVEL. Thank you, Ms. Fudge. If you had asked me about ERAM a year and a half or two years ago, I would have told you that we had great confidence in the program at that time. It appeared that the requirements for the contract were stable, that the program management was consistent and capable, and timelines for costs and for performance appeared to be track.

Things appeared to unravel, however, about the time that the product was presented to the FAA Tech Center in New Jersey for testing and government acceptance. Frankly, it is quite disturbing. We have been asked, my office has been asked by the House Appro-

priations Committee to do an in-depth study of the ERAM Program, and this is an area that we are going to have to dive into.

It appears that an incomplete version of the product was presented to the Tech Center initially. It was lacking some of the key software codes. That portion being specifically that would enable key interface between the test sites in Salt Lake and Seattle and other air traffic facilities. The Tech Center never had an opportunity to test that. It appears also, and this has been noted by MITRE, that the Tech Center didn't have the capability to do all of the testing that would have been desired, and FAA correctly points out that in any event, testing at the Tech Center might well have been imperfect since you can't plug a product like this into the NAS and have it direct live traffic. It had to go out to the test centers at Salt Lake and Seattle. Once that happened, that is where some of the key defects became apparent; interface issues, radar processing issues, erroneous flight data tagged to aircraft, and handoff problems between controllers specifically.

The problems became so acute that the system had to be taken offline. Those centers had to resort to the Legacy Host System in order to direct high-altitude, long-range traffic, and now we find ourselves in a position where FAA itself says that ERAM delivery will be delayed by about four years and cost an extra $330 million. MITRE, on the other hand, says a more accurate number might be to 2015, or even 2016, and perhaps $500 million.

So a lot is at stake in delivering this. ERAM is a key enabling platform for a number of critical programs that are truly NextGen-related as Ms. Cox has noted. FAA will get ERAM right. It will take a lot more time and a lot more money, but in the meantime it does raise questions for us about the adequacy of the Tech Center's programs and ability to conduct key testing like this.

And also, frankly, with the contract negotiation and management point. If problems with testing at the Tech Center were known or should have been known, why were those not taken into account in the contract process so that the government alone would not have borne the total risk? It could have been spread between government and contractor perhaps. We will look at that and report to the Department and to the Congress.

Ms. FUDGE. Thank you so much. I yield back.

Chairman PALAZZO. I now recognize Mr. Sensenbrenner for questions.

Mr. SENSENBRENNER. Thank you very much. My question is basically on what is being done to plug the holes in the air traffic control system. Let me say, at the end of June last year I was on a United Airlines commercial flight that was going into Washington National Airport, and because there was a line of thunderstorms between Dulles and the National Airport, my plane was taken off the regular approach pattern into National.

Shortly after that, the collision avoidance system went off twice on the plane that I was on. The plane made some very rapid and very sharp maneuvers in order to avoid a collision, and I asked the FAA to come and show me the tapes, and I came within 100 feet of being wiped out together with about 110 other passengers. *The Washington Post* has run a whole series of stories as a result of this relative to near collisions. Some people call them near misses.

I think it is better to call them near collisions in the skies above DCA. With the number of people that go in and out of DCA, Members of Congress and government officials, I think it is important to plug the holes lest there be, you know, a huge tragedy.

What apparently came out of this investigation was that there was a manual handoff or what was called a splat splat between the National Airport controllers and the Dulles Airport controllers. The National Airport controller handed control of the plane off, he thought, to the Dulles Airport controller, except the Dulles Airport controller never picked it up.

This was something that was done manually. Apparently there was no training on the part of the Dulles Airport controller who was relatively new in the FAA, and since he didn't know he was in charge of dealing with both the general aviation plane that took off from Dulles as well as my United Airlines commercial plane, we came very close, like 400 feet, to having a tragedy.

What is being done to prevent this from happening again?

Ms. COX. A large part of the focus of the NextGen Program is on better managing how we control traffic in very congested airspace, such as the situation you described. Providing better tools to the controller so that they can be alerted to potential conflicts, such as the one that you experienced, and help them to deal with it in a more automated fashion.

As you point out, very much of the system today is a manual system. A lot of tracking is done by the human, and we are looking at ways to automate some of that. From Dr. Hansman's presentation you also saw the impact that weather can have to further exacerbate the situation. NextGen also invests in better tools for predicting the weather so that further out in the system we can place that traffic more efficiently and effectively for getting it into the airport of destination.

So these are the kinds of investments that we are looking at.

Mr. SENSENBRENNER. Okay, but I just heard that NextGen is going to require a lot of money, which we don't have at the present time, and take quite a bit of time like maybe five years plus, to become effective. I just don't want to see a tragedy occur, whether it is in the congested airspace over the DC area or someplace else.

Is there anything that is being done on a more immediate basis to prevent one controller handing control of a plane off to another controller, and the other controller doesn't pick it up?

Ms. COX. You are correct. Some of these investments in automation systems do require long-term investments and longer-term deliveries. Some of the things that we are looking at are better control on the surface and integrated arrivals and departures that manage those departures better, and some of that capability is being delivered today.

So deconflicting traffic is one, for a departing aircraft, for example, we are investing in capabilities that will address that, and I will say that——

Mr. SENSENBRENNER. And when will it be addressed?

Ms. COX. The——

Mr. SENSENBRENNER. Do we need to have a mid-air collision before it becomes an urgency on the part of the FAA?

Ms. COX. I think that the safety of the system is always an urgency with the FAA and has our attention, and we believe that we are one of the safest systems in the world.

Mr. SENSENBRENNER. Well, you know, so do I, but the situation that the commercial airliner that I was on was serious enough to warrant the NTSB's investigating this, and it always takes awhile for them to figure out what went wrong, but I would like to know that when the NTSB reaches its conclusion that there would be immediate implementation of whatever recommendations they make, and I haven't heard anything in this hearing to put my mind at ease.

Ms. COX. I can't speak to the outcome of the investigation. I am certain that it will be taken very seriously.

Another investment that NextGen is making today, is in our ability to take data such as you described and others that are less serious than the incident that you described, track that data, and develop capabilities to assess it so that we can avoid those incidents in the future. Not wait until the incident happens and then do the investigation. The ASIAS or the Aviation Safety Information Assessment Sharing Program that NextGen funds will help us make this safer.

Mr. SENSENBRENNER. Thank you.

Chairman PALAZZO. Dr. Hansman, did you have anything you would like to add?

Dr. HANSMAN. Well, I was just going to point out that while this was a mistake in the system, I think it also illustrates that we actually do have redundancies in the system that provide protection. So there was a secondary collision alerting system that the crew had to prevent a mishap.

Some of the things that are happening——

Mr. SENSENBRENNER. If you will yield, the secondary system that was on board the Airbus 319 that United was flying went off twice.

Dr. HANSMAN. Sure, and so it worked.

Mr. SENSENBRENNER. Yeah, it worked, and I am here today because it worked.

Dr. HANSMAN. Yeah, and I think one of the things that is happening in NextGen is we are adding additional levels of redundancy in the system, so some of the things that are happening, for example, with ADS–B, is the GA airplane in the future, which wasn't equipped, I presume, will probably be equipped. That will also have collision alerting system. So there are things that are happening.

Chairman PALAZZO. Thank you. I now recognize Ms. Sewell for questions.

Ms. SEWELL. Thank you, Mr. Chairman. I would also like to thank the panelists for your testimony.

My question actually has to do with the Joint Planning and Development Office. Ms. Cox, the OIG says that there is confusion within FAA and the industry about the JPDO's role in advancing NextGen. While the OIG acknowledges that FAA recognizes the need to better define JPDO's mission, no definitive action has been taken to determine what role, if any, JPDO will play in the critical NextGen implementation.

My question is three-fold. Does FAA agree with OIG's assessment? Secondly, what specifically do you plan to do to address this concern?

Ms. COX. I believe that the role of the JPDO is somewhat better understood. They have a role with keeping an eye on longer-term research that will provide the vision that the FAA can aim its nearer-term activities toward achieving. So those long-term goals are theirs.

The other mission of the JPDO is the one that Mr. Scovel alluded to, which is the interagency contributions to the Next Generation air transportation problem, and I think we do concede that interagency cooperation is a very challenging undertaking. We have made some advances with the help of the Joint Planning and Development Office in leveraging some research going on in other agencies, with NASA in particular, upon whom we depend so much for a lot of the more basic and fundamental research that contributes to our more applied efforts.

We have been working very closely under the auspices of the JPDO with Research Transition Teams. We are focusing in four key areas that will help us improve NextGen. The JPDO this past fall called together a workshop of the Air Force Research Laboratory, NASA, and the FAA to look at long-term planning for unmanned aerial systems operating in the National Airspace System. So we are hoping to leverage those capabilities.

The Department of Defense named the Air Force as their chief agency with responsibility for NextGen integration. The Air Force has assigned a liaison, who is resident with us at FAA headquarters to assist us in this effort, and we are working very closely with the National Weather Service in planning some of our joint weather plans for the future.

Ms. SEWELL. Inspector General Scovel, do you agree with her assessment?

Mr. SCOVEL. Thank you, Ms. Sewell. I would like to note, and it is more than just a historical footnote, but I think much of the confusion and disappointment with our industry stakeholders in the JPDO's role——

Ms. SEWELL. Uh-huh.

Mr. SCOVEL. —stems from the decision in 2008, to place the JPDO within the Air Traffic Organization, in effect to bury it. The Air Traffic Organization, of course, is rightly concerned with safe operations of the NAS 24/7. The JPDO is designed to look long term in executing NextGen. By placing it under the ATO, the rationale was to make sure that long-term plans will align with the operators who have to carry them out, but in effect, the JPDO languished—it drifted for a couple of years.

It has now been removed from the ATO. It is now placed directly under the Deputy Administrator——

Ms. SEWELL. Uh-huh.

Mr. SCOVEL. —and Mr. Huerta has taken a very keen interest in making sure that the JPDO steps forward to take its rightful place not only for long-range NextGen planning but also we hope and industry hopes along some of the lines that I outlined in my statement for simulation and modeling perhaps, technology trans-

fer most certainly in the multi-agency role, prototype development and policy formulation as well.

Ms. SEWELL. Dr. Hansman, you stated that the JPDO has not been effective as a long-term, long-range planning office, and after playing an important and significant role in identifying the needs for NAS modernization, the JPDO has lost its focus, is what you said.

What needs to be done to restore the JPDO's effectiveness in your opinion?

Dr. HANSMAN. So, I think there are a couple of challenges. One is the challenge of basically having too many bosses, so you have an organization that when it began was fairly bold in its vision but then became timid because it was afraid of offending, while making some of the hard decisions. So I think that is one thing.

I think they also need to be looking for not so much at micro-designing what the system will be in 2015——

Ms. SEWELL. Uh-huh.

Dr. HANSMAN. —but really tracking what the future demands and challenges on the system would be. So, for example, it is disappointing that the JPDO is not more focused on environmental concerns and efficiency issues, which have emerged after the initial definition of the plan, but they were very slow to respond.

So I would much rather see them really taking a longer-term view of what the requirements are as opposed to the detailed design of exactly how a procedure is going to work in 2015.

Ms. SEWELL. Ms. Cox, do you agree with his critique?

Ms. COX. I think that the suggestions are quite good in terms of looking to the longer term and focusing there. So in general, yes, I do.

Ms. SEWELL. I yield the rest of my time.

Chairman PALAZZO. Thank you. I now recognize Mr. Rohrabacher for questions.

Mr. ROHRABACHER. Thank you very much, and Chairman Palazzo, I want to congratulate you for—I take it this is the first hearing of your subcommittee, and you have chosen for the first hearing of your subcommittee a non-space-related issue, and sometimes the criticism, and I think justified criticism, of this subcommittee is that it spends all of its time on space when there are general aviation issues and aviation issues that are vitally important to the security and the prosperity of our country. So I appreciate that.

We all know that Gabby Giffords isn't with us today, and we are sad about that, and we certainly wish her well and hope she gets back very soon.

So I would like to get back to priorities and things, and the gentleman just mentioned too many bosses, and one thing that seems to be coming out of this hearing at me is that we have this bureaucratic system that is all around us, and looking at components of this NextGen, it seems to me, that maybe that we have in every one of those departments or components that we are trying to place this part of the effort here or over here, what is the ratio? Maybe I should ask that of our Inspector General here. What is the ratio there of bosses versus engineers and scientists and people doing the software and people who are doing the grunt work that needs

to be done? What is that? Do we have a system that has too many bosses?

Mr. SCOVEL. Thank you, Mr. Rohrabacher. I can't peg a number to answer your question. We haven't done work in that specific area. I can tell you, however, that what we have, as we did in 2007, recommended to FAA that it undertake an analysis of its acquisition work for us, specifically those skills that would be needed for NextGen, FAA concurred in that recommendation, contracted with National Academy of Public Administration to do that, NAPA presented its report in September, 2008, and identified, in fact, 26 key competencies that were needed. The grunts, if you will, not just the top leadership level.

FAA has moved, we think, quite slowly in filling the trenches with those grunts in key areas like——

Mr. ROHRABACHER. And could that be because the people making the decision to hire the people that are actually doing the real work know that the budget is coming out of the money that would go to pay to them? I mean, this sounds like to me we got an awful lot of people managing some engineers who are actually doing all the work.

Mr. SCOVEL. I don't know what the rationale, sir, is. I can only report on the results, which are that key skills like program management, software development, systems engineering, and integration specifically, for instance, having to do with an emphasis on human factors, which is what NAPA identified, some of those areas are lacking. My office is currently undergoing or undertaking another review of FAA's acquisition workforce, and we are going to try to peg those specific deficiencies with greater specificity.

Mr. ROHRABACHER. Well, when I asked the original question, thank you, Mr. Chairman, for granting me that one minute with unanimous consent, and I said what are your highest priorities, would I take it then that your highest priority is not hiring more managers for this system but instead hiring more people who are actually getting the software done and the engineering done on the technology? Would I suggest that that might your top priority and your lowest priority right there?

Mr. SCOVEL. It is certainly key, and in our statement we identify that as one of the five action items that we have recommended to FAA in this area.

Mr. ROHRABACHER. Well, we are still, remember, we are going on here with a $40 billion program, we are being told, that it went from—and the date for the actual put it in place went from 2025, to 2035, now. How is that affecting the bottom line? Is that—maybe I should ask Ms. Cox about that.

Ms. COX. The original 2025 date was for the visionary system that was described by the Joint Planning and Development Office back in 2004——

Mr. ROHRABACHER. Uh-huh.

Ms. COX. —when the authorization set that office up. The FAA has done some careful assessments, looked at research requirements, and come up with what we believe is an achievable plan for what will in essence transform the way the system operates in a more mid-term timeframe, and our plans focus toward those

deliverables, which, granted, are not as visionary perhaps as the original 2025.

The JPDO, meanwhile, continues to focus on the long-term vision and look at how we can realistically connect that research to deliver a capability in the future, because we can't just stop in 2025——

Mr. ROHRABACHER. Right.

Ms. COX. —or 2018 or——

Mr. ROHRABACHER. Sure.

Ms. COX. We must continue to look forward, and that is our goal, and that's why the investment in the research and engineering is so very important as well.

Mr. ROHRABACHER. And when is that date when this new system is going to be evident, although it is not complete?

Ms. COX. I think there is evidence today that we are introducing new capabilities. For the general aviation community in particular, access to airports that they never had access to before is available through space-based nav aids that provide access to operators who are equipped, and they are equipping at remarkable rates.

Mr. ROHRABACHER. One last question, Mr. Chairman. The FAA budget, is it $346 million a year research budget, is that for overall FAA, or is that a NextGen?

Ms. COX. The President's '12, budget request is a $380 million range for our National Aviation Research Plan. The total NextGen request is in the 1.2 billion range.

Mr. ROHRABACHER. Okay. Well, thank you very much, Mr. Chairman.

Chairman PALAZZO. All right. With the committee's indulgence I will conclude the hearing with one last question.

Mr. Scovel, Mr. Hansman, whoever wants to respond to this is fine, but I think it is pretty much your statement, so might want to back up. Might not be everybody's. Your statement suggested a high level of participating agencies are not realigning their R&D budgets and programs to aggressively support NextGen. With exception of FAA and DOT, is NextGen's implementation imperiled because of indifference or diminishing commitment of some or all the partnering agencies?

Mr. SCOVEL. Thank you, Mr. Chairman. I think imperiled is probably too strong a word. Is there potential for delay? Most certainly. Is there potential for missed opportunities? Absolutely.

I would characterize FAA's success in the multi-agency effort as frankly being patchy at this point. They have had some successes working with NOAA and Defense along weather lines, but at the same time Commerce has made clear that they are going to work on the 4–D weather cube to suit Commerce's needs until FAA is able to better articulate and define what FAA's weather needs are for NextGen. It has been the same with DOD when it comes to unmanned aircraft systems and surveillance needs. Human factors are also another area that needs greater attention.

So I think FAA is going to get all of this right, but it is frustrating for us and frankly for some of the other agency partners, DOD in particular, when it comes to unmanned aircraft systems, to see FAA's seeming inability in a prompt manner in the views of the other agencies to define what the needs are so that the agen-

cies can work in a way that they think will suit not only their own needs but FAA's.

Mr. ROHRABACHER. Mr. Chairman, would you indulge me one more question?

Chairman PALAZZO. Let Dr. Hansman answer and then absolutely I will recognize you for one additional question.

Dr. HANSMAN. I was just going to mention that there has actually been good collaboration with NASA on NextGen, so I think that has been a good interface. I agree that there is a tension between the DOD and the FAA particularly in the area of UAV operations.

There is also, I think, a concern on the part of the DOD that a lot of the NextGen plans presume airborne equipage, and it is very difficult for the DOD to be able to afford to equipage for the number of airplanes that they have.

Mr. BUNCE. Mr. Chairman, I would just add an industry perspective for you on this. One of the things that we have been very disappointed about is the involvement of the Department of Homeland Security in the process as well. When you look at what we are able to do with the NextGen System and when we deploy ADS–B and we have this capability out there, the original vision was we could get rid of some radars, and radars are expensive down on the ground. Basically, these ADS–B boxes that we are putting all over the country are about the size of a refrigerator, much smaller, much easier to maintain, and we are moving a lot of the infrastructure up to the air.

As you go you would think that as we deploy this system that we would be able to get rid of a lot of the old technology that we have been relying on, but there is a concern out there about people that don't want to cooperate, what is called non-cooperative targets, and want to turn off their systems. How are we going to monitor those?

So who is going to be responsible for those radars that are no longer needed by the FAA that have to be either picked up by Homeland Security or picked up by DOD, and that is where I think industry's frustration is as we look at the interagency process and trying to see, okay, who is all sitting at the table and when they go and the JPDO talks about this long-range vision, when the FAA comes and says we want to do that, deploy this NextGen System, where can we reap some savings and then who do those responsibilities now transfer to?

And that is why we have to get everybody at the table, and the only people that are going to be able to drive that is going to be at the Administration level where they can say to the secretaries, you got to get people to sit down at the table and hash this all out and make the JPDO process work.

Ms. COX. Mr. Chairman, can I make a small clarification in terms of the FAA's planning for the radar systems? With the advent of ADS–B, Automatic Dependent Surveillance-Broadcast, as our primary surveillance system, the FAA has judged that it can remove about 50 percent of our secondary radars that track traffic in the immediate terminal areas for us, and we can do that by resiting some of the existing radars and get the same coverage that we have today.

The longer-range radars that track the uncooperative targets are today under the management of the DOD and the DHS but maintained by FAA, and there is no plan to remove those radars.

Chairman PALAZZO. Okay. Thank you, all. The Chair recognizes Mr. Rohrabacher for an additional question.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman. I would just like to ask Mr. Scovel, I am sure he can't answer this question now but maybe you could get back to me with an assessment from your organization as to what the actual cost is here between managers and administrators for the NextGeneration Project versus the actual online personnel who are the scientists and the engineers.

I think it would be good for us to know what are the administrative costs and, you know, at some point you can hire enough administrators that they have to find reasons to argue with one another, and they actually get in the way of people who are actually developing software, et cetera, and I would just like to get a better understanding of this particular program and where the costs are in terms of personnel, and that would be, I think, helpful for us to do our job here in making sure that we make sure the money is being spent efficiently.

Thank you very much, and could you get back to me with some assessment of that?

Mr. SCOVEL. I would be happy to, sir. You are right. We don't currently have that information, but we would be glad to take a crack at it for you.

Mr. ROHRABACHER. Thank you.

Chairman PALAZZO. I thank the witnesses for their valuable testimony and the Members for their questions.

The Members of the Subcommittee may have additional questions for the witnesses, and we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments and statements from Members.

The witnesses are excused, and this hearing is adjourned.

[Whereupon, at 11:15 a.m., the Subcommittee was adjourned.]

Appendix:

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

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

Questions submitted by Chairman Steven M. Palazzo

Q1. The witness from the General Aviation Manufacturers Association testified that certifying an unleaded gasoline for piston aircraft would be a significant challenge. Assuming a new unleaded aviation gas formulation is developed, what process would FAA undertake to approve the use of this fuel in the legacy piston fleet? Would FAA require each and every legacy piston engine type and model to be recertified, and how would the certification be conducted? Would legacy fuel tanks and aircraft fuel delivery systems also be subject to certification?

A1. The FAA and its industry partners in the Unleaded Avgas Transition Aviation Rulemaking Committee (UAT ARC) recognize the challenge of certifying an unleaded aviation gasoline for the entire piston-engine powered aircraft fleet. The UAT ARC established a focus area dedicated to investigating this issue and to providing recommendations on how to facilitate the process. The scope of the resulting certification process will depend on the degree of similarity of the new fuel with the existing, lead-containing avgas. The difference will determine whether or not a fleet-wide approach can be accomplished, or whether the certification will need to address groups of similar type engines and aircraft. Regardless, the FAA will strive to streamline or facilitate the certification process. Legacy fuel tanks, aircraft fuel delivery systems, and other ground-based infrastructure systems and components are not under the FAA's regulatory authority and will not be included in our resulting certification policy.

Q2. The Inspector General testified that there is "confusion" within FAA and industry about JPDO's role. The Chairman of the REDAC also offered the view that JPDO's role is "not effective." What is FAA's response to these assessments? Is FAA planning to take additional measures to clarify JPDO's roles and responsibilities?

A2. The Vision 100 - Century of Aviation Reauthorization Act (Public Law 108-176) established the Joint Planning and Development Office (JPDO) in the Federal Aviation Administration (FAA) "to manage work related to the Next Generation Air Transportation System (NextGen)." The integrated plan is designed to ensure that NextGen meets safety, security, mobility, efficiency and capacity needs for 2025. The JPDO responsibilities include coordinating goals, priorities and research; facilitating technology transfer; and creating multi-agency research and development roadmaps.

Now that the FAA is implementing NextGen, it is important that the JPDO considers the implementation path. The JPDO will continue long-range research planning, while synchronizing that planning with near-term deployments and managing the policy challenges posed by implementation. The JPDO Director serves as an advisor to the Secretary of Transportation and as his liaison to the Senior Policy Committee, consistent with Executive Order 13479.

The JPDO leads the interagency coordination of NextGen policy issues. The Office monitors the progress and pace of implementation, keeps senior leadership apprised of the progress, and if necessary, raises concerns to the appropriate officials. The Director provides dedicated senior leadership to ensure that NextGen is coordinated among all government partner agencies, and with private industry. The Office continues its work with planning and modeling, keeping in mind the Federal government's planned funding levels.

Q3. With respect to Unmanned Aircraft Systems research and development, what are FAA's near- and mid-term plans and goals? What research activities is FAA undertaking?

A3. The FAA has identified critical areas where Unmanned Aircraft Systems (UAS) research is needed to ensure the safe integration of UAS in the National Airspace System (NAS) through the development of policy, regulation, and a basis for certification:

- UAS performance thresholds for safe operations in the NAS and in the Next Generation Air Transportation System (NextGen).
- Certification requirements for UAS pilots and crews.
- Design standards for UAS control stations.
- UAS data link performance requirements.

- UAS sense and avoid requirements.

The goal of this work is to reduce the mitigations required to integrate UAS into the NAS, and eventually reach the point where UAS have unfettered access to the NAS.

The FAA is undertaking research that will provide data to support the safe integration of UAS in the NAS, including:

- Demonstrations of UAS performance and impacts on the NAS, as well as the integration of NextGen concepts and technologies through collaborative efforts with industry and other Government agencies.
- Studies of key UAS human factors issues and safety analyses through partnerships with academia.
- UAS standards development work, specifically in the areas of control and communications, and sense and avoid using modeling and simulation, and
- Additional collaboration on research initiatives to address joint UAS challenges through interagency agreements.

It is essential these efforts continue to evolve as we move toward the far-term, to ensure that we overcome all of the key challenges critical to safe UAS integration into the NextGen NAS.

In addition, FAA has joined with the Joint Planning and Development Office (JPDO), NASA and DOD to examine the current interagency research activities, plans and challenges for integrating Unmanned Aircraft Systems (UAS) into a future NextGen airspace. Three technical teams were formed during a workshop co-sponsored by the JPDO and the Air Force Research Laboratory in October 2011. The Air Vehicles team focused on the on-board technology needed to enable semi-autonomous UAS to operate safely in controlled airspace and populated areas. The essential focus of the Sense and Avoid/Communications team was the requirement to construct a framework that can bridge the current practice of see and avoid to NextGen-appropriate paradigms that reflect and leverage the operational differences between a manned and a remotely operated aircraft. The Human Factors and Ground Control Station team concentrated on developing pilot qualifications, levels of automation, communication latency, contingency management, ground control station information display, navigation system compatibility, and the fact that the pilot is spatially separated from the UAS. The workshop outcomes will serve as a starting point for developing a strategic UAS research, development and demonstration roadmap.

Questions submitted by Representative Jerry F. Costello

Q1. The Transportation Inspector General's statement indicated that FAA had yet to make critical design decisions or address research and development gaps with its partner agencies that will affect NextGen's cost, schedule, and performance. Two of the four unresolved issues he stated were integrating weather information into advanced automated systems and determining joint surveillance requirements to track aircraft.

a. What is the crux of the technical disagreements between FAA and the Department of Commerce over how to synchronize national applications of observed, forecast, and disseminated weather data? How do you plan to resolve these disagreements and what is your timetable for reaching a resolution?

A1a. Although synchronization of programmatic efforts between partner agencies is a coordination challenge, there are no significant technical disagreements between FAA and the Department of Commerce (DOC) with respect to national applications of observed, forecast and disseminated weather. Integration of weather information with FAA air traffic management (ATM) automation has been a topic of considerable review and discussion during the past year. Those discussions have resulted in a shared understanding of an ATM-Weather integration context that affirms DOC's role as the primary provider of 4-dimensional atmospheric state information and the FAA's primary role in translating that information into relevant ATM constraint and impact information.

The FAA recognizes DOC's lead role in developing the NextGen 4D Weather Data Cube which is intended to serve as the source of weather information from which a common operating weather picture will be derived by airspace system users. In support of that role, the FAA has collaborated with DOC for the past two years to develop and demonstrate the application of standards that will enable effective exchange of weather information between the NextGen 4D Weather Data Cube and FAA applications. Those standards are essential components of the infrastructure

investment programs now under consideration at both DOC and FAA. Although a final investment decision on the FAA's NextGen Network Enabled Weather (NNEW) program will not be made before the end of CY2012, close coordination between the agencies will remain during detailed investment analyses to ensure that interoperability is not affected as detailed technical implementation choices are made.

Note also, that the JPDO's NextGen Executive Weather Panel (NEWP) has been and remains in place as an executive oversight and strategic support body for cross-agency issue coordination and resolution.

b. Why have FAA and the Departments of Defense and Homeland Security not established joint surveillance requirements, which are needed to track aircraft and achieve the integrated surveillance and the capabilities envisioned for NextGen?

A1b. In 2009, the NextGen Senior Policy Committee (SPC) directed their staffs to analyze existing and potential executive bodies to provide interagency governance of aviation surveillance activities and make a recommendation to the SPC as to which alternative should be implemented. The main barrier to establishing interagency joint surveillance requirements has been the lack of an institutional mechanism to oversee and coordinate surveillance capabilities across all departments and agencies. Such a governance mechanism must be trusted to allocate requirements and costs fairly among the Federal surveillance partners.

In July 2010, the SPC endorsed the governance recommendation and the work plan for integration and alignment of surveillance capabilities and directed staff to proceed with the plan as outlined. The governance plan establishes an interagency executive-level council and a technical staff to perform the engineering and analysis needed to develop joint requirements and an acquisition strategy. It also provides a process for elevating decisions when necessary through the National Security Staff's interagency policy coordinating process.

As governance is established, technical work is proceeding in several areas that will support joint requirements and a whole-of-government solution, including additional refinement of a near-term concept of operations, validation of non-cooperative surveillance requirements, and documentation of planned capabilities and capability gaps.

Q2. Unmanned aircraft systems, human factors, and weather are among some of the areas that the Transportation OIG and REDAC have identified as needing urgent attention, research, and planning at a cross-agency level. How is the JPDO responding to their recommendations?

A2. The JPDO, recognizing the importance of Unmanned Aircraft Systems (UAS) to both the public and private sectors, brought the need for interagency research and planning to the attention of the Senior Policy Committee in July 2010. Subsequently, the JPDO and the Air Force Research Laboratory (ARFL) co-sponsored a workshop to focus on critical and cross-cutting long-term research challenges associated with flying UAS in a future NextGen trajectory-based operations airspace. NASA, DOD and FAA participated in the workshop. Technical teams were formed to examine research relating to human factors, sense and avoid/communications and air vehicles. These three teams continue to work to identify current activities for long-term integration of UAS into the national airspace system, map interagency research and develop opportunities for collaborative demonstrations. A top-level summary of the initial workshop is posted on http://www.jpdo.gov.

The JPDO recommended to the JPDO Board, at its February 2011 meeting, a plan to use the workshop outcomes as the basis for developing a UAS research, development and demonstration roadmap to identify the long-term research choices. The JPDO convened executive leadership from the agencies to set particular direction for roadmap development in March 2011. The next steps are to establish a work charter and to produce an initial roadmap.

In February 2011, the JPDO released the "NextGen Human Factors Research Coordination Plan." This plan, developed by the FAA and NASA in conjunction with the JPDO, formalizes the coordination process between these two agencies for human factors research. It also begins an annual coordination process to review planned research efforts, identify gaps, monitor and evaluate progress, and report results. The coordination process leverages GAO-recommended best practices to help enhance and sustain collaboration among Federal agencies.

The JPDO's Weather Working Group has been working over the last several years to define concepts, develop architectural designs and demonstrate IT and net-centric capabilities for near-term infrastructure improvements for NextGen. Parallel to that effort is the needed improvements to the accuracy of digital weather information provided to the FAA to enable integration and with improved performance of air traffic management processes and systems. These improvements will require con-

tinuing research and development efforts from governmental, private sector, and academic institutions to realize NextGen requirements. Our Weather Working Group and continues the work to define overarching science and technological challenges and gaps that exist in R&D to meet those challenges. Initial improvements from R&D efforts include better turbulence and icing forecast predictions, as well as the demonstration of thunderstorm forecast improvements for air traffic management. We will continue to work with the NextGen partners in the working group to develop a plan to leverage research efforts currently in place, and identifying and incorporating new R&D required to meet NextGen goals for optimized air travel.

Q3. The Transportation OIG says that FAA now plans to complete the En Route Automation Modernization also known as ERAM in 2014—a schedule slip of 4 years. However, the OIG also says that FAA and its contractor plan to add new capabilities at the same time it is attempting to resolve problems identified in earlier software versions-which could further schedule delays.

a. Does it make sense to add new capabilities to an unstable system?

A3a. The FAA has made significant progress in the deployment of ERAM. The Salt Lake City (ZLC) and Seattle (ZSE) Key sites have been operating in an Operational Suitability Demonstration (OSD) phase since October 19, 2010 and November 13, 2010, respectively. The FAA is executing the plan agreed to with the Office of Management and Budget (OMB) to ensure we have repeatable processes with entrance and exit criteria prior to delivery of software releases to sites for operational use. Additionally, there is a measured benchmarking process used at the sites to ensure that the software builds are mature and the site is able to progress through a controlled process of initial, extended, and continuous operations. Given the improvements in strategy and processes, some software development of new capabilities in parallel with the waterfall rollout of ERAM is a manageable activity.

For example, upgrading the D-side position is necessary to future NextGen applications including the en route data communication applications, advanced conflict probe functionalities including conflict resolution advisories and integration of weather onto the planning display. This also addresses the industry recommendations included in the Task Force 5 recommendations on future en route data communications.

b. Is the contractor incurring any penalties for the delays?

A3b. To date, there have been no contractual penalties incurred. However, going forward, the FAA has strengthened the acceptance criteria in the contract for future ERAM software releases to help ensure higher quality software in the operational builds.

Q4. A Continuing Resolution at FY08 budget levels, or lower, would translate into significant cuts for all agencies. How would FAA prioritize its research under those conditions?

A4. Conducting current research activities at the FY 2008 levels ($147M) would present challenges. This would be approximately a 23% reduction from the FY 2011 request level. This reduction would require a reevaluation of all research activities and severely impact the ability of the FAA to meet goals stated in the past National Aviation Research Plans (NARP). This reduction would have significant impacts on all areas of FAA research. Since safety is our highest priority, the most substantial reductions will be in other areas, but there will be significant impacts to our safety research programs as well.

A reprioritization of the research portfolio would be coordinated by the R&D Executive Board (REB), which is responsible for strategic planning and budget formulation for research in the FAA. The REB members represent the FAA lines of business (associate administrators) and assistant administrators who sponsor or manage funds for R&D programs. The REB would review all currently planned programs and reprioritize them taking into consideration the balance between current safety requirements and future NextGen requirements. The REB would also coordinate the reprioritization with the NextGen Integration and Implementation Office.

Q5. The REDAC found that the aircraft icing program's very limited in-house expertise requires FAA to rely heavily on partners and grantee/contractors to manage their programs. As a result, the REDAC recommended that FAA review the current "bench strength" and take appropriate hiring action to assure continuity in technical strength well into the future. What is the FAA doing to address the REDAC's recommendation?

A5. The FAA recognizes the need for additional in-house expertise in atmospheric and aerodynamic science and engineering and has addressed it in the short term by developing research partnerships with NASA, the U.S. National Center for Atmospheric Research, National Research Council Canada, Environment Canada, other national research organizations and academic institutions. For the longer term, the FAA had planned to add to our technical staff, starting with a research meteorologist. Unfortunately, due to current budget constraints and the ceiling on federal positions in the RE&D appropriation, we will not be able to add staff in this area at this time. We will pursue our hiring plans if the situation changes. In the meantime, we will continue to work with the Aircraft Icing Chief Scientist and Technical Advisor (CSTA) and our research partners to ensure the needed technical strength in the aircraft icing research area.

ANSWERS TO POST-HEARING QUESTIONS

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

Questions submitted by Chairman Steven M. Palazzo

Q1. As a routine matter, to what degree does FAA build margin into their cost and schedule estimates for NextGen-related research projects and plans?

A1. FAA's initial NextGen plans were very ambitious and did not consider risk or build in sufficient margins to account for moving a complex, software intensive system from development into actual implementation. The Trade Space Analysis, led by the JPDO, examined FAA's vision for NextGen targeted for 2025 and showed that FAA did not sufficiently factor margins and risks into NextGen plans. This analysis showed that capabilities originally planned for 2025 will probably not be implemented until 2035 or beyond. Moreover, FAA's plans did not fully account for the costs and time for airspace users to equip with a wide range of NextGen avionics.

Q2. Your testimony highlighted difficulties encountered with initial ERAM testing at Salt Lake City, estimating that total cost growth could be as much as $500 million (based on a MITRE study). Does this estimate reflect added cost to the ERAM program alone, or does it also include cost increases associated with the delays of other NextGen-related technologies that are dependent on ERAM?

A2. Answer: FAA's estimate that the current cost growth for ERAM will be $330 million--which could increase to $500 million--reflects the effort required to complete the program as originally planned. The delays associated with NextGen, and related efforts, such as data communications for controllers and pilots, are not included in the estimate and have yet to be determined.

Questions submitted by Representative Jerry F. Costello

Q1. In your view, what are the impediments to FAA's implementation of your organization's recommendations and what should be done to address those impediments?

A1. FAA has concurred with most of our recommendations to reduce risk with developing and implementing the multibillion-dollar NextGen initiative. The problem, however, has been following through to complete actions needed to fully respond to and ultimately close our recommendations. We have found that impediments to FAA's response to our recommendations mirror those that FAA faces in advancing NextGen. These include overall complexity of the effort, lack of firm requirements, and a culture highly resistant to change that focuses on running the current system. For example, in responding to our recommendations for leveraging other Federal research and completing an integrated budget document, FAA officials also told us that a ″not invented here attitude″ is a factor in limiting their progress. We will continue to track FAA's progress with NextGen and how it implements our recommendations.

Q2. How would you prioritize your organization's recommendations relative to NextGen? What would you recommend to FAA as the top 5 priorities and would those priorities be the same if FAA's budget gets cut significantly?

A2. In our statement, we outlined areas where FAA needs to take actions to better manage its NextGen long-term efforts. The current budget environment underscores the urgent need for FAA to strengthen the multi-agency approach, better leverage Federal research, and prevent duplicative efforts. The following actions are needed regardless of the funding level Congress provides for FAA's long-term NextGen efforts:

- Establish research priorities and develop an integrated NextGen budget document that better aligns with partner agency resources: Without an integrated budget document that identifies the NextGen funding and R&D priorities of all the partner agencies, Congress will not be able to determine if the right research is being conducted and if the Government is making the best use of taxpayer dollars.
- Clarify the role of the JPDO: There is confusion within FAA and the industry about JPDO's role in advancing NextGen along the lines of development, sim-

ulation and modeling, technical transfer and policy issues. FAA must clarify JPDO's role so it can move forward and provide value to NextGen efforts.

- Finalize performance goals and metrics for NextGen: Although there are broad goals for what NextGen should accomplish, there are no clear, specific goals for performance capabilities or metrics for FAA and industry to measure accomplishments.
- Leverage DOD research and development for NextGen: Neither FAA nor the JPDO have fully assessed DOD's vast research and development portfolio to determine if DOD's completed work could be useful in meeting NextGen goals without incurring cost, time, and risks to ″re-develop″ needed capabilities.
- Secure necessary expertise to execute NextGen: A recent National Academy of Public Administration study identified weakness and gaps in the FAA workforce that, if left uncorrected, could impede FAA's efforts to execute NextGen.

Q3. How could FAA and JPDO better leverage DOD's R&D base in developing NextGen?

A3. As we noted in our statement, DOD contributes to NextGen as a member on various committees, boards, and work groups. DOD has also taken the lead in the area of net-centric operations and is working with FAA and JPDO on surveillance issues. However, neither FAA nor the JPDO have done a complete assessment of DOD's vast research and development portfolio. DOD's experience with enterprise architecture development, large-scale systems integration, and overall management of high-risk efforts could prove useful. Moreover, FAA could leverage DOD technology such as satellite-based Joint Precision Approach and Landing System to reduce risk with FAA's precision landing systems for NextGen. In response to our June 2010 recommendation, FAA agreed to develop a plan to review and identify DOD research and technologies that could be used for NextGen and establish mechanisms to transfer the information to FAA. According to JPDO officials, this effort should be completed this year.

Q4. In your view, do NextGen implementation schedules reflect the time to complete necessary environmental R&D and policies? If not, how much additional time should be appropriately added?

A4. FAA's plans for NextGen in the near, mid-and long-term do not fully reflect the risks associated with resolving various environmental issues and policies. For example, FAA notes in its most recent NextGen Implementation Plan that environmental reviews could delay new routes that take advantage of precise navigation equipment on aircraft. Further, FAA's Trade Space Analysis underscored the need for greater attention to carbon emissions and noise generated by aircraft. We have not conducted a review of NextGen environmental issues and therefore are not in a position to comment on how much time should be added to NextGen program schedules to resolve them.

ANSWERS TO POST-HEARING QUESTIONS

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

Questions submitted by Chairman Steven M. Palazzo

Q1. When talking about FAA's research portfolio, you stated that research is needed in fundamental and applied areas to support implementation of NextGen enabled activities, specifically mentioning research in procedure development, and development and testing to support future certification and environmental approval. You also suggested there was much more work still to be done. What other lines of research should FAA pursue in order to enable full operational benefits of NextGen?

A1. In order to achieve significant operational benefits from the NextGen investment it will be necessary to change the operational procedures to take advantage of the improved performance from the advanced NextGen Communication, Navigation and Surveillance infrastructure. If we only use these technologies to fly our current procedures and separation standards the operational benefit will be limited. Research is needed to support the definition of new high performance procedures and new ways of operating. The research should also provide data to support the safety analysis required for operational approval. It is extremely difficult to prove that a new NextGen procedure will not compromise the extraordinarily high level of safety slowing down NextGen implementation. Research in new approaches to safety analysis may provide approaches which will allow implementation of the high benefit NextGen procedures while assuring that the high level of safety of the system is maintained. A similar need for innovative research exists in the environmental domain.

Questions submitted by Representative Jerry F. Costello

Q1. In your view, what are the impediments to FAA's implementation of R&D Advisory Committee (REDAC) Recommendations and what should be done to address those impediments?

A1. The FAA has responded to all REDAC recommendations and has developed a formal tracking process to monitor the response to REDAC recommendations. In some cases the FAA is limited in it's ability to implement recommendations due to resources, personnel, culture or other higher priority issues which slow the response. In some cases the FAA may disagree with the REDAC recommendations.

Q2. How can the Congress assess whether initial NextGen building blocks are achieving intended delay reductions in the absence of clearly defined metrics to measure benefits.

A2. There is good tracking of delay data at the airport, facility and system level, which is reported by the FAA and the Bureau of Transportation Statistics so it is possible to track the overall delay trends. There are a number of factors which make it difficult to attribute delay reduction to specific NextGen building blocks. First, changes in traffic demand and weather conditions will change the baseline delay expectation and confound the delay data. Second, NextGen will require multiple "building blocks" as well as new procedures in order to achieve delay reduction. A single "building block" such as ADS–B, RNP or 3D trajectory management will have limited benefit on it's own without the other elements.

Q3. You state that 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. Why is this important and has the FAA responded to the REDAC's concerns? What should be the role of the JPDO in the development of the R&D plan?

A3. A high level Research and Development plan is necessary to define and prioritize research requirements as well as to provide the context for the different research elements and for the stakeholders to have a clear vision of the system under development. It is also useful in managing the risk in the development program and coordinating with the various stakeholders who contribute to or are investing in the NextGen system.

The initial JPDO NextGen Integrated Plan followed by the Operation Concepts documents were good motivational documents which outlined the desired directions for NextGen but were too general to clearly define research requirements. Subsequently the JPDO defined a vast set of Operational Improvements which were uneven in detail are so numerous that it is difficult to identify clear priorities. The FAA's NextGen Implementation Plan is a reasonable high level document but it is limited to mid term implementation.

Both the JPDO and the FAA have taken an Enterprise Architecture approach to define the details of the NextGen program. This approach, taken from DOD acquisition, is designed for managing complex acquisition programs. It is useful for managing the acquisition parts of NextGen but is extremely detailed and complex. Most who attempt to use the Enterprise Architecture to understand NextGen find it intractable and it would be extremely useful to have a higher level Research and Development plan which is consistent with and traceable to the lower level and more detailed Enterprise Architecture elements. In the initial development there was an intent to link the Enterprise Architecture to research requirements. The REDAC applauded this effort but has not been briefed on the results so it is unclear if this has been done.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Mr. Peter Bunce, President and CEO, the General Aviation Manufacturers Association

Questions submitted by Chairman Steven M. Palazzo

Q1. Once an alternative aviation gasoline candidate has been developed, how long do you estimate it would take to get the fuel certified?

A1. There are two steps required to "certify" an alternative fuel. First, is an assessment and qualification of a potentially viable candidate through the establishment of an aviation fuel specification which is typically done at ASTM in coordination with FAA, manufacturers, and fuel producers. This step provides the definition and control necessary for use in aviation. This can be expected to take 2–4 years depending on how different the fuel is.

Second, FAA must certify or approve all existing engines and aircraft to allow them to operate using the new avgas fuel. Depending on how different the fuel is and whether any engine modifications are required, certification/approval of the existing fleet to support a complete transition could take several years. The automotive industry transition from leaded to an unleaded fuel took a decade to accomplish and industry did not have to wait for government certification.

Q2. And in your view, what's the safest and most effective path for certifying legacy aircraft engines and fuel systems?

A2. First, we will need FAA research and development conducted, in partnership with industry, to develop the appropriate certification guidance, standards, processes and regulations necessary to certify/approve the existing fleet of engines and aircraft to transition to an alternative unleaded avgas. Second, FAA will need to determine which of the existing fleet of engines/aircraft it can approve to transition seamlessly to operate on an unleaded avgas. Finally, FAA and industry must work in collaboration to identify, evaluate and certify the modifications necessary for the remaining part of the fleet that could not transition seamlessly to an unleaded avgas

Questions submitted by Representative Jerry F. Costello

Q1. What is the nature of the testing that will be performed at the Tech Center with regards to alternative fuels?

A1. Testing will be focused on the assessment of fuels and on the certification approval standards for engines and aircraft.

For fuels, the testing will support the development of assessment and qualification guidance, standards and processes appropriate for proposed alternative unleaded avgas candidate fuels. For example, the testing will evaluate the minimum fuel performance requirements necessary to ensure it is fit for aviation use including high/low temperature characteristics, anti-knock tests, and the development of a performance scale for unleaded fuels. The testing will also assess exhaust gas emissions to ensure there are no potential new issues/concerns that would be unacceptable to FAA/EPA.

For engines and aircraft, the testing will support the development of appropriate FAA certification guidance, standards, processes and regulations necessary to certify/approve the existing fleet of engines and aircraft to transition to an alternative unleaded avgas. These will include determining the tests or limits necessary for safety to address differences in fuel composition, properties and performance and determining which engines/aircraft can operate safely on the alternative unleaded avgas and which engines/aircraft may need modifications.

Most of these testing requirements are included in the FAA's draft research plan and 5-year master schedule which was developed in support of the proposed FY11 R&D program on alternative fuels for general aviation requesting $2M per year 2011–2015 (*http://www.crownci.com/download/NAAFRP.pdf*).

Q2. How long do you think it will take before a new fuel is developed that is both economical and safe to use by the General Aviation Community?

A2. With the support necessary from FAA and EPA, GAMA believes an unleaded avgas can be developed by industry and independently assessed and qualified by ASTM and FAA within 2–5 years that is potentially viable from both a safety and cost per gallon perspective. The identification of a viable unleaded avgas by May

2013 is a key decision point in the FAA's draft alternative fuels for general aviation research plan.

However, the total economic impact of an alternative fuel will require an appropriate transition period commensurate to the level of impact upon the existing fleet of aircraft (of up to 10-years) to ensure that current owner/operators of aircraft that may not be able to transition without some form of modification and re-certification can plan accordingly. This type of a transition period is consistent with the automotive industry shift from leaded to unleaded fuel.

Q3. What do you see as the biggest remaining impediments?

A3. The biggest impediments include lack of appropriate coordination and support from government agencies particularly if EPA fails to coordinate their policy and regulatory activities with FAA and industry; lack of political support for the funding necessary to support this transition; the current economic climate that impacts the level of private sector resources and investments to address this problem; and claims of a "quick-fix" solution that distracts and diverts resources from FAA and industry efforts to take a deliberate, well-thought out approach to addressing this issue.

Q4. Can you expand on your remarks regarding the need for NextGen research to benefit all segments of the aviation system? Would projected improvements for air carriers be similarly applicable to the General Aviation community? If not, what else needs to be done?

A4. General aviation is the most diverse segment of civil aviation. It is commonly accepted that the NextGen program was established to address air carrier delays and congestion, while building overall National Airspace System (NAS) capacity.

The foundational technologies that drive the NextGen evolution for Communications, Navigation and Surveillance (CNS) are data link communications (C), performance based navigation (N), and Automatic Dependent Surveillance Broadcast (S) each of which are in various degrees of maturity, deployment, and benefit to different segments of aviation.

In the case of general aviation, performance based navigation is providing real benefits to operators today through the deployment of the Wide Area Augmentation System (WAAS) capability in the NAS which enables enhanced navigation and approaches for general aviation. With respect to ADS–B, general aviation is recognized as incurring significant cost with limited benefits for "Out" [see quote in FAA rule at Federal Register Volume 75 at 30187 "General Aviation: High Equipage Cost with Little Benefit"] and with respect to "In" only five of the seventeen applications in the FAA's work plan are believed to be relevant to light general aviation operators [see FAA Applications Integrated Work Plan (AIWP) Version 2, June 2010]. Finally, in the case of data link communications, light general aviation is likely to not deploy this technology, while high-end general and business aviation struggle to achieve a positive cost-benefit ratio for those airspace areas where data link will be deployed in the near term such as in North Atlantic Oceanic operations. General aviation in many cases will be equipping for the principal reason of maintaining access to airspace and airports.

Since the program for NextGen is built around air carrier operations, we similarly see the research prioritized toward air carrier operations and uses. While this is the correct prioritization, GAMA believes that all segments must be considered. Some targeted general aviation research is funded and underway in the ADS–B program to develop a more advanced collision avoidance system. GAMA, as well as one of our member companies, is currently involved in this research program and we applaud the FAA for guiding research funds toward the development of this application.

However, more needs to be done. We would encourage the FAA to look further into human factors issues surrounding the deployment of data link for business aviation operators who often conduct single pilot operations. Similarly, the agency needs to look further into how to smartly enable the deployment all NextGen technologies into the NAS for small operators in a streamlined fashion that does not bury the operator (or the agency) under volumes of red tape with respect to approvals. Additionally, the FAA must look at tailoring requirements for equipage so that small aircraft (those certificated under Part 23) can cost-effectively deploy the equipment in an efficient manner while ensuring that safety is properly addressed. This does not mean that the same equipment requirements for avionics such as ADS–B must be applied to small airplanes, but we must through research look to innovative ways in which the requirements can be scaled.