

Statement of

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before the

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House Committee on Science
U.S. House of Representatives**

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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.

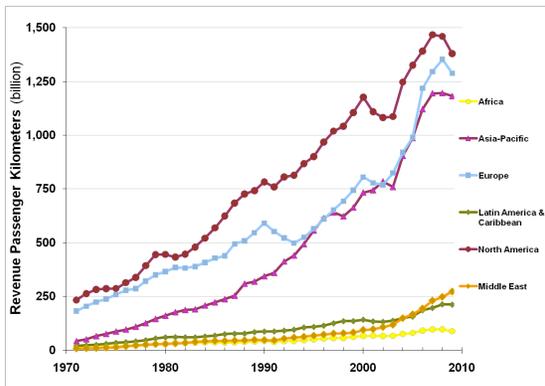


Fig. 1. Passenger Demand Trends (ICAO)

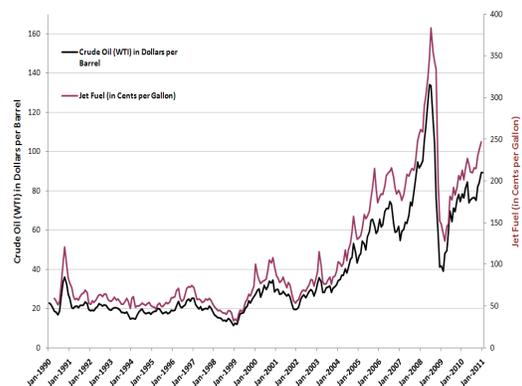


Fig. 2 Fuel Price Trends (EIA, ATA)

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.

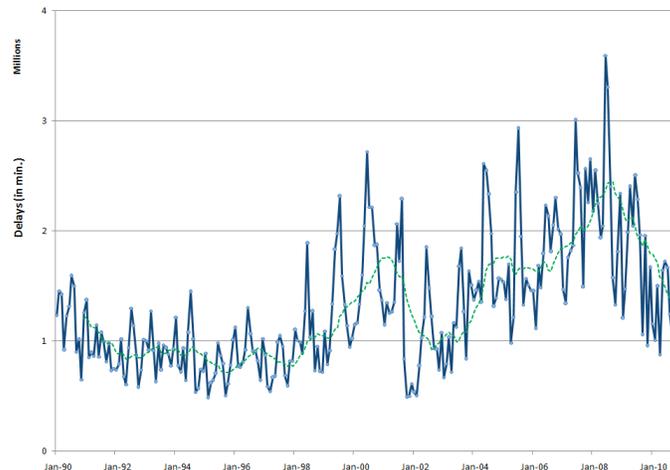


Figure 3. U.S. Delay Data (FAA OPSNET)

At the time NextGen was initiated, delay was the key issue motivating system improvement with assumptions of a 3 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 approval 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.