

# JPDO Paper

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## Environmental Management System Strategy and Framework for the Next Generation Air Transportation System

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Prepared by: Joint Planning and Development Office (JPDO), Environment Working Group

The goal to increase National Airspace System (NAS) capacity to meet projected growth in the demand for air transportation is inextricably linked with the need to mitigate aviation environmental impacts and manage related energy issues. Research and development, technology innovations, alternative fuels, air traffic management and flight procedures, and airport practices will be critical to counter the environmental and energy pressures that an increase in air transportation demand will place on the natural and human environment.

A strategic Environmental Management System (EMS) approach will provide the foundation for integrating environmental protection and energy goals into the core business and operational strategies of the Next Generation Air Transportation System (NextGen).

The most common framework for an EMS—and the framework that will be applied for NextGen—is the Plan-Do-Check-Act process, with the goal of continual improvement in the aviation industry’s environmental performance. The EMS framework is intended to facilitate an effective environmental management approach, which will ensure that the overarching performance goal of *environmental protection that allows sustained aviation growth* is built into all aspects of NextGen.

ISO-14001 is the predominant, internationally accepted EMS standard used by industry, Federal agencies, and organizations around the world. It will also serve as the basis for the NextGen EMS framework. The use of ISO-14001 elements to structure an appropriate EMS framework for NextGen ensures formal, rigorous management of environmental aspects and the reliable accomplishment of goals and targets.

A generalized approach for implementation of the NextGen EMS framework is provided in this paper. For more details, refer to the JPDO Integrated Work Plan<sup>1</sup> and the FAA National Aviation Research Plan<sup>2</sup>.

## **Environmental Management System Strategy and Framework for the Next Generation Air Transportation System**

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An Environmental Management System (EMS) provides the foundation for integrating environmental protection and energy goals into the core business and operational strategies of the Next Generation Air Transportation System (NextGen) to achieve environmental protection that allows sustained aviation growth.

Aviation capacity demands are expected to increase over the next 15 to 20 years. The achievement of sustainable growth requires an Air Transportation System that is safe and secure, flexible, resilient, scalable, adaptive, highly automated, and environmentally sound. The primary environmental and energy concerns that are significant for aviation are aircraft noise, air quality, global climate effects, energy, and water quality. Associated with these are a broad range of issues, interdependencies, and stakeholders that present an extremely complex management paradigm. Without aggressive and concerted actions, aviation growth is likely to worsen environmental performance and increase impacts that, in turn, can constrain aviation growth. Goals to increase National Air Space (NAS) capacity require a complementary increase in the ability to adequately address and mitigate aviation environmental impacts and manage related energy issues.

Aggressive research and development (R&D) programs will be critical to advance our scientific understanding of complex environmental interactions, our technical capabilities to predict interrelated environmental consequences and maximize cost-beneficial mitigation strategies, and our capacity to develop and implement environmental and energy improvements apace with aviation growth<sup>3</sup>. A number of transformational advances will be necessary to reduce aviation's environmental footprint and energy consumption, including: (i) aircraft, engine, and fuel technologies, (ii) aircraft operations (iii) air traffic management procedures with companion fuel efficiency and environmental benefits, and (iv) sound environmental practices at airports. Technology and operational improvements must be combined with a more flexible, information driven, adaptive, and systematic approach to managing environmental issues.

Implementation of a strategic EMS framework will be an important approach to managing the environmental and energy performance aspects of NextGen. The EMS approach is intended to help organizations with aviation responsibilities manage complex and dynamic environmental challenges. EMS principles will provide a foundation for integrating environmental protection and energy goals into the core business and operational strategies of NextGen. The implementation of NextGen EMS by NextGen stakeholder organizations will play an increasingly important role in achieving the environmentally sustainable growth of air transportation.

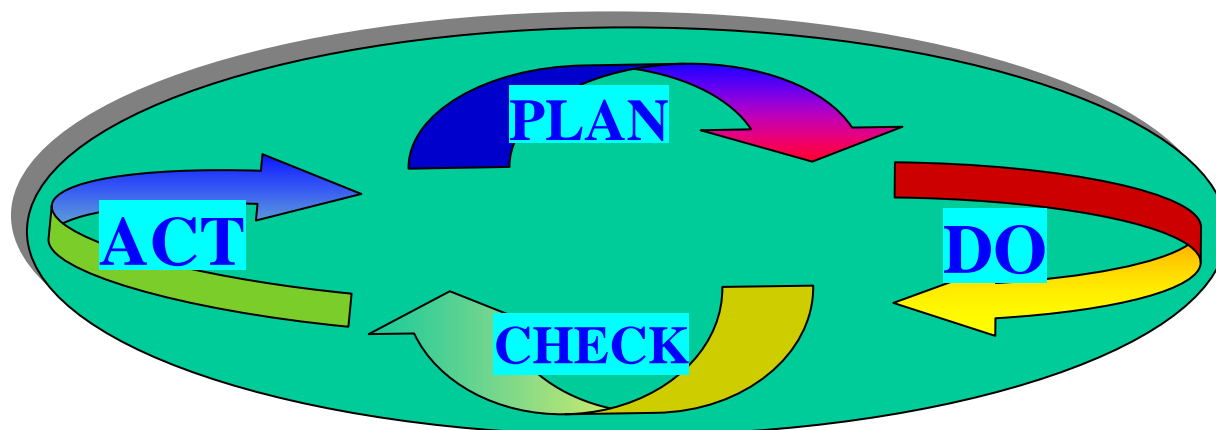
EMS emerged in the early 1990s to provide organizations with a proactive, systematic approach for managing the potential environmental consequences of their operations. Subsequently, public and private organizations have increasingly adopted EMSs to address their environmental responsibilities. On January 24, 2007, the President issued Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*. This Executive Order requires that EMS be used as the primary management approach for addressing

environmental aspects of government agency operations and activities. It establishes clear environmental goals and requires the implementation of EMSs at all appropriate organizational levels of Federal agencies to meet these goals. These requirements were retained and expanded by Executive Order (EO) 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, signed by President Obama on October 5, 2009. EMS implementation is therefore mandatory for Federal agencies, but many private sector organizations have also implemented EMSs voluntarily. The NextGen environmental framework will encourage NextGen stakeholders with EMSs to incorporate significant NextGen environmental aspects to meet NextGen targets and goals. It will also promote implementation of EMS by organizations that do not yet have one.

EMS provides organizations of all types with a structured system and approach for managing environmental and regulatory responsibilities to improve overall environmental performance and stewardship, including product design, resource conservation, energy efficiency, and other sustainable practices. EMS facilitates the integration of the full scope of environmental considerations into the mission of the organization. Environmental performance is improved by establishing a continual process of checking to ensure that critical concerns are identified, goals and targets for addressing those concerns are set, and progress is made towards achieving those goals and targets. EMS encourages preventive action to avoid problems, and includes procedures for taking corrective action if environmental performance is not being adequately addressed.

The most common framework for an EMS—and the framework that will be applied for NextGen—is the Plan-Do-Check-Act process, with the goal of continual improvement in environmental performance (see Figure 1). Similarly, the NextGen EMS contains a self-correcting feedback cycle that systematically identifies, manages, monitors, and adapts to the environmental demands of the high volume and dynamic nature of NextGen. The EMS framework is intended to facilitate an effective environmental management approach that can be adopted by all applicable NextGen stakeholders, including airlines, airports, manufacturers, and government organizations with aviation responsibilities, and ensure that the overarching performance goal of *environmental protection that allows sustained aviation growth* is built into all operational aspects of NextGen.

**Figure 1. Plan-Do-Check-Act Process**



NextGen EMS will be based on sound, proven, internationally recognized EMS principles. ISO-14001 is the predominant, internationally accepted EMS standard used by Federal agencies and other entities that currently have EMSs, and will be used as the basis for developing NextGen EMSs. ISO-14001 supports operational environmental management through the above illustrated cycle of continuous planning, implementing, checking, and readjustment. The use of ISO-14001 elements to structure appropriate EMSs for NextGen ensures formal, rigorous management of environmental aspects and the reliable accomplishment of goals and targets.

## **Plan**

Initial planning efforts focused on identifying the significant environmental aspects of NextGen. These efforts identified aircraft noise, air quality, global climate effects, energy, and water quality as the most significant aspects. Ongoing planning efforts are establishing baselines and environmental goals for these significant aspect areas,—noise, air quality, water quality, climate, energy—, long-term targets for the system as a whole (i.e., at an enterprise level), and first generation metrics to characterize impacts and measure progress towards achieving goals. A goal, for example, would be to reduce significant community noise. A target will address more specifics regarding how much noise reduction and on what time scale. A metric (e.g., population exposed to 65 DNL) will provide a way of calculating and tracking performance. Goals, targets, metrics, and standardized approaches for measuring progress will be aligned with the planning for NextGen.

The next phase of EMS planning for NextGen will be to establish strategies and detailed plans to address and achieve the goals. This includes identifying existing and new strategies, initiatives, and processes, and integrating them into a system focused on the critical issues. This will involve multiple layers of planning. The FAA and other Federal and industry organizations have successfully employed this approach in the development of organizational level EMSs, and will continue to build upon the elements and components of EMSs that they already have in place. The identification of high level strategies—again at an enterprise level—will accompany the establishment of goals, targets, and metrics.

High level strategies must be supported by specific programs, activities, and initiatives at organizations responsible for various NextGen components. NextGen is a shared responsibility that involves effective planning, R&D, resource deployment, performance, and collaboration among multiple entities. The NextGen EMS framework will provide flexibility for organizations to develop more specific EMSs to manage the environmental performance of different aspects of NextGen within their areas of responsibility—e.g., research, technology development, operational enhancements, policy initiatives—to achieve near-term gains and long-term goals. Some organizations will have different abilities than others to affect a goal, so the targets in one organization's EMS for meeting a particular goal are expected to be different from another organization's for that same goal. NextGen stakeholder organizations will be encouraged to develop EMSs, or build upon their existing EMSs, in a way that is appropriate to their organization and operations. Identifying the specific contribution of organizations to NextGen environmental and energy aspects and establishing EMS responsibilities will be part of early tasks, as will determine effective ways to capture collective data on environmental performance.

## Do/Implement/Manage

Organizations responsible for NextGen components will implement EMSs to systematically manage environmental performance in conjunction with their primary aviation performance goals and parameters. The EMS implementation timeline will correspond with the broader NextGen timeline so as to support NextGen efforts as effectively as possible. There is a broad array of NextGen program areas to manage for environmental and energy aspects (noise, air quality, water quality, climate, energy), for example:

- Environmental improvements in airframe and engine technologies;
- Alternative fuels that can reduce environmental impacts;
- Advanced aircraft avionics to support operational capabilities that can also produce environmental benefits;
- Improvements in air traffic management that can reduce environmental impacts;
- Capabilities for Flight Management Systems (FMS), Required Navigation Performance (RNP), Area Navigation (RNAV), and energy management guidance that support en-route, terminal, and surface operations that can reduce environmental impacts;
- Development of airport infrastructure in an environmentally sound manner; and
- Improvements in surface operations that reduce fuel burn and emissions.

An EMS is intended to ensure that necessary actions are taken to integrate environmental accountability into day-to-day decision-making and longer term planning processes. The ability to identify root causes and their impact on the environment, and appropriately apply this information, can greatly facilitate successful EMS implementation. More effective use of information and advanced decision-support tools can offer substantial advantages in identifying and mitigating environmental impacts. Monitoring and modeling of selected environmental conditions will be used to ascertain progress and results. The ability to identify and collect key data and assimilate the data into an effective management tool is important for the long-term success of EMS.

The FAA will lead the way for other Federal and industry organizations by developing and implementing the first EMSs for NextGen. The experience gained through this endeavor will serve as a guide and model for other Federal agencies and non-Federal entities to address aviation related issues. Existing FAA organizational mechanisms for developing and implementing EMSs will be utilized to make the transition to EMSs for NextGen first within the FAA and then within other Federal and industry organizations. There is existing EMS policy signed by the Administrator on August 11, 2005, and an FAA directive (FAA Order 1050.21, *Environmental Management Systems*) issued in October 2007. The FAA has made excellent progress in implementing EMSs. The FAA has:

- Created organizational EMSs in conformance with the requirements of the Office of the Federal Environmental Executive;
- Established successful major initiatives within all lines-of-business (LOB);
- Implemented EMSs in the Airports Program Division Offices in each of the nine FAA Regions;
- Initiated implementation of EMSs in the staff office of Regions and Centers Operations; and

- Successfully achieved or moved towards third-party registration of several organizational EMSs (Registered EMSs are awarded an ISO 14001 certificate from a certification body that is accredited by an International Registrar Accreditation Board).

The FAA will integrate NextGen-related activities into the existing FAA EMS framework by first identifying the potential environmental impacts of NextGen activities. The FAA will then develop and implement management plans to control potential risks associated with these activities within its existing EMS framework. FAA's Office of Environment and Energy provides EMS policy, guidance, program oversight, and technical support to FAA organizations. There is also an FAA Steering Committee, led by the Director of Environment and Energy and composed of relevant FAA LOB and staff offices, that coordinates and guides the development, implementation, application, and maintenance of FAA EMSs. The Committee's mission is to "promote the efficient and effective management of the potential environmental impacts of FAA operations so that FAA can execute its mission in a sustainable manner through the development, implementation, and continual improvement of FAA Environmental Management Systems (EMSs)."

JPDO government partners are subject to the same direction and encouragement in the Executive Orders on EMS as the FAA. These agencies are anticipated to join the FAA within a fairly short time in applying the NextGen EMS framework. Non-Federal organizations responsible for NextGen components will be encouraged to use the EMS framework across a range of organizations and settings; however, there is no requirement for them to do so. The FAA will lead by example by developing, implementing, and maintaining EMSs for NextGen at appropriate organizational levels and will engage in outreach to promote the voluntary adoption of EMSs by non-Federal entities. In this regard, the Office of Airports has already taken action. Large to medium hub airports who desire to prepare an EMS for their airport are eligible for Airport Improvement Program (AIP) funding. The FAA will use its experience implementing EMSs, as well as its knowledge of the environmental and energy issues associated with NextGen, to develop strategies, plans, and specific initiatives that encourage NextGen EMS implementation across the NextGen enterprise. Central to this process are the communication and information transfer systems and tools that enable organizations to make decisions that are informed by environmental data. This will be facilitated through the development and use of net-enabling capabilities and Communities of Interest that aid in information sharing throughout NextGen.

### **Check/Monitor/Review**

Environmental performance will be regularly monitored using EMS processes to ensure that strategies and initiatives are working. Regular checks on the environmental status of the NAS, based on performance data, will provide feedback for evaluating strategic long-term goals and activities supporting the goals. Mechanisms will be developed for data collection and sharing, modeling and analysis of outcomes, and trends to gauge whether NextGen environmental goals are being achieved. The FAA will develop mechanisms and encourage other Federal and industry organizations to share information to provide a comprehensive integrated assessment of environmental performance.

The development and adoption of commonly used metrics, models, and decision-support tools will facilitate this part of the EMS cycle. Initially, legacy models, such as FAA's suite of

environmental models, which includes the Integrated Noise Model (INM), will be used to measure environmental performance. Environmental research efforts are producing integrated aviation noise and emissions models to provide information on trade-offs among impacts, and assist in the selection of optimum environmental performance characteristics. Increasingly sophisticated metrics to characterize environmental impacts are expected to be available. EMSs will mature to measure and support integrated environmental performance.

As individual organizations use the models and tools to measure environmental performance, a variety of mechanisms will be developed so that information can be communicated to other key stakeholders across the enterprise. This will ensure the most current information is available to inform activities and provide organizations with quick and easy access to current tools, models, and science to inform their planning activities. Mechanisms will be appropriate to specific reporting requirements and data needs. For example, some data may only require periodic environmental reporting, while in other cases there may be benefits to continual, real-time monitoring. Therefore, it may be possible to establish simple systems for periodic reports, where in other cases the NextGen EMS framework will leverage larger NextGen information systems to assess the environmental impacts of traffic flows, proposed routes, or changes in airspace and operations.

### **Act/Improve/Adapt**

The EMS cycle of planning, implementing, checking, and re-adjustment leads to ongoing adaptations based on feedback, and continual improvement of the system to focus on environmental performance improvement with ever more certainty and efficiency. This enables managers to receive process, disseminate, and act upon reliable information. Environmental strategies and initiatives for NextGen will be adapted and improved based on information received through monitoring.

The NextGen EMS framework (see Figure 2) will use information on environmental and energy performance, as well as system performance to adjust technology, operational procedures, programs, guidance, and policy. As the scientific understanding of aviation's impacts is improved through a better characterization of health and welfare impacts, environmental and energy goals, targets, metrics, and models will be refined. Similarly, EMSs may be adjusted according to changing environmental protection needs identified through on-the-ground monitoring, new technological and operational capabilities, or changing conditions. Systems for data collection, models to assess environmental impacts, and tools to help decision makers will be increasingly refined.

There will be future advances in automated collection of applicable data and real-time calculations, and mitigation of aviation's environmental impacts and energy use. Standardized processes will be available to calculate environmental benefits automatically across programs and for different operational scenarios. A network of environmental communication, providing instant access to key environmental data and targets, will enable access to the best possible information to assist in selecting and implementing cost-beneficial management options.

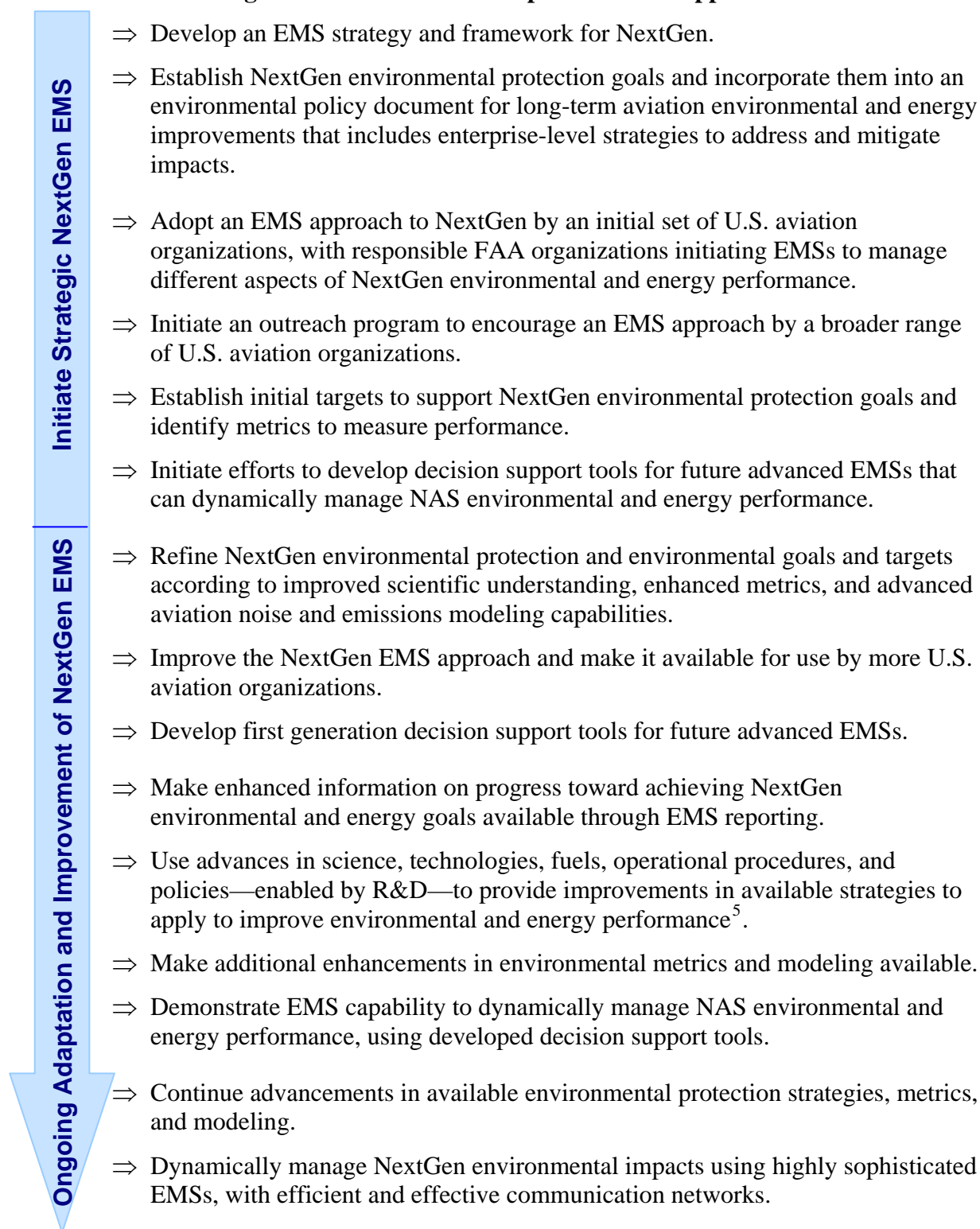
Figure 2. NextGen EMS Concept



A generalized approach to implementation is provided in Figure 3. For more details, refer to the JPDO Integrated Work Plan<sup>1</sup> and the National Science and Technology Council (NSTC) National Aviation Research Plan<sup>4</sup>.



**Figure 3. NextGen EMS Implementation Approach**



The JPDO Environment Working Group will collaborate with key partners—i.e., other JPDO Working Groups, Federal agencies, industry, and non-governmental organizations—to implement this EMS strategy and framework.

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### Document Revision History

VERSION	DATE	DESCRIPTION
Draft 0.1	January 31, 2008	Initial draft completed by JPDO Environment Working Group
Draft 0.2	March 31, 2008	Revised draft completed by JPDO Environment Working Group
Draft 0.3	April 21, 2008	Transmitted to Partnership Management Div
Version 1.0	August 15, 2008	Transmitted to JPDO Integration Council
Version 1.0	August 2008 – May 2009	Comments received from JPDO divisions and Working Group
Version 2.0	July 29, 2009	Transmitted to JPDO Board
Version 3.0	November 2010	Revised per JPDO Board Comments
Version X.X	TBD	Published on JPDO Web site

<sup>1</sup> Joint Planning and Development Office, *Next Generation Air Transportation System Integrated Plan* ([http://www.jpdo.gov/library/NGATS\\_v1\\_1204r.pdf](http://www.jpdo.gov/library/NGATS_v1_1204r.pdf))

<sup>2</sup> Federal Aviation Administration, *National Aviation Research Plan (NARP)* ([http://www.faa.gov/about/office\\_org/headquarters\\_offices/ato/service\\_units/nextgen/research\\_planning/narp/media/pdf/NARP\\_08.pdf](http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/nextgen/research_planning/narp/media/pdf/NARP_08.pdf))

<sup>3</sup> National Science and Technology Council, *National Plan for Aeronautics Research and Development and Related Infrastructure* (<http://www.ostp.gov/galleries/defaultfile/Final%20National%20Aero%20RD%20Plan%20HIGH%20RES.pdf>)

<sup>4</sup> National Science and Technology Council, *National Aviation Research Plan*

<sup>5</sup> National Science and Technology Council, *National Aeronautics Research and Development Policy*, (<http://www.ostp.gov/pdf/nationalaeronauticsrdpolicy06.pdf>)