THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

May 5, 2014

The Honorable John D. Rockefeller IV
Chairman
Committee on Commerce, Science,
  and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

As the Chair of the Next Generation Air Transportation System (NextGen) Senior Policy Committee (SPC), I am pleased to submit an annual report, as required by the FAA Modernization and Reform Act of 2012 (P.L. 112-95). The Partner Agency Progress Report for 2012 provides a description of the progress made in carrying out the integrated work plan and a comprehensive view of the overall NextGen investment.

In Fiscal Year 2012, under the direction of the SPC, the NextGen partner agencies collaborated on key initiatives identified in the NextGen Integrated Work Plan to transform and advance the Nation's air transportation system. Our partner agencies are the U.S. Departments of Commerce, Defense, Homeland Security, and the National Aeronautics and Space Administration. Collectively, the agencies achieved significant progress in three critical NextGen areas: integrated surveillance, unmanned aircraft systems integration planning, and interagency data exchange.

We look forward to the continued collaboration of the partner agencies as we implement NextGen. Together we will establish and maintain a national air transportation system that meets the present and future civil aviation, homeland security, economic, environmental protection, and national defense needs of the United States.

A similar letter has been sent to the Chairman of the House Transportation and Infrastructure Committee; Ranking Member of the Senate Commerce, Science, and Transportation Committee; and Ranking Member of the House Transportation and Infrastructure Committee.

Sincerely,

Anthony R. Foxx

Enclosure

THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

May 5, 2014

The Honorable John Thune
Ranking Member
Committee on Commerce, Science,
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United States Senate
Washington, DC 20510

Dear Senator Thune:

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Anthony R. Foxx

Enclosure

THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

May 5, 2014

The Honorable Bill Shuster
Chairman
Committee on Transportation
   and Infrastructure
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

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Committee (SPC), I am pleased to submit an annual report, as required by the FAA
Modernization and Reform Act of 2012 (P.L. 112-95). The Partner Agency Progress Report for
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Committee.

Sincerely,

Anthony R. Foxx

Enclosure

May 5, 2014

The Honorable Nick J. Rahall, II
Ranking Member
Committee on Transportation
   and Infrastructure
U.S. House of Representatives
Washington, DC 20515

Dear Congressman Rahall:

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Anthony R. Foxx

Enclosure

NextGen Partner Agency Progress Report
December 2013

Table of Contents

NextGen Partner Agency Progress Report
Fiscal Year 2012

EXECUTIVE OVERVIEW

The Next Generation Air Transportation System, or NextGen as it is more widely known, is an interagency initiative to modernize our nation's airspace system. It balances the existing system with new technologies to deliver improvements, such as satellite navigation and surveillance, digital communications, and automation capabilities while maintaining safety as a top priority. With fewer delays, increased airspace capacity and efficiency, and reduced emissions, NextGen is changing the way millions of Americans—travelers, airlines, pilots, and beyond—experience and manage air travel. This report documents key interagency initiatives guided by the NextGen Senior Policy Committee (SPC). Individual agency contributions are provided in more detail in agency specific reports such as the Federal Aviation Administration's (FAA) *NextGen Implementation Plan*.

NextGen is among the largest and most complex infrastructure projects in our nation's aviation history. FAA estimates that gridlock—both in the air and on the ground—could lead to $22 billion in lost economic activity by 2022 and more than $40 billion in such losses by 2033. NextGen will ensure that the U.S. aviation infrastructure has the capacity, efficiency, flexibility, safety, security, and environmental elements needed to meet air travel demands throughout the twenty-first century. The transformation to NextGen relies on multiple interdependent systems, both new and existing, and is enabled by a number of government partner agencies and stakeholders.

Together, NextGen partner agencies—which include the Departments of Transportation (DOT), Defense (DOD), Homeland Security (DHS), and Commerce (DOC), the FAA, the National Aeronautics and Space Administration (NASA), the White House Office of Science and Technology Policy (OSTP), and the Office of the Director of National Intelligence (ODNI) (ex officio)—plan and coordinate projects for safe and timely NextGen implementation.

Partner agencies have worked collaboratively in areas, such as Integrated Surveillance, Unmanned Aircraft Systems (UAS) Integration, and Interagency Data Exchange that are beneficial to NextGen progress. Data sharing is an important component of NextGen that optimizes the National Airspace System (NAS) by allowing NextGen partners to give and receive the right information at the right time to aid in decision-making. NextGen partner agencies are working to expand and create standards and protocols for data sharing, and are defining the roles and responsibilities for each agency regarding the timing, governance, and protection of proprietary data. Data sharing will be leveraged to improve situational awareness, which is essential to supporting evolving flight operations.

Multiple departments and agencies share a need for timely, accurate, and reliable air surveillance information. Each has an individual need for data and sensors to see aircraft and all activity in the NAS to meet its own mission. Integrated Surveillance creates a clear operational picture of a real- or near-real time situation within the nation's air transportation system, enhancing aviation safety, security, and efficiency. Partner agencies continue to provide high-level commitment and resources to support efforts that synchronize interagency Integrated Surveillance architectures, requirements, and investments.

In 2008, the Government Accountability Office (GAO) reported that the U.S. must develop a clear and common understanding of what is required to safely and routinely operate UAS in the NAS. Through the *FAA Modernization and Reform Act of 2012*, Congress emphasized the importance of UAS integration and NextGen partners were tasked to lead the development of several deliverables. A UAS National Plan included a program framework to define decision points for NextGen implementation in 2015 and beyond, a common Concept of Operations, and an initial framework to assess research and development priorities. In addition, a *UAS Comprehensive Plan* describes key components of UAS integration into the NAS.

One of the primary documents driving the transformation to NextGen is the Joint Planning and Development Office's (JPDO) *Integrated Work Plan (IWP)*. The IWP describes the transition to NextGen from current-state to end-state. Accordingly, the IWP intends to be a master-planning document that depicts the collaborative stakeholder efforts that are needed to implement the NextGen vision. It is important to note that the IWP describes numerous paths to realize the expected outcomes, but not the specific resources or implementation activities such as facility rollout, training, or decommissioning of systems. Following the definition of NextGen goals in 2004, partner agencies have performed an annual assessment of these goals to update the IWP. This allows them to prioritize needs, establish commitments, and focus resources on NextGen investments. The annual updates also reflect the high pace of change in technologies and air traffic, allowing for continuous performance monitoring and improved strategic planning.

The SPC—chaired by the Secretary of Transportation and comprised of the Secretaries and Administrators of NextGen partner agencies—was established to provide interagency policy guidance and coordinate NextGen decision making and resources within their respective agencies. The challenges inherent in multi-agency programs are complex and can present significant difficulties. NextGen can be impacted by competing goals from various agencies. The SPC provides the leadership necessary to overcome potential obstacles and successfully integrate agency programs and activities into a cross-functional NextGen environment.

In addition, JPDO identifies and integrates the commitments of the partner agencies to achieve NextGen goals. It facilitates day-to-day interagency coordination and ensures efficient collaboration between the agencies. Rather than coordinate on a situation-by-situation basis, the JPDO cuts across the agencies to plan, design, and implement NextGen. And because the JPDO maintains regular, on-site representation from the partner agencies, it understands their respective organizational cultures, making it uniquely poised to foster optimal NextGen progress.

The *FAA Modernization and Reform Act of 2012* includes responsibilities of the JPDO and SPC set forth in the legislation known as *Vision 100--Century of Aviation Reauthorization Act*, which established both entities in 2003. The 2012 Act adds responsibilities for the JPDO and its interagency partners, and requires the SPC to meet biannually. In support of the SPC, the JPDO governance structure has a Board, chaired by the JPDO Director, whose members include executives from each department/agency. These members meet quarterly and work continuously to resolve issues as directed by the SPC.

In Fiscal Year 2012, under the direction of the SPC, NextGen partner agencies collaborated to align their work with the capabilities described in the IWP. Collectively the agencies succeeded in achieving significant progress in the three critical NextGen areas previously described: Integrated Surveillance, UAS Integration Planning, and Interagency Data Exchange. The following sections of this Report describe the agencies' collective highlights of individual agency contributions to advancing the capabilities described in the IWP.

NextGen IWP Capabilities

As NextGen evolves, its partner agencies use cross-functional efforts to advance innovations that will be needed to ensure the NextGen vision is realized. As referenced earlier, the IWP describes the transition to NextGen from current-state to end-state. Capabilities within the IWP are described in the legend below. The following pages describe highlights of activities, both collaborative among and specific to the partner agencies. These efforts have advanced NextGen by supporting the IWP capabilities shown at the top of each section.

Collaborative Capacity Management
This capability provides the ability to collaborate with NextGen stakeholders to balance and assign resources for responding to dynamic airspace demands using design requirements, standards and configuration conditions.

Collaborative Flow Contingency Management
This capability optimizes and secures how airspace users manage major traffic flow issues by allowing for real-time resolution and decision making using established capacity management plans.

Efficient Trajectory Management
This capability offers the ability to assign flight trajectories that minimize the frequency and complexity of aircraft conflicts by allowing airspace users to negotiate and adjust individual trajectories.

Flexible Separation Management
This capability uses automation to establish and maintain safer, more reduced aircraft separation minimums by predicting conflicts and identifying appropriate resolutions in real time.

Integrated NextGen Information
This capability provides authorized airspace users with timely, accurate, and actionable flight information (like weather and air traffic) to improve situational awareness, while increasing efficiency and reducing decision cycles.

Air Transportation Security
This capability gives airspace users a way to identify and respond to potential security threats without compromising airline operations, safety, or civil liberties.

Improved Environmental Performance
This capability ensures that aviation's environmental impacts are considered and environmental objectives are integrated into NextGen's planning and decision-making process.

Improved Safety Operations
This capability promotes collaboration and information sharing to integrate safety considerations that are consistent with national and international regulations, standards, and procedures.

Flexible Airport and Ramp Operations
This capability provides airspace users with technology improvements and infrastructure developments that allow them to reallocate or reconfigure airport and surface assets to accommodate increasing passenger and cargo demands.

Collaborative Interagency Activities and Accomplishments

INTEGRATED SURVEILLANCE

IWP capabilities advanced by this effort:

Improved Safety Operations

Collaborative Flow Contingency Management

Collaborative Capacity Management

Integrated NextGen Information

Air Transportation Security

Introduction

An important initiative, as it relates to advancing NextGen, centers on the need to maintain Integrated Surveillance of the NAS. After the September 11, 2001 terrorist attacks, the U.S. Government has moved toward a flexible security system for the nation's entire air domain – one that responds to varying threat levels and effectively addresses current and future threats. While progress has been made in improving the nation's air surveillance capabilities to support this effort, gaps remain that impose operational risks, ultimately impacting NextGen implementation.

Integrated Surveillance pertains to the consolidation of data and information about cooperative and non-cooperative airborne targets by surveillance systems to create a clear operational picture of a real- or near-real time situation within the nation's air transportation system. A key component of NextGen, Integrated Surveillance greatly enhances safety, security, and efficiency of the U.S. Air Domain. Given the complexity of the NAS, and the increasing volume of air traffic, achieving a more robust and effective Integrated Surveillance system is an increasingly important multi-agency responsibility. The SPC continues to provide high-level commitment and resources to support efforts that synchronize interagency Integrated Surveillance architectures, requirements, and investments.

The JPDO's Integrated Surveillance activities are part of a larger whole-of-government approach to Air Domain Awareness as outlined in the *National Strategy for Aviation Security* and its supporting plans. The effort is led by the Air Domain Awareness Board, which supports development of integrated solutions, clarifies priorities, and synchronizes future interagency actions by identifying overarching investment goals and potential policy/strategic level synergies, redundancies, and conflicts. The Air Domain Awareness Board is chaired by DHS's Assistant Secretary, and includes Deputy Assistant Secretary-level principals from DHS, DOD, DOC, DOT, ODNI, and the Department of Justice (DOJ). In response to a directive from the SPC in 2010, the JPDO proposed and formed the Integrated Surveillance Support Office (ISSO). This group leads, coordinates, and provides the technical work for the Integrated Surveillance mission. Members of the ISSO include representatives from DOD, FAA, and ODNI. To enhance partnership engagement within the aviation community, in May 2012 the Air Domain Intelligence Integration Element (ADII-E) was established to support Intelligence Integration, the National Strategy for Aviation Security (NSAS), and Air Domain Awareness Board.

Key attributes of the NextGen Strategy for improving air surveillance capabilities include:

- Leveraging existing surveillance assets to provide optimal, persistent, and wide-area surveillance coverage of key sectors of U.S. airspace and approaches.

- Developing an interagency information-sharing infrastructure that enables seamless exchange of surveillance data and other relevant information through machine-to-machine interfaces.

- Encouraging and facilitating development of automated data correlation, fusion, filtering, and analysis tools to alleviate information overload and reduce the burden on operators of conducting time-consuming and labor-intensive manual information management tasks

Integrated Surveillance One-Year Challenge Demonstration

Today, information sharing among agencies plays a key role in the Integrated Surveillance efforts of the NAS. In 2010, the SPC directed the JPDO and partner agencies to investigate current information-sharing approaches and develop an operational capability within one year. Shortly thereafter, efforts to demonstrate the ability to synchronize interagency architectures were under way. Known as the Integrated Surveillance One-Year Challenge, this initiative included participation from the JPDO, FAA, DOD, DHS, DOC, and DOJ, as well as private industry.

In 2012, there were several successful information exchanges proven during the demonstration that increased shared situational awareness throughout the user community, including the exchange and distribution of flight, weather, and law enforcement data during the pre-flight portion of the demo, as well as after take-off and during the flight. Ultimately, the demonstration showed that existing capabilities could be integrated to provide federal agencies with the same data at the same time. Participants also noted a number of critical lessons learned from the demonstration, including the need for interagency governance and policy to operationalize and optimize capabilities and identify gaps.

Technical Interchange Meetings (TIMs)

During the past year, members of the Integrated Surveillance community met quarterly to address topical issues associated with their mission. Known as Technical Interchange Meetings (TIMs), participants included technical subject matter experts from the ISSO, which acts as the core technical support capability for the governance of national air surveillance, NextGen partner agencies, and other participating organizations. The goal of the TIMs was to identify emerging technologies and support the ISSO mission of developing an interagency plan for Integrated Surveillance as envisioned in the NextGen Concept of Operations. This coordination allows agencies the opportunity to leverage each other's work and enhances the efficiency of Integrated Surveillance efforts, ensuring that duplication does not occur.

Throughout these meetings, the ISSO team analyzed a variety of related initiatives to determine how they fit into its capability architecture and define where additional analysis or demonstrations are needed. Topics of discussion included command and control systems, roadmaps, and user-defined operational pictures. A number of opportunities for further collaboration were identified during the TIMs, and the ISSO will continue to work with partner agencies on each of these areas.

Collaborative Interagency Activities and Accomplishments

UNMANNED AIRCRAFT SYSTEMS (UAS) INTEGRATION

IWP capabilities advanced by this effort:

 Improved Safety Operations

 Collaborative Flow Contingency Management

 Collaborative Capacity Management

 Integrated NextGen Information

 Flexible Separation Management

Introduction

UAS are generally defined as systems that contain the necessary equipment, communication links, and personnel to control and employ an unmanned aircraft. From oil pipeline monitoring and border surveillance to local crime scene investigations, search and rescue missions, and military training, UAS provide a wide variety of operational, societal, and economic benefits to the U.S. Seamless integration of UAS into the NAS is an essential part of NextGen.

In designing NextGen, one of the most significant technical challenges is developing a safe and efficient way for UAS to operate in the same airspace as manned aircraft without compromising safety to other aircraft or objects on the ground. This was identified as a key initiative because the current airspace system is designed around the use of manned aircraft. UAS access to it remains restricted due to the lack of appropriate integration procedures, standards, and policies. In addition, privacy concerns related to UAS have gained significant momentum amongst various stakeholders

> **Key attributes of the NextGen Strategy for improving UAS capabilities include:**
>
> - Comprehensive Plan describes key components of public and civil UAS integration into the National Airspace System (NAS).
>
> - Coordinating with industry on UAS operational scenarios, concerns, and insights regarding UAS integration.
>
> - Partner agencies have provided a foundational component that clearly outlines the technologies, methods, and processes that must be established to ensure safe and consistent UAS operations throughout the NAS.

and the general public. Given these issues, effective UAS integration, with direct linkage to NextGen planning, requires long-term, multi-agency coordination among NextGen partner agencies. The SPC has taken a key role in making it a priority to support continued UAS integration efforts.

In Fiscal Year 2012, the JPDO and partner agencies began work on the UAS Comprehensive Plan. The *Unmanned Aircraft Systems (UAS) Comprehensive Plan* details work that has been accomplished, along with future efforts needed to achieve safe integration of UAS into the NAS. Throughout Fiscal Year 2012 (FY12), work was conducted to develop elements required to create a more complete picture of achieving safe UAS integration. The perspectives and information available from these individual activities create a framework and reveal an evolving capability for successfully achieving safe integration beginning in 2015.

High-level strategic goals that are specific, measureable, attainable, realistic, and timely were developed reflecting the principal objective of safe UAS integration into the NAS. These high-level goals were derived from existing goals provided by the partner agencies and should therefore resonate with the wide range of UAS stakeholders. Objectives, or initiatives, to achieve those goals were also derived from partner agency plans. In all, six UAS National Goals and eight Objectives, developed in coordination with executive- and working-level representatives provided by the partner agencies, were created. Together, the UAS National Goals and Objectives provide a common framework for interagency coordination and planning.

In addition to privacy considerations, safely integrating public and civil UAS into the NAS carries certain national security implications. Relevant U.S. government departments and agencies and stakeholders will proactively address these areas of concern through coordinating bodies such as the JPDO.

UAS Integration

> According to the Teal Group, **growth in the market** for government and commercial UAS could result in worldwide market value of as much as **$89.1 billion over the next decade**.

In 2008, the GAO reported that the U.S. must develop a clear and common understanding of what is required to safely and routinely operate UAS. As a result, the SPC addressed UAS issues during its meetings in 2009 and 2010, focusing on operational requirements, data, and research and development. Through the aforementioned *FAA Modernization and Reform Act of 2012*, Congress emphasized the importance of UAS integration and NextGen partners were tasked to lead the development of several deliverables. An initial UAS National Plan included a program framework to define decision points for NextGen implementation in 2015 and beyond, a common Concept of Operations, and an initial assessment of research and development priorities. In addition, the Plan addresses such topics as prioritizing research for accelerating technology enhancements and UAS test range implementation, which will enable test ranges to be positioned to provide data to assist with engineering activities that will support integration.

Partner agencies formed a committee of executives in 2011 to help coordinate UAS research and development and demonstrations across these agencies. The *NextGen UAS Research Development and Demonstration Roadmap Version 1.0* identified that the technology path for UAS integration was not complete, requires further assessment of gaps, and cannot be defined in a piecemeal fashion. Ultimately, this effort laid the groundwork for a UAS research and development prioritization framework.

In April 2012, the JPDO assembled executive- and working-level teams also comprised of representatives from NextGen partner agencies. These individuals began the technical work required to develop the *UAS Comprehensive Plan*. Over the next six months, the interagency team worked collaboratively to share data and information, reported to senior leadership in their respective organizations to ensure buy-in of agreed-upon approaches, and assigned subject matter experts to work in teams to identify challenges and map existing work across agencies. As part of this collective effort, the JPDO also coordinated with industry to discuss their concerns and insight regarding UAS integration, and vetted operational scenarios to identify risks that could—from a private-sector perspective—delay UAS integration.

> ### *NextGen partner agencies completed preparation on a number of UAS integration products:*
>
> - *Six National Goals and eight objectives for UAS integration.*
>
> - *In parallel, the FAA prepared a UAS Concept of Operations and established a roadmap for safe integration by 2015.*
>
> - *A traceable framework for prioritizing research needs by goal and objective.*
>
> ### *These products formed the basis of the UAS Comprehensive Plan as required by the FAA Modernization and Reform Act of 2012*

The interagency team distilled and coordinated approval of six UAS National Goals and eight Objectives reflective of NextGen partner agency UAS missions. In parallel, the FAA prepared an *Integration of UAS into the National Airspace System Concept of Operations* (Concept of Operations) and established a roadmap for safe integration by 2015. Together, the JPDO and FAA-led products form the basis of the *UAS Comprehensive Plan* that is required by the *FAA Modernization and Reform Act of 2012*. In addition, the Plan addresses such topics as airspace designation of cooperative manned and UAS operations in the NAS and the establishment of a process to develop certification, flight standards, and air traffic requirements for civil UAS at test ranges.

Safe integration of UAS into the NextGen environment remains a long-term goal that will be systematically addressed. With recent interagency efforts, and, specifically, the development of the *UAS Comprehensive Plan*, NextGen partner agencies have provided a foundational component that clearly outlines the technologies, methods, and processes that must be established and policy considerations including security, privacy, and civil liberties that must be addressed to ensure safe and consistent UAS operations throughout the NAS.

Collaborative Interagency Activities and Accomplishments

INTERAGENCY DATA EXCHANGE

IWP capabilities advanced by this effort:

Improved Safety Operations

Collaborative Flow Contingency Management

Flexible Separation Management

Integrated NextGen Information

Introduction

There are many activities under way by partner agencies that are beneficial to NextGen progress. The SPC identified data sharing as a critical component of NAS by allowing NextGen partners to give and receive the right information at the right time to aid in decision-making. This exchange is a critical step to improving situational awareness which improves air safety, increased fuel savings, and enhances national security within the NAS. NextGen partner agencies are working to expand and create standards and protocols for data sharing, and are defining the roles and responsibilities for each agency regarding the timing, governance, and protection of proprietary data. Data sharing will be leveraged to improve situational awareness, which is essential to supporting evolving civil and public flight operations. Additionally, NextGen partners are developing an approach focused on shared understanding that incorporates technical components and leverages existing interagency infrastructures which results in cost savings because of reduced duplication. In 2012, NextGen partner agencies were involved in a number of initiatives, including the Net-Enabled Test Environment, the Community of Interest Engagement Plan, NextGen Federated Identity Credentialing and Access Management, and the NextGen Enterprise Information Sharing Agreement.

> **Key attributes of the NextGen Strategy for improving interagency data exchange capabilities include:**
>
> - Creating uniform rules for data sharing, defining the roles and responsibilities of each party, the timing, governance, protection of proprietary data
>
> - Recognizing the value of semantic tools and ontologies and how they add value to interagency decision processes and improve safety.
>
> - Developing an approach focused on shared understanding that incorporates technical components and leverages existing interagency infrastructures, which results in cost savings through reduced duplication.
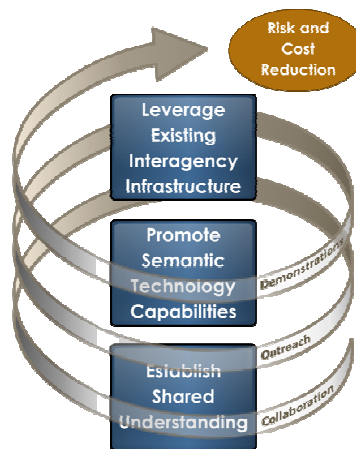
Information sharing depends on a combination of process, technology, and infrastructure. As depicted in the diagram, existing agency infrastructures can be combined with semantic technologies to promote collaboration and information sharing among partner agencies. This results in reduced risk and cost, as well as a shared understanding to aid in achieving the NextGen mission.

The Net-Enabled Test Environment (NETE)

In 2012, NextGen partner agencies developed the NETE, a virtual test environment that connects the research networks of NextGen partner agencies. The NETE allows users to research and develop concepts in order to demonstrate the value of NextGen IWP capabilities to senior leaders and stakeholders. The NETE provides a conduit to leverage work already being done by NextGen stakeholders and enhances interagency relationships, processes, and architectures. By sharing this information, it reduces redundancy in efforts and ultimately the cost associated with duplicating the work that has already been performed by another partner agency. Initial NETE participants included FAA, DOD, DOC, and NASA. The NETE's technical infrastructure promotes data access for partners, and planned enhancements will help create, support, and manage critical data about different types of information sets. In addition, these enhancements will provide NextGen users with tailored information that is closely matched to their environment and operational needs, which will result in accelerated development of additional NextGen capabilities. The National Weather Service (NWS) has used the NETE to post weather data for access and will use it with FAA/DOD test environments for information sharing and Net-Centric operations (see DOC highlights). In August, the FAA's System-Wide Information Management (SWIM) portfolio assumed the technical management of the NETE, allowing NextGen partners to continue accessing NETE network infrastructures and information-sharing capabilities. While the current version of the NETE technology promotes data accessibility, further enhancements will help create, support, and manage metadata about different types of information sets.

Community of Interest (COI) Engagement Plan

The Engagement Plan promotes collaboration and information sharing that integrates safety considerations that are consistent with national and international regulations, standards, and procedures. Information sharing allows NextGen partners to maximize the value of their information assets and reduce costs by reusing established data sources. The COI Engagement Plan, a JPDO-led effort, describes how NextGen partners can use a common "language" to represent different types of data to help multiple communities exchange information – regardless of varying terminologies and needs. For example, NextGen users must have a common understanding of weather information, yet this weather information is provided by FAA, DOD, and NWS in varying formats and data definitions. The information sharing approach relies on small, agile development teams, called COI Engagement Teams, to create an efficient and sustainable information exchange. The COI Engagement Teams define key terms and relationships between those terms, known as an ontology, which allows these disparate communities to agree upon a common meaning, which results in a shared understanding within the context of NextGen. Thus the Engagement Plan creates a safer, more secure airspace by providing users with quicker, more comprehensive access to data and a wider range of options for responding to potential threats. Of special note, this data is now both human- and machine-readable, and can accommodate a variety of implementation platforms.

NextGen Federated Identity Credentialing and Access Management (NFICAM)

The NextGen environment will require complex, fast-paced decision making based on timely, accurate, and comprehensive information. Integrated NextGen information is an emergent and enabling enterprise that depends on and results from the implementation of operational improvements that provide core NextGen capabilities (e.g., capacity, trajectory, flow contingency, and separation management, air transportation security). Almost every significant decision and its execution will require coordination among multiple geographically dispersed participants using a family of systems operated by NextGen partner agencies and air transportation service providers. The first step to securing these exchanges is a program known as NFICAM, which uses programs, processes, technologies, and personnel to create trusted credentials (digital identities and permissions). While FAA air traffic focuses on credentialing for traditional controller-pilot interaction, the integrated nature of NextGen requires a broader credentialing solution which includes not only people, but systems and associated services. Recognizing that NFICAM is critical to the success of NextGen, the JPDO identified representatives from the FAA, NASA, DOC, DOD, DHS, and DOT, along with industry experts, to form a Study Team aimed at establishing the steps necessary to ensuring that NextGen partners can securely and quickly exchange information in the NAS. The Study Team is developing a NextGen Identification Authentication Policy to define what qualifies as sensitive information. This policy will then be used to define what level of identification is required by specific data categories. Ultimately, this work will help ensure that airspace users are able to exchange sensitive data safely and securely.

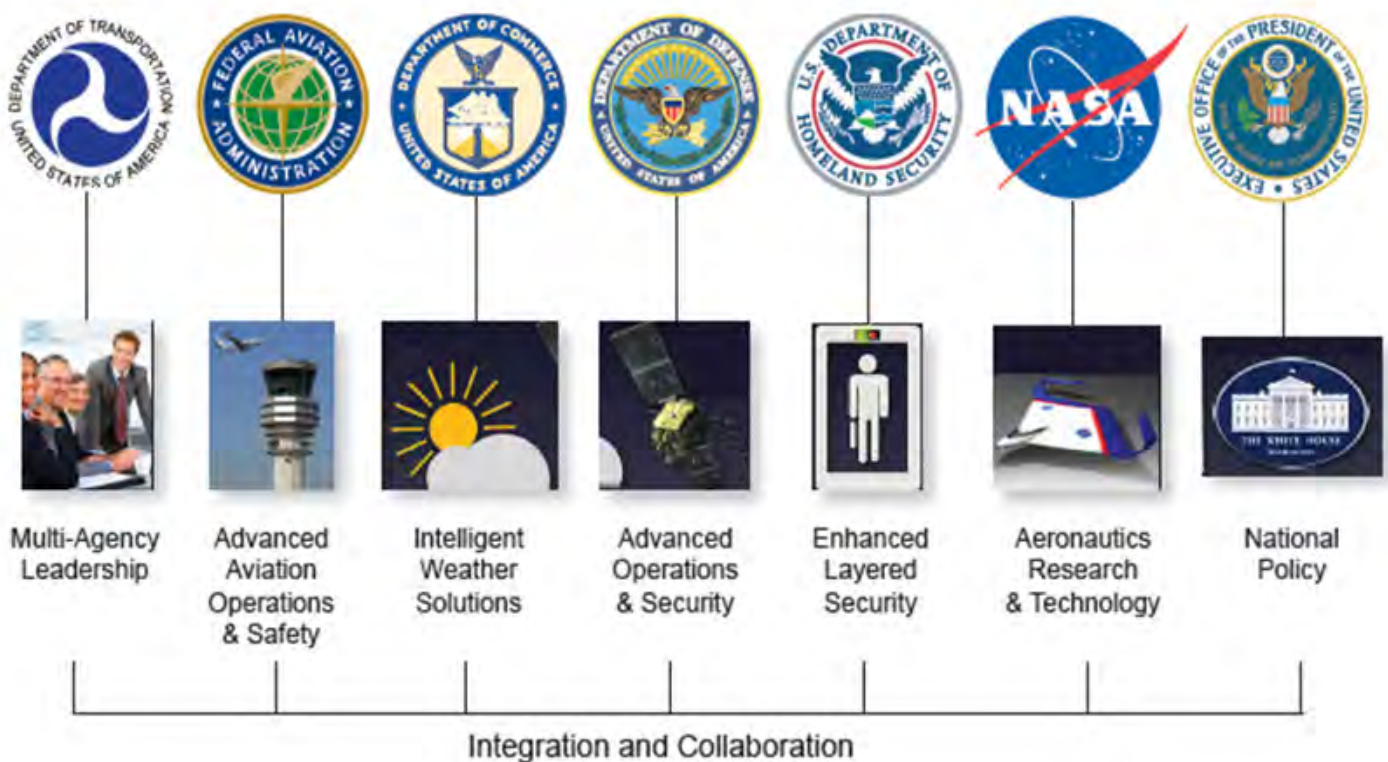## NextGen Enterprise Information Sharing Agreement (NEISA)

Information sharing in the NAS will rely on a complex "enterprise of enterprises" with numerous government, public, and private participants and stakeholders, including national defense, homeland security, air traffic management, and commercial and general aviation entities. Each of these entities must continuously share trustworthy, reliable information

among each other, in real time, to keep air transportation safe, secure, and efficient. Integrated NextGen information capability will be provided to aviation stakeholders through enterprise management services of the net-centric environment and physical infrastructure, assuring its availability and security, and through content management services that provide discovery, storage, and delivery of information from producers to consumers. In March 2012, the NextGen partners began development that will establish the NEISA, which is an agreement that describes a net-centric approach for safely and securely sharing information in the NAS. Essentially, this means that users will participate in a continuously evolving, complex array of devices, information, and services that are communicating through government and industry networks. For NextGen to be a long-term success, it is imperative that these exchanges provide clear, concise, relevant data-sharing outlets.

In addition to the collective progress of the NextGen partners, each agency has contributed valuable resources to advance NextGen planning, research and development, and policy efforts. The total reported interagency investment in NextGen was approximately $1.5 billion in 2012, including research, ground and air systems, and operations. The JPDO selected highlights consistent with partner agency activities that show a diversity of implementer, researcher, and operator activities supporting NextGen. The pages that follow highlight specific, representative projects that are under way within the agencies in support of IWP capabilities and SPC priorities.

Partners in the Next Generation Air Transportation System

| Multi-Agency Leadership | Advanced Aviation Operations & Safety | Intelligent Weather Solutions | Advanced Operations & Security | Enhanced Layered Security | Aeronautics Research & Technology | National Policy |

Integration and Collaboration

NextGen Partner Agency Highlights

FEDERAL AVIATION ADMINISTRATION

The Air Traffic Management Technology Demonstration 1 (ATD-1) Research Transition Team (RTT)

IWP capabilities advanced by this effort:

 Collaborative Flow Contingency Management

 Efficient Trajectory Management

 *Improved Environmental Performance*

 Improved Safety Operations

On November 6, 2012, the FAA formally kicked off its partnership with NASA to scope collaborative ATD-1 activities. The scope of the ATD-1 encompasses operational concepts, procedures, and technologies supporting air traffic management, air traffic control, and user operations for aircraft from 30 minutes prior to top of descent (approximately 150 NM from the airport) all the way to the runway threshold.

The ATD-1 Concept of Operations integrates three (NASA) research efforts intended to achieve high throughput, fuel-efficient arrival operations throughout busy terminal airspace. They are:

- Traffic Management Advisor with Terminal Metering (TMA-TM) for precise time-based schedules to the runway and meter points within terminal airspace
- Controller-Managed Spacing (CMS) decision support tools for Terminal controllers to better manage aircraft delay using speed control
- Flight-Deck Interval Management (FIM) aircraft avionics and flight crew procedures to conduct airborne spacing operations

Recent accomplishments include:

- Multiple coordination meetings held between NASA and FAA.

- Identified necessary organizations for participating in the Research Transition Team.

- Announced kickoff meeting for the Research Transition Team.

- Drafted initial Research Transition Team (RTT) Plan.

**FIM
Arrival operations**

**CMS in
Terminal Airspace**

Integrated Arrival Solution

TMA-TM
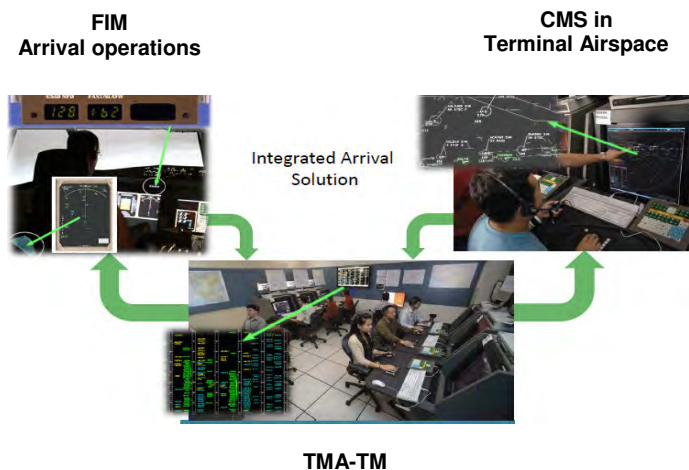
NextGen Partner Agency Highlights

FEDERAL AVIATION ADMINISTRATION

UAS Multiple Intruder Autonomous Avoidance (MIAA)

IWP capabilities advanced by this effort:

 Flexible Separation Management

 Efficient Trajectory Management

 Improved Safety Operations

 Air Transportation Security

The Air Force Research Laboratory (AFRL) and the Naval Air Systems Command worked together on the MIAA program. This goal of the MIAA program was to demonstrate autonomous avoidance of multiple cooperative and non-cooperative targets using a variety of developed and integrated sensors. The FAA provided two manned aircraft, Automatic Dependent Surveillance-Broadcast (ADS-B) sensor equipment, truth system equipment, and personnel to conduct flight-testing. These planned test flights included an ongoing series of tests, and were completed the week of January 14, 2013. FAA aircraft served as intruder aircraft to exercise sense-and-avoid algorithm reaction. Additionally, DOD/AFRL provided one manned aircraft, sense-and-avoid sensors, and personnel to conduct flight-testing. DOD aircraft served as surrogate UAS. The FAA is evaluating one of many sense-and-avoid emerging technologies, while DOD/AFRL expects to gain insight into how their algorithms will work within a NAS environment.

Recent accomplishments include:

- The Air Force Research Laboratory and the Naval Air Systems Command worked together on the UAS Multiple Intruder Autonomous Avoidance (MIAA) program.

- Flight tests were completed the week of January 14, 2013, which were the final planned events for the program. The Air Force Research Laboratory has a Technical Interchange Meeting planned for early March to go over the results, and final conclusions or future work will be addressed at that time. The FAA UAS Research and Development Matrix Team will use the observations and data received from testing as input for future Sense-and-Avoid (SAA) research.

NextGen Partner Agency Highlights

FEDERAL AVIATION ADMINISTRATION

4th UAS NextGen Demonstration

IWP capabilities advanced by this effort:

 Integrated NextGen Information

 *Collaborative Flow Contingency Management*

 Efficient Trajectory Management

The UAS NextGen Demonstration—which involved FAA Air Traffic Operations, DHS Customs and Border Protection (CBP), the United States Air Force 45th Space Wing, and NASA's Kennedy Space Center—showed how NextGen Technologies provide information to advance UAS integration into the NAS. The FAA observed a CBP flight operating under an FAA-issued Certificates of Authorization. The observation included a pseudo pilot and a pseudo controller interacting with each other during off nominal events induced by the research team. The research team assessed the ability for an independent Ground Based NAS Voice System prototype to restore communication between the pseudo UAS pilot and pseudo Air Traffic Controller in the event of lost link/lost communication scenario and also tested the viability of providing an independent Cockpit Display of Traffic Information (CDTI) system to aid a UAS pilot in tracking own-ship information in the event of lost link/lost communication. This system was integrated with ADS-B, Traffic Information Service-Broadcast (TIS-B) and primary radar information for increased situational awareness of surrounding traffic.

Recent accomplishments and outcomes include:

- Human in the Loop Simulation #1 (November 2011) – Provided data on the impact of Cockpit Display of Traffic Information (CDTI) in the control station on pilot situational awareness.

- Human in the Loop Simulation #2 (April 2012) – Provided a high fidelity set of impact data regarding the placement of a Cockpit Display of Traffic Information (CDTI) and Voice over Internet Protocol (VoIP) communication system during lost link scenarios.

- UAS Demonstration (4) Live Flight (October 2012) - Conducted a live concept validation flight using a DHS Customs and Boarder Protection Predator B UAS maritime variant. Human Machine Interface data was collected using pseudo pilots located at Cape Canaveral Air Force Station (CCAFS) and pseudo controllers located at Miami Center (ZMA). A fully networked VoIP prototype was installed throughout Florida and used by the pseudo pilot to instantaneously communicate with ATC and a Cockpit Display of Traffic Information (CDTI) was used to track own-ship positional information and surrounding traffic using ADS-B, TIS-B and integrated primary radar.

- UAS Demonstration (4) is complete. A technical report has been drafted and is going through an internal review. Results will be forthcoming from the FAA. The report will include analysis of Human-Machine Interface data with recommended steps for future UAS demonstrations.
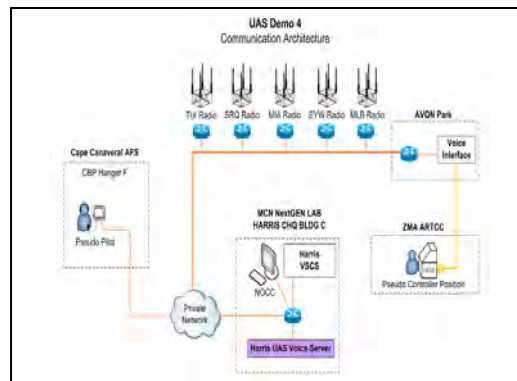
NextGen Partner Agency Highlights

FEDERAL AVIATION ADMINISTRATION

Three-Dimensional Path Arrival Management Project (3D PAM)

IWP capabilities advanced by this effort:

Collaborative Capacity Management

*Efficient Trajectory Management*

Improved Environmental Performance

Collaborative Flow Contingency Management

NASA, Denver Center, The Boeing Company, United Airlines, Continental Airlines, and SkyWest Airlines partnered on the 3D PAM, which is a concept that enables Area Navigation and Required Navigation Performance (RNAV) optimal profile descents. The concept enables four-dimensional (4D) trajectory-based operations for arriving aircraft at medium- and high-density airports, resulting in increased fuel and operational efficiency. The 3D PAM concept features the use of a new ground automation tool known as the Efficient Descent Advisor (EDA) and automation currently in most modern airline and regional jet aircraft. An initial study was successfully completed for the extension of 3D PAM operations using data communications. A total of nine air traffic control centric and eight flight deck simulations were performed over the period of project performance (May 2005 to November 2011). Two successful flight tests were flown in Denver airspace in September 2009 and November 2010 where aircraft from partner airlines and one of the FAA's research aircraft flew the 3D PAM procedures. The results were used to improve trajectory prediction in the development of the EDA.

Optimized profile descents are special airport arrival procedures which enable aircraft to make the most fuel efficient arrivals possible by minimizing level-offs in the descent and allows the aircraft's flight management computer to manage the descent of the aircraft. Assuming a full implementation of the 3D Path Arrival Management concept; after seven years, stakeholders can expect an annual cost of fuel savings of $300 million a year at the top 35 busiest U.S. airports.

Recent accomplishments include:

- Tech transfer of Three-Dimensional Path Arrival Management (3D PAM)/Efficient Descent Advisor to Time-Based Flow Management Program Office (February 2012).

- Completion of Risk Mitigation Study: Three-Dimensional Path Arrival Management (3D PAM) Operations in Select Off-Nominal Events (November 2012).
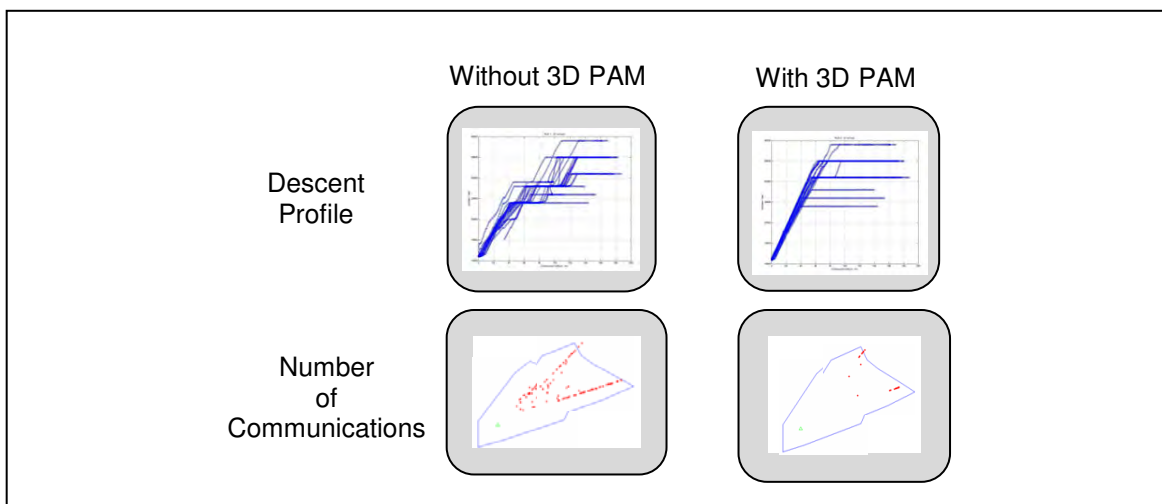
NextGen Partner Agency Highlights

FEDERAL AVIATION ADMINISTRATION

NextGen Surveillance & Weather Radar Capability

IWP capabilities advanced by this effort:

Integrated NextGen Information

Flexible Separation Management

Improved Safety Operations

Through a reimbursable agreement with the National Oceanic and Atmospheric Administration's (NOAA) National Severe Storms Laboratory, and in collaboration with NWS, DOD, DHS, and the Department of Energy, a Multifunction Phased Array Radar capability is being investigated as a solution implementation alternative for providing a cost-effective replacement for the legacy surveillance and weather radars and supporting the FAA's transformation of the nation's aviation system. A final investment decision on the solution to be acquired is planned for 2017, which will be supported by current activities in the development of mission analysis artifacts required by the FAA's Acquisition Management System, as well as risk and engineering analyses and technology demonstrations.

Recent accomplishments include:

- Awarded 2 SE2020 Dual Polarization Engineering Studies (August 2012). Final Reports completed (December 2012).

- Released Request for Information (August 2012). Nine packages received (October 2012).

- Conducted Industry Day (October 2012).

- Announced SE2020 Antenna Design Task Order (October 2012).
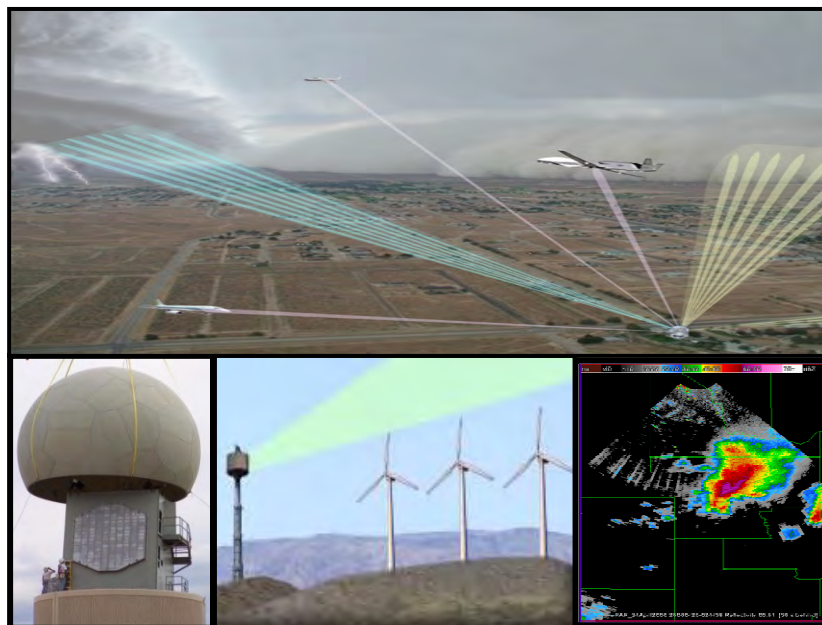
NextGen Partner Agency Highlights

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Synthetic/Enhanced Vision Systems Evaluation

IWP capabilities advanced by this effort:

Improved Safety Operations

Flexible Airport Facility and Ramp Operations

To improve airport safety and capacity, NASA evaluated the viability of flying approaches to landing in extremely low visibility conditions using Synthetic/Enhanced Vision Systems technology. Partnering with FAA, Gulfstream, and Honeywell, NASA evaluated approaches in low visibility with professional pilots, using heads-up displays (HUD), Synthetic Vision System (SVS) primary flight displays, and enhanced (FLIR) vision. NASA compared flight test results to previous simulator studies.

Results showed completed touchdowns met pilot performance standards, correlated with simulation, and validated the use of lower visibility minima for Synthetic/Enhanced Vision Systems. Data will be used to define new RTCA standards, develop FAA guidance, regulations, and procedures, and establish airport infrastructure needs for low visibility operations supportive of NextGen. The results support redefined visual requirements to allow runway identification using either natural or enhanced vision. Synthetic and Enhanced Vision Systems significantly improve safety under low visibility conditions through improved instrument-to-visual transition and greater situation awareness of the aircraft trajectory with respect to the runway environment. They should also support higher terminal area capacity under NextGen for those airports unequipped with ground-based Category II and Category III Instrument Landing Systems.

Recent accomplishments include:

- Evaluated approaches in low visibility with professional pilots, using heads-up-display (HUD). Results showed completed touchdowns met pilot performance standards, correlated with simulation, and validated the use of lower visibility minima for Synthetic/Enhanced Vision Systems.
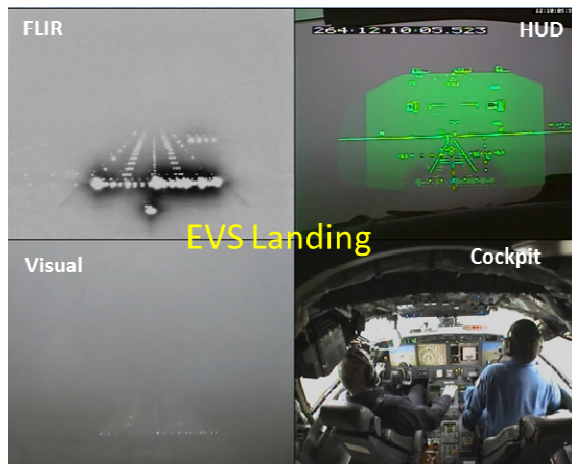
Enhanced Vision System (EVS) Landing Showing Runway as Viewed with FLIR (Enhanced) System, through HUD, Unaided, and from Cockpit (Shown Clockwise from Upper Left).

NextGen Partner Agency Highlights

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Precision Departure Release Capability (PDRC)

IWP capabilities advanced by this effort:

Improved Safety Operations

Collaborative Capacity Management
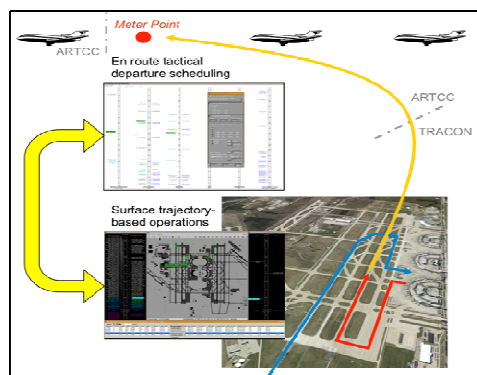
Flexible Airport Facility and Ramp Operations

NASA research on PDRC automates coordination between surface and en route departure schedulers to increase take-off time accuracy, and to reduce tactical departure delays and missed overhead slots. The approach uses surface trajectory-based (automated) take-off time predictions for en route tactical departure scheduling and evaluates performance and benefits via shadow and operational tests in a relevant environment.

In 2012, NASA completed data collection for initial field evaluation. Preliminary results show better compliance with ATC-assigned takeoff times. ATC-assigned takeoff times are used to meet en route traffic constraints. This average error was reduced by 45 percent, and the standard deviation was reduced by 58 percent. Traffic Management Coordinators (TMC) developed innovative uses of PDRC technology during the field evaluation that will lead to updates to the Concept of Operations. Initial research transition products were delivered to FAA on July 2, including Concept of Operations document, and preliminary evaluation and analysis results.

Challenges going forward include continued enhancements and transition. Research transition collaboration with FAA requires PDRC technology to be included in Time-Based Flow Management and Tower Flight Data Manager programs. In FY13, NASA will continue enhancement of the PDRC concept based on analysis of field evaluation data and user feedback.

Recent accomplishments include:

- Completed data collection for initial field evaluation. Preliminary results show 45 percent reduction in take-off time error, and 58 percent reduction in standard deviation, compared to baseline data, for Precision Departure Release Capability (PDRC)-scheduled departures. Traffic Management Coordinators (TMC) developed innovative uses of PDRC technology during the field evaluation that will lead to updates to the Concept of Operations.

- Initial research transition products were delivered to FAA on July 2, including Concept of Operations document, and preliminary evaluation and analysis results.

PRDC automates coordination between surface and departure schedulers to increase take-off time accuracy, and to reduce tactical departure delays and missed overhead slots.

NextGen Partner Agency Highlights

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Dynamic Weather Routes

IWP capabilities advanced by this effort:

Improved Safety Operations

Collaborative Capacity Management

Efficient Trajectory Management

Flexible Airport Facility and Ramp Operations

NASA research is addressing the operational problem created by weather. Routes are developed based on predicted weather, 60 minutes before departure. Weather predictions change over time, thereby making the original route hazardous or inefficient. Workload and lack of automation prevents dispatchers and FAA controllers and traffic managers from generating the most efficient routes once aircraft are airborne.

In 2012, NASA researchers developed and tested a Dynamic Weather Routes (DWR) prototype with FAA Fort Worth Center traffic, considering wind-corrected flying time, modeled weather, sector congestion, traffic conflicts, and special use airspace. In July, NASA signed an agreement with American Airlines for operations trials and started shadow testing at the Airline System Operations Center in Fort Worth, Texas. Dynamic Weather Routes were issued to revenue flights (two flights) and showed that 1,300 pounds of fuel was saved. Additional reroutes were issued as the shadow testing continued. Average potential savings are 8 minutes per flight, which, for an assumed average of $168 per minute in operating costs, translates to significant benefits. Based on analysis of traffic in one center over 3 months, nationwide annual savings are estimated to be 465,000 flying minutes or $78 million in operating costs. There is substantial interest from the FAA and industry, including American Airlines, United Airlines, FedEx, Delta, Boeing, General Electric, and Weather Services International.

Challenges going forward include continued shadow testing, data collection, and operational testing with American Airlines and eventual transition to airlines and systems suppliers industries. Several companies are interested in adopting the DWR concept and software to provide service to their airline customers. The DWR automation also could be included in the FAA's Trajectory-Based Flow Management (TBFM) infrastructure. In 2013, NASA plans to complete testing on a prototype concept for automated airline/ATC coordination with DWR.

Recent accomplishments include:

- Conducted shadow testing with Dynamic Weather Routes (DWR) in Fort Worth, Texas, showing potential savings of 8 minutes per flight, with significant potential savings in operating costs of 465,000 flying minutes or $78 million annually nationwide.

- Signed an agreement with American Airlines for operations trials and started shadow testing their System Operations Center in Fort Worth, Texas.
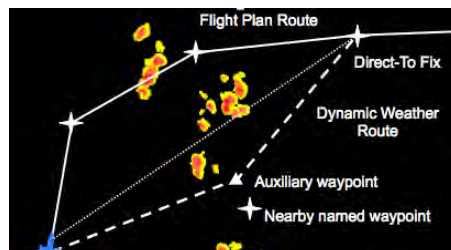
Dynamic Weather Re-Routing tools uses automation to enable dispatchers and controllers/TMUs to generate
the most efficient routes around weather hazards once aircraft are airborne.

NextGen Partner Agency Highlights

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Environmental Vehicle Research

IWP capabilities advanced by this effort:
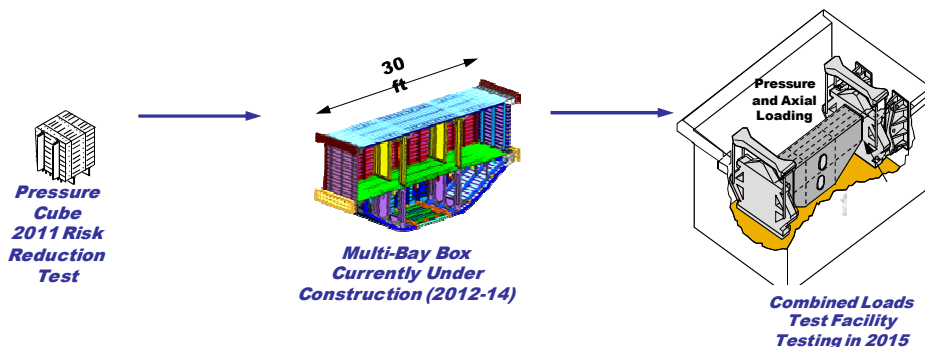
Improved Environmental Performance

NASA conducts research for fundamental knowledge, tool development, and integrated systems to enable future vehicles with improved efficiency and environmental performance. These improvements address goals for reducing fuel burn, noise, and emissions in the future air transportation system.

During FY12, NASA expanded its work on characterization of emissions from alternative fuels with in-flight tests to measure gaseous and particulate emissions from aircraft engines burning alternative fuel. This data will help establish hydro-treated renewable jet fuel as a potentially carbon-neutral aviation fuel. NASA is developing new design and analyses capabilities to enable new technologies and vehicle concepts. The Environmentally Responsible Aviation project supported system development by performing rigorous examination of the benefits, cost, and risks associated with potential technologies to determine which ones merited further examination over the next three years. Technologies included: 1) innovative flow control for drag reduction, 2) advanced composites for weight reduction, 3) advanced Ultra High Bypass (UHB) engine designs for specific fuel consumption and noise reduction, 4) advanced combustor designs for Oxides of Nitrogen reduction, and 5) airframe and engine integration concepts for community noise and fuel burn reduction. Analyses indicated significant progress toward the integrated goals was being accomplished, but to reach the integrated goals, an advanced airframe configuration beyond the conventional "tube and wing" would be necessary.

Challenges going forward include identifying opportunities to further demonstrate technologies and associated tools and issues integrating these technologies with an advanced airframe.

Recent Accomplishments include:

- Completed the initial phase of the Environmentally Responsible Aviation (ERA) Project and identified eight Integrated Technology Demonstrations for Phase 2.
- Developed two promising advanced combustor designs.
- Conducted alternative fuel characterization experiments.
- Developed new vehicle design tool capabilities.

Pressure Cube 2011 Risk Reduction Test

Multi-Bay Box Currently Under Construction (2012-14)

Combined Loads Test Facility Testing in 2015

NextGen Partner Agency Highlights

DEPARTMENT OF COMMERCE

IWP capabilities advanced by this effort:

 Improved Safety Operations

 Collaborative Capacity Management

 Efficient Trajectory Management

 Flexible Airport Facility and Ramp Operations

 Flexible Separation Management

 Collaborative Flow Contingency Management

 Improved Environmental Performance

In FY12, DOC initiated development of a prototype for net-centric delivery of seven NWS product sets for usage by the FAA in a test environment. DOC also prepared for the annual interagency Capability Evaluation that demonstrates secure discovery and transfer of weather information between the FAA and NWS through standard formats and services. The Capability Evaluations continue to inform and validate requirements for inclusion in DOC's future delivery of product sets. Additionally, DOC completed a draft of the Joint System Specifications document describing joint (NOAA and the FAA) requirements for information transfer services. This document is expected to be signed by both agencies in FY13.

Going forward, the NWS is integrating the IT Services portion of the NextGen Weather Program into an Integrated Dissemination Program to better align data exchange capabilities with the FAA within a more holistic NWS and NOAA enterprise framework. DOC is working to minimize the schedule risk this introduces for NOAA's net-centric services support to the FAA. DOC, specifically NOAA/NWS, is working with FAA to identify priorities, thresholds, and objective criteria for requirements as the agencies also work together to first develop and deploy IT services capabilities.
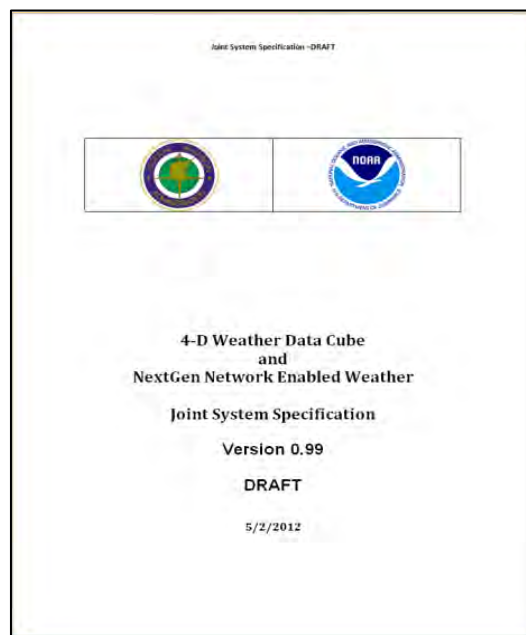
Recent accomplishments include:

- Initiated development of a prototype for net-centric delivery of seven NWS product sets for usage by the FAA in a test environment.

- Participated in an interagency Capability Evaluation that demonstrated secure discovery and transfer of information between the FAA and NWS through standard formats and services.

- Completed a draft of the Joint System Specifications (NOAA and the FAA).

NextGen Partner Agency Highlights

DEPARTMENT OF HOMELAND SECURITY

IWP capabilities advanced by this effort:

 Collaborative Capacity Management

 Air Transportation Security

 Integrated NextGen Information

The Customs and Border Protection (CBP) Office of Air and Marine (OAM) is working with NextGen partner agencies to address the Office of Management and Budget's (OMB) tasking to develop a comprehensive plan for integration of civil UAS into the NAS. Using a CBP unmanned aircraft, the Office is also working with the FAA's William J. Hughes Technical Center to demonstrate NextGen capabilities on UAS. Current and future manned aircraft upgrades and acquisitions will be made in accordance with NextGen airspace rules, which mandate ADS-B equipage. Additionally, all CBP unmanned aircraft are ADS-B equipped and several are being upgraded with avionics and other systems. Planned aircraft acquisitions will be NextGen compliant.

As part of the Coast Guard's ongoing program to ensure NextGen compliance for its aviation fleet, it has numerous programs in place for avionics and communications upgrades. These upgrades are required to ensure Coast Guard aircraft have access and are able to freely participate in the NAS, as well as international airspace. To ensure fleet readiness prior to NextGen implementation, Coast Guard aircraft Platform Managers as part of an ongoing procurement strategy, seek funding on a yearly basis to acquire required avionics upgrades. As part of this process, in FY12 the Coast Guard performed avionics upgrades, including ADS-B, Voice-Over-IP and Mode S Transponders, for its MH-60T, H-65E, HC-130H and HC-130 J aircraft. These are efforts that will continue until all Coast Guard aircraft are NextGen compliant.

DHS has established a Department-wide working group, led by the Office for Civil Rights and Civil Liberties (CRCL), the Privacy Office (PRIV), and CBP to clarify the privacy, civil rights, and civil liberties (P/CRCL) legal and policy issues surrounding DHS use of UASs. The working group, which includes other DHS components with UAS equities, will serve to support all DHS mission areas and, in particular, PRIV and CRCL's mandate to ensure that privacy, civil rights, and civil liberties are not diminished by efforts, activities, and programs aimed at securing the homeland.

Recent Accomplishments include:

- Working with the FAA's William J. Hughes Technical Center to demonstrate NextGen capabilities on UAS.

- All Customs and Border Protection unmanned aircraft are ADS-B equipped.

NextGen Partner Agency Highlights

DEPARTMENT OF DEFENSE

IWP capabilities advanced by this effort:

Improved Safety Operations

Collaborative Capacity Management

Efficient Trajectory Management

Flexible Airport Facility and Ramp Operations

Flexible Separation Management

Collaborative Flow Contingency Management

Integrated NextGen Information

Improved Environmental Performance

In FY12, DOD pursued requirements and expended resources necessary to investigate equipping DOD aircraft with ADS-B Out, to include related studies and demonstrations. These activities include the research and development necessary to modify military aircraft and military transponders to transmit the civil ADS-B Out signal.

The DOD, in conjunction with the FAA, established several workgroups to address many new challenges the DOD faces due to the adoption of ADS-B as the primary source of surveillance within the NAS after January 2020. These include the integration of ADS-B data into DOD air traffic control facilities, operational security issues, as well as equipage challenges. The U.S. Air Force and the FAA have signed a Memorandum of Agreement to integrate ADS-B data into two Air Force Terminal Radar Approach Controls (RAPCON) facilities, McGuire AFB and Nellis AFB. This work continues, and the RAPCONs expect to be operational, receiving and processing ADS-B data in FY13.

The DOD, in conjunction with the DHS and the FAA, are continuing to support integrated surveillance necessary to enable many NextGen operations. The DOD, with DHS and FAA, are funding the upgrade of the nation's long range radars, which are a fundamental aspect of integrated surveillance. The DOD also provides radar track feeds from many DOD approach radar systems.

The DOD is instrumental in acquiring, deploying, and operating the Global Positioning System (GPS), the foundation of NextGen technologies. Two fundamental technologies and operations depend on GPS: ADS-B and Performance Based Navigation (PBN). GPS also provides Precise Time and Time Interval (PTTI), which are used throughout the NextGen system.

In FY12, the DOD conducted several analyses of DOD operations in the NextGen environment that resulted in the ongoing development of the DOD NextGen Concept of Operations and the DOD *NextGen Implementation Plan*. These analyses and documents were developed through collaboration with DOD stakeholders and serve as the foundation toward understanding DOD's unique operations and implementation aspects of NextGen. They further enable the efforts being conducted in FY13 to identify DOD Operational Benefits and Implications and Air Force ADS-B Out Gaps.

The DOD is committed to the development of alternative fuel for its aircraft, and is currently focused on the technologies, components, and systems that develop new and/or more efficient power sources. The alternative fuels effort also identifies and addresses potential changes needed in fuel specifications to implement alternative fuels into current and future systems. For the Navy, these efforts include Engine Test and Certification as well as Power and Energy Materials Research. The Air Force has completed extensive testing and fuels qualification, and continues to research and evaluate alternative fuels and aircraft engine compatibility.

The DOD redefined and acquired a new SES-level Highly Qualified Expert (HQE) to lead not only NextGen net-centric programs, but to also develop a stronger bond between DOD and the JPDO to facilitate NextGen success. The HQE is assigned to the JPDO as the Senior Tech Advisor, Net-Centric Operations, but is also now aligned under the Air Staff and the Policy Board for Federal Aviation (PBFA) to better coordinate operational needs, impacts, and capability enhancement associated with robust adoption of NextGen. In addition, the HQE role was revised by DOD to include a unique mix of both operational and technical background and is now much better equipped to interact with a broad array of Air Force and Office of the Secretary of Defense (OSD) staff. Since appointment in mid-2012, the HQE has redefined the net-centric program to better support partner agencies in the development of information-sharing programs and technologies, developed a mapping of DOD to FAA R&D programs and initiatives, successfully outlined the need for enhanced cyber security awareness and support, and facilitated the transition of semantically based technology to support Community of Interest and information sharing.

In 2012, DOD enlisted the direct support of AFRL, first by comparing shared goals and outcomes between R&D Core Technology Competencies/Programs and the R&D needs expressed in the *NextGen Implementation Plan* and associated Operational Improvements. Initial analysis revealed key overlap between R&D goals and NextGen needs in areas of information sharing, cyber security, unmanned/autonomous systems development. From this initial analysis, a robust, shared "NextGen R&D portfolio" is under development, with significant R&D being shared for the development of data/information sharing services, modular/low cost NextGen equipage alternatives, cyber education and planning, and autonomous systems operations.

A key element of this R&D partnership is the extension of DOD developed semantic services to reason about huge volumes of "big data," and to convert that information into concise textual and graphical messages which can be provided directly to operators in the ground or in the air. The DOD Notice to Airmen (NOTAMS) office partnered with the JDPO and the FAA William J Hughes Technical Center to design, develop, and demonstrate a first-ever ability to semantically process and delivery aeronautical information closely matched to the aviators needs. Leveraging the NETE, these demonstrated capabilities are now scheduled for transition directly into the FAA SWIM program to be shared by all the partner agencies.

The JPDO and DOD developed semantic services are being leveraged to develop a proof of concept for the NextGen weather community stakeholders. This proof of concept shows both the military and civil weather stakeholders how these technologies can be extended to first shape weather information for shared use, and then deliver tailored weather information to users. The DOD also supported sharing information used to decide a common weather picture, facilitating DOD and FAA decision making for operations in the NAS. DOD also worked toward UAS integration in the NAS.

During the development of information-sharing services, the need for better awareness and understanding of information security has grown apparent. Because of the DOD expertise in this area, DOD orchestrated several information exchanges and devoted expert resources to the NextGen community to help understand and develop information security, or "cyber-security," awareness. Based on these exchanges, early FY13/FY14 program planning now includes devotion of additional DOD R&D and operational expertise to NextGen to develop a "cyber" strategy based on DOD lessons learned and focused on "mission assurance" for NextGen.

In all information sharing, it is critically important to understand who is producing the information, who is receiving the information, and how it is shared. To that end, DOD has partnered with the JPDO to investigate and mature FICAM standards that will support NextGen. DOD has a long history of development, testing, and deployment of mature credentialing methods, tools, and structures. As such, DOD is lending assistance and expertise the JPDO/FAA FICAM working group, to include the sharing of knowledge, technologies, and resources to support this critical facet of NextGen implementation. FY12 successes have spawned additional support in FY13, with an extension or connection of this work to include "cyber" security.

A key element of adoption of NextGen is the cost of equipage and the benefits derived from compliance. Because DOD R&D is well versed in developing modular "combat" capabilities to meet a broad spectrum of threads or risks, they quickly adapted this approach to an investigation of modular equipage for NextGen. Specifically, an AFRL program entitled "Open Pod," based on the use of modular pods to add new capabilities to existing aircraft platforms, has been adapted to explore the use of both hardware pods and software structures to add NextGen capabilities to existing aircraft without the traditional cost of aircraft redesign and certification.

Early evaluation of this DOD-developed method and technology has led to an FY13 program specifically tailored to evaluation of how these technologies might support both military and civil platforms adoption of NextGen capabilities and dramatically reduced costs.

Recent Accomplishments include:

- The DOD, in conjunction with the FAA, established several workgroups to address many new challenges the DOD faces due to the adoption of ADS-B as the primary source of surveillance within the National Airspace System (NAS) after January 1, 2020.

- The U.S. Air Force and the FAA have signed a Memorandum of Agreement to integrate ADS-B data into two Air Force Terminal Radar Approach Control (RAPCON) facilities, McGuire AFB and Nellis AFB.

- The DOD and DHS, in coordination with the FAA, are funding the upgrade of the nation's long range radars, which are a fundamental aspect of integrated surveillance.

- The DOD NextGen Lead Service Office began development of the DOD NextGen Concept of Operations and DOD NextGen Implementation Plan.

- The Air Force has completed extensive testing and fuels qualification and continues to research and evaluate alternative fuels and aircraft engine compatibility.

- The Secretary of the Air Force published a NextGen Keystone Document reaffirming the agency's support for and commitment to NextGen. It defines basic information about NextGen such as its genesis, purpose and scope of the keystone document and covers processes, roles and responsibilities for offices within the Service.

NextGen Partner Agency Highlights

DEPARTMENT OF DEFENSE

Unmanned Aircraft Systems (UAS) Integration

IWP capabilities advanced by this effort:

	Improved Safety Operations		*Collaborative Capacity Management*
	Efficient Trajectory Management		*Flexible Airport Facility and Ramp Operations*
	Flexible Separation Management		*Collaborative Flow Contingency Management*
	Integrated NextGen Information		*Improved Environmental Performance*

The DOD is working with NextGen partner agencies to develop a comprehensive plan for integration of civil UAS into the NAS. DOD is also participating in the UAS Aviation Rulemaking Committee and sharing operational experience to aid development of civil UAS policy and procedures. DOD, through the US Air Force, supported the UAS NextGen Demonstration to expand the understanding of how NextGen Technologies can provide information to advance UAS integration into the NAS. DOD has been working directly with the FAA for years on UAS Airspace Integration, and while UAS airspace integration is not part of the DOD NextGen program it is very important that they work closely to ensure UAS NAS access.

UAS Sense and Avoid

The majority of DOD's UAS R&D activity has been in developing the technology to provide DOD UAS a "sense and avoid" capability. DOD has been pursuing two approaches, a Ground Based Sense and Avoid (GBSAA) system and an Airborne Sense and Avoid (ABSAA) system.

The Military Departments are currently developing certifiable GBSAA solutions that include sensors, correlation, fusion, communications, networks, logic, procedures and user interfaces to provide UAS pilots/operators air domain awareness. GBSAA solutions utilize radars to track and display cooperative and non-cooperative traffic, and other objects, such as birds, and present that information to UAS aircrew in order to permit safe navigation of local airspace.

ABSAA development efforts are focusing on onboard capability to perform both self-separation and collision avoidance to ensure an appropriate level of safety. The ABSAA enabling capabilities include self-separation through merging on-board radar information, Traffic Collision Avoidance System (TCAS) and ADS-B cooperative sensors, and provide collision avoidance information to the UAS aircrew. The radar is being designed to be portable and scalable according to UAS performance, size, weight, and power constraints. The USAF is incrementally building to provide autonomous conflict and collision avoidance as a fail-safe method for operations in all classes of airspace. DOD envisions the integration of GBSAA with ABSAA to expand operational utility and maximize safety.

Over the last eight years, the Air Force and OSD have invested over +$147M in technology development of a prototype ABSAA capability known as the Multiple Intruder Autonomous Avoidance (MIAA) program. The MIAA effort has demonstrated its readiness to transition to an Air Force acquisition program as its next step towards providing a robust ABSAA system for military UAVs. Continued collaboration between the FAA and the DOD in the development of sense and avoid technologies, including continued ABSAA/MIAA flight tests and demonstrations, will serve continued mutual evaluation of these sense-and-avoid emerging technologies while facilitating shared insight into how ABSAA equipped UAVs must integrate into the NAS environment.

Recent accomplishments include:

- Development of common Ground Based Sense and Avoid (GBSAA) requirements and standards.
- Creation of an interoperable / interchangeable Ground Based Sense and Avoid (GBSAA) test bed at Dugway, UT.
- Development of self-separation criteria using cooperative sensors.
- Radar and EO/IR sensor developments for airborne sensing capability.
- The Air Force Research Laboratory and the Naval Air Systems Command worked together on the UAS Multiple Intruder Autonomous Avoidance (MIAA) program.

UAS Airspace Integration Concept of Operations Joint Test

The UAS-Airspace Integration Quick Reaction Test (QRT) and subsequent Joint Test are testing and evaluating the flight profiles found in the Joint Forces Command *Joint Concept of Operations (CONOP) for Unmanned Aircraft Systems Airspace Integration*. The FAA, NASA, and CBP provided subject matter experts to the QRT and plan to do so, as well for the upcoming Joint Test.

The QRT used a mix of simulated entities and emulated systems with human-in-the-loop to create a virtual environment similar to the conditions under which UAS operate in the NAS. The simulation tested a cross section of the Concept of Operations flight profiles and associated procedures for UAS experiencing in-flight contingencies involving loss of control link, loss of two-way radio communications, and loss of sense and avoids capability. The QRT provided initial demonstration that with appropriately developed procedures, UAS could safely integrate into the NAS with minimum impact on other NAS users and ATC workload. A more robust Joint Test is underway through FY15 that will build upon the results compiled during the QRT and work toward development of standardized procedures. DOD is working closely with FAA to ensure the procedures established within the CONOPs are compatible with existing Air Traffic Management practices.

Recent accomplishments include:

- Completed the Quick Reaction Test and published results.
- Started initial planning for an expanded Joint Forces Command Joint Concept of Operations (CONOP) Joint Test.

NextGen Partner Agency Program Investments

Agency	Item	Top-line budget account	NextGen Program/Initiative	Component Support Program	Component Support Activities	FY 12 Actual	FY 13 Enacted	FY 14 President's Budget Request	Comments
NASA	Aviation Safety Program					$ 80,100,000	$ 77,500,000	$ 80,000,000	
NASA	Airspace Systems Program					$ 92,700,000	$ 89,700,000	$ 91,500,000	
NASA	Fundamental Aeronautics Program					$ 130,400,000	$ 130,100,000	$ 130,900,000	
NASA	Integrated Systems Research Program					$ 104,200,000	$ 99,000,000	$ 101,500,000	
NASA	Innovative Concepts for Aviation Project					$ 10,100,000	$ 10,000,000	$ 9,800,000	
DOC	NOAA NextGen Weather Program					$ 6,444,000	$ 16,199,000	$ 16,199,000	
DHS/USCG)	Avionics	Acquisition, Construction & Improvement (AC&I)	Net-Centric	Avionics	MH-60T Avionics Upgrade 42 Aircraft Required Navigation Performance (RNP) Certified.	$ -	$ -		The H-60 Conversion Projects Discrete Segment 1 included RNP development, which was completed with prior appropriated funding.
DHS/USCG)	Communications	AC&I	Net-Centric	Avionics	H-65E Avionics Upgrade 102 Aircraft RNP, Automatic Dependent Surveillance Broadcast (ADS-B), and Wide Area Augmentation System (WAAS) certifications.	$ 10,000,000	$ 86,000,000		RNP, ADS-B and WAAS functionality are provided under H-65 Conversion Projects Discrete Segment 6 (DS6)upgrades. Cost shown are the total cost for DS6 which includes some work not related to meeting NextGen requirements.
DHS/USCG)		AC&I	Net-Centric	Avionics	HC-130H Avionics Upgrades for 12 aircraft RNP, ADS-B, and WAAS certified.	$ 23,800,000	$ 33,900,000		RNP, ADS-B and WAAS upgrades are being completed as part of the HC-130H Avionics One Upgrade project (A1U). Costs shown for FY12, FY13 and FY14 are the total AIU project costs which includes some work not related to meeting NextGen requirements.
DHS/USCG)		AC&I	Net-Centric	Avionics	HC-130J Block 8.1 Upgrades include RNP, ADS-B, and WAAS certifications.	$ 100,000	No Request		HC-130J avionics upgrades, including Next Gen requirements, are being developed under an Air Force C-130J Block Upgrades Program. The costs shown represent CG FY12 funding related to this effort, but is not the total cost for the upgrades.
DHS/USCG)		AC&I	Net-Centric	Avionics	HC-144A avionics upgrade including ADS-B and WAAS certifications.	$ -	$ -		$12M under FY10 funding for CDU-7000 Upgrade. ADB-S and WAAS cost was not broken out in CDU-7000 Upgrade. Not yet awarded.
DHS/USCG)		Operating Expenses (OE)	Net-Centric	Avionics	C-37 Command & Control Aircraft: Flight Management System upgrade.	$ -	No Request		Planned for FY14
DHS/USCG)		OE	Net-Centric	Communications	Mil SatComIntegraded Waveform (IW)	No Request	$ 2,000,000		
DHS/USCG)		OE	Net-Centric	Communications	Mode 5 IFF Upgrades all platforms.	$ -	$ 3,000,000		
DOD	ADS-B Out					$ 75,781,000	$ 78,954,000	$ 85,560,000	
DOD	ADS-B Ground							$ 160,000	
DOD	Common WX Picture							$ 50,000	
DOD	UAS Integration into the NAS					$ 41,813,000	$ 56,255,000	$ 63,900,000	
DOD	Tower & Radar Modernization							$ 12,008,000	
DOD	Alternative Fuels					$ 8,073,000	$ 4,000,000	$ 3,830,000	

NextGen Partner Agency Program Investments (continued)

Agency	Item	Top-line budget account	NextGen Program/Initiative	Component Support Program	Component Support Activities	FY 12 Actual	FY 13 Enacted	FY 14 President's Budget Request	Comments
FAA	ADS-B NAS Wide Implementation (ADS-B)	NextGen F&E	NextGen Transformational Programs:			$ 285,100,000	$ 271,057,000	$ 282,100,400	
FAA	System-Wide Information Management (SWIM)	NextGen F&E	NextGen Transformational Programs:			$ 66,350,000	$ 49,102,000	$ 70,500,000	
FAA	Collaborative ATM Technologies (CATMT)	NextGen F&E	NextGen Transformational Programs:			$ 41,500,000	$ 34,351,000	$ 29,390,800	
FAA	Communications in Support of NextGen	NextGen F&E	NextGen Transformational Programs:			$ 143,000,000	$ 142,344,000	$ 115,450,000	
FAA	NAS Voice System (NVS)	NextGen F&E	NextGen Transformational Programs:			$ 9,000,000	$ 10,230,000	$ 16,000,000	
FAA	Time-Based Flow Management (TBFM)	NextGen F&E	NextGen Implementation Programs:			$ 38,700,000	$ 12,874,000	$ 10,500,000	
FAA	Colorado Wide Area Multilateration (WAM)	NextGen F&E	NextGen Implementation Programs:			$ 3,800,000	$ 1,397,000	$ 3,400,000	
FAA	Aeronautical Information Management (AIM Seg 2)	NextGen F&E	NextGen Implementation Programs:			$ 8,000,000	$ 2,106,000	$ 9,050,000	
FAA	ERAM D-Position Upgrade & System Enhancements	NextGen F&E	NextGen Implementation Programs:			$ -	$ 9,980,000	$ 64,974,000	
FAA	NextGen Future Facilities	NextGen F&E	NextGen Implementation Programs:			$ 15,000,000	$ 32,405,000	$ 10,000,000	
FAA	Performance Based Navigation - Optimization of Airspace and Procedures for Metroplex (OAPM)	NextGen F&E	NextGen Implementation Programs:			$ 29,200,000	$ 41,118,000	$ 32,200,000	
FAA	Terminal Flight Data Manager (TFDM)	NextGen F&E	NextGen Implementation Programs:			$ -	$ 33,533,000	$ 23,500,000	
FAA	Aviation Safety Information Analysis & Sharing (ASIAS)	NextGen F&E	NextGen Implementation Programs:			$ -	$ 14,970,000	$ 15,000,000	
FAA	NextGen Weather Processor	NextGen F&E	NextGen Implementation Programs:			$ -	$ -	$ 23,510,000	
FAA	NextGen Demonstrations and Infrastructure Development	NextGen F&E	NextGen Pre-Implementation Activities:			$ 15,000,000	$ 22,255,000	$ 24,674,500	
FAA	NextGen System Development	NextGen F&E	NextGen Pre-Implementation Activities:			$ 85,000,000	$ 50,898,000	$ 61,500,000	
FAA	NextGen Trajectory Based Operations (TBO)	NextGen F&E	NextGen Pre-Implementation Activities:			$ 7,000,000	$ 13,273,000	$ 18,000,000	
FAA	NextGen Reduce Weather Impact (RWI)	NextGen F&E	NextGen Pre-Implementation Activities:			$ 15,600,000	$ 16,267,000	$ 6,000,000	
FAA	NextGen Arrivals/Departures at High Density Airports (HD)	NextGen F&E	NextGen Pre-Implementation Activities:			$ 12,000,000	$ 9,481,000	$ 7,000,000	
FAA	NextGen Collaborative Air Traffic Management (CATM)	NextGen F&E	NextGen Pre-Implementation Activities:			$ 24,000,000	$ 20,559,000	$ 41,000,000	
FAA	NextGen Flexible Terminals and Airports (FLEX)	NextGen F&E	NextGen Pre-Implementation Activities:			$ 33,300,000	$ 24,152,000	$ 15,000,000	

NextGen Partner Agency Program Investments (continued)

Agency	Item	Top-line budget account	NextGen Program/Initiative	Component Support Program	Component Support Activities	FY 12 Actual	FY 13 Enacted	FY 14 President's Budget Request	Comments
FAA	NextGen Systems Networked Facilities (FAC)	NextGen F&E	NextGen Pre-Implementation Activities:			$ 5,000,000	$ 9,481,000	$ 9,000,000	
FAA	Personnel & Related Exp - NextGen (ANG 85 EOY/85 FTE)	NextGen F&E	Other NextGen Support			$ 12,750,000	$ 12,798,000	$ 12,961,000	
FAA	Personnel & Related Exp - NextGen (ATO 132 EOY/132 FTE)	NextGen F&E	Other NextGen Support			$ 13,500,000	$ 17,016,000	$ 20,741,000	
FAA	Personnel & Related Exp - NextGen (AVS 40 EOY/40 FTE)	NextGen F&E	Other NextGen Support			$ -	$ 3,300,000	$ 6,684,000	
FAA	Joint Planning & Development Office	NextGen R,E&D				$ 5,000,000	$ 4,990,000	$ 12,057,000	
FAA	NextGen - Wake Turbulence	NextGen R,E&D				$ 10,674,000	$ 10,653,000	$ 9,267,000	
FAA	NextGen - Air/Ground Integration Human Factors	NextGen R,E&D				$ 7,000,000	$ 6,986,000	$ 10,329,000	
FAA	NextGen - Self Separation	NextGen R,E&D				$ 3,500,000	$ 3,493,000	$ -	
FAA	NextGen - Weather Technology in the Cockpit	NextGen R,E&D				$ 8,000,000	$ 7,984,000	$ 4,169,000	
FAA	NextGen - Alternative Fuels, General Aviation	NextGen R,E&D				$ 2,071,000	$ 2,067,000	$ 5,571,000	
FAA	NextGen - Advanced Systems and Software Validation	NextGen R,E&D				$ -	$ -	$ 1,021,000	
FAA	NextGen - Environmental Research: Aircraft Technologies, Fuels, and Metrics	NextGen R,E&D				$ 23,500,000	$ 23,453,000	$ 18,979,000	
FAA	Integrate Environmental Performance into NextGen (APL 5 EOY/5 FTE)	NextGen Operations				$ 725,000	$ 725,000	$ 737,000	
FAA	NextGen Environmental/Noise Studies (APL 5 EOY/5 FTE)	NextGen Operations				$ 1,675,000	$ 1,675,000	$ 1,692,000	
FAA	NextGen Staffing (ANG 24 EOY/24 FTE)	NextGen Operations				$ 3,200,000	$ 3,200,000	$ 3,253,000	
FAA	NextGen Staffing (ATO 51 EOY/51 FTE)	NextGen Operations				$ 6,800,000	$ 6,800,000	$ 6,913,000	
TOTAL						$ 1,518,456,000	$ 1,613,581,000	$ 1,597,530,700	