VIRGINIA'S FLIGHT TO 2025:

An Aviation Vision for the Commonwealth

VIRGINIA DEPARTMENT OF AVIATION

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EXECUTIVE SUMMARY

This Strategic Plan presents the vision for Virginia's future aviation system as we move forward to take advantage of new technologies to provide better access and more economic opportunities to Virginia communities. The purpose of this document is three-fold:

1. The strategy informs Virginia Citizens and Legislators;
2. The plan motivates Virginia's Aviation Community; and
3. The vision excites stakeholders to unite in moving the Commonwealth forward into a new era of air mobility.

This new opportunity is driven by national investments in NextGen, which deploys new technologies, and advances safe access to all airports in the Commonwealth, thus expanding business opportunities. As stated by Virginia Delegate Joe May, our Virginia airports are well positioned to be "technology magnets" for our communities in the Commonwealth.

The Virginia Department of Aviation (DOAV) is the agency responsible for planning, supporting, and growing the Commonwealth's aviation system to meet the Commonwealth's future aviation transportation needs.

OUR VISION

We will make the Virginia aviation system the model air transportation system, providing Virginia communities economic development opportunities and convenient access to the National Air Transportation System and DOAV will be the standard of excellence amongst state aviation agencies.

Our Vision requires a strong team of stakeholders working together to make Virginia the model for other states to emulate and to keep Virginia "The Best State for Business," as awarded by Forbes magazine 2006, 2007, 2008 and 2009. Unity among the stakeholders will accelerate the realization of the Vision.

OUR MISSION

- Cultivate an advanced aviation system that is safe, secure and provides for economic development;
- Promote aviation awareness and education; and
- Provide safe and secure flight services for the Commonwealth Leadership and State agencies.

Our mission makes it necessary for us to look for new technologies that will enable us to improve our safety and security while providing better access and economic development opportunities for our communities.

To accomplish our Mission and achieve our Vision we will leverage the current and future capabilities of NextGen by creating an integrated approach of the following three key distinct initiatives:

1. Being an **Early Adopter** of the NextGen mature technologies.
2. Creating a **Test Bed** for the NextGen maturing technologies.
3. Providing a **Virginia Aviation/Aerospace Research Consortium** to assist in the development and deployment of NextGen emerging technologies.

All three of these initiatives will require an aggressive outreach program that is core to our second mission: To promote aviation awareness and education. Additionally, as they open significant business and air travel opportunities for the Commonwealth, they will create jobs for our citizens.

In working to accomplish our vision for Virginia aviation, the opportunities are greatly expanded for all Virginia airports, the communities they serve, aircraft business and recreational operators. Virginia will promote infrastructure advancements enabled by national NextGen investments, including computer-enhanced weather reporting, satellite-based instrument approaches, business-friendly airport terminal facilities, and digital communications systems for aircraft operators. These, among other NextGen technologies enable General Aviation (GA) to become a safer, more routine mode of transportation for trips of 150-600 miles and more. As a result, access to the national airspace, business opportunities and the quality of life for all Virginians is enhanced. Virginia communities not currently well served by scheduled commercial air transportation and with limited facilities to support business aircraft will see significant improvement in business access. Affordable, on-demand air transportation serving markets too small for scheduled air carriers opens new business opportunities and greatly improves emergency response to remote communities.

I invite you to join us as we move forward in this new era of air mobility. Together we will achieve our vision to make the Virginia aviation system the model air transportation system, providing Virginia communities' economic development opportunities and convenient access to the National air transportation system. By achieving our Vision, Virginia will remain the "Best State for Business."

Sincerely,

Randall Burdette

Director, Virginia Department of Aviation

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INTRODUCTION

A recent FAA estimate[1] forecasts the demand for air travel to increase by 71% over current levels by 2027. Because current human-centric air traffic control (ATC) methods are not capable of accommodating the additional traffic with current systems, the Joint Planning and Development Office (JPDO) was given the task of designing a new way to manage the nation's skies. Their solution is a system of systems, dubbed NextGen, and the cornerstone of that solution is ADS-B (Automatic-Dependent Surveillance-Broadcast). The use of radios in aircraft to broadcast aircraft information including location and type and the ground systems that collect and rebroadcast the information along with traffic and weather information are the most well known capabilities of ADS-B and NextGen. The FAA now has the responsibility of implementing NextGen to meet America's aviation growth needs. Though switching to an entirely new system of air traffic management will require significant investment from the FAA initially, it is necessary to meet the increased demand over the next 10 years. The FAA should be able to reduce its legacy infrastructure costs by decommissioning many of its ground-based radars as ADS-B becomes the standard for aircraft operating within the NAS. It will use the position broadcasts from aircraft rather than radar as the primary means of determining aircraft location and managing separation. Because ADS-B position updates are more frequent than radar, it may even be possible to reduce the separation between aircraft and make more efficient use of the nation's airspace. These cost savings and efficiency gains, though, are dependent upon having aircraft that are equipped with ADS-B radios. For Virginia to achieve its vision for air travel, the majority of aircraft operating in the Commonwealth will need to be equipped with ADS-B radios, as well.

To understand the scope of this equipment challenge, consider that, according to FAA data from 2008[2], 95% of the planes in the US are classified General Aviation (includes on-demand Commuters). Though many of these aircraft may not fly as often or as far as scheduled cargo or passenger aircraft, still 62% of the flight hours over the last 20 years were GA. The data for Virginia is consistent with these findings. According to FAA data[3] from 2008, even at Dulles International Airport, 51% of the operations were GA. So, at any given moment in any air traffic control setting, most of the aircraft that controllers are managing can be expected to be GA aircraft. If the FAA cannot entice GA operators to buy ADS-B radios, they cannot take full advantage of the efficiencies provided by ADS-B and NextGen technologies.

To address that need, the FAA issued a mandate in May of 2010[4] stating that all aircraft must be equipped with ADS-B radios by 2020 or they shall not be flown in IMC, in VMC above 10,000 feet, or in Class B or C airspace. Unequipped aircraft will only be permitted to operate on clear days, below 10,000 feet, and well clear of busy commercial airports. Stating that it did not see sufficient advantages to GA operators to equip early, the Aircraft Owners and Pilots Association (AOPA), representing a membership of over 415,000 pilots and aircraft owners, quickly issued a statement[5] encouraging its members to delay equipping as long as possible. The FAA's and the Commonwealth's challenge is to show the value of the new technologies to the system users. ADS-B In (the ability to not just broadcast, commonly called ADS-B Out, but to receive transmissions, as well) must be accelerated so the users can see the added safety and capabilities provided to the pilots and users of the system. DOAV is working to encourage the FAA to expedite the development and release of the standard for ADS-B In. It also intends to gather operational data necessary to develop the business case for equipage that is necessary for operators to support the new technologies. Only through showing that value can operators be encouraged to equip in greater numbers and only in equipping in greater numbers can the cost of equipage be reduced to enable more acceptance of the technologies.

Our vision for implementing NextGen supports the FAA's need to enroll the GA community. If the FAA partners with Virginia in reaching its vision more quickly, Virginia will be able to help the FAA show the rest of the country why they need these technologies, now. Once Virginia has sufficient ADS-B coverage and a reasonable level of aircraft equipage, Virginia will work to become a test bed for the FAA and industry for evaluating new systems and procedures. With the early implementation of NextGen technologies and the development of Virginia's Test Bed capability, Virginia will promote our rich research capabilities such as NASA, NIA, and our extremely capable Universities and Industries for conducting research to resolve some of NextGen's future challenges for both government agencies and industry.

VIRGINIA'S AIR TRANSPORTATION VISION

Virginia seeks to unleash the potential and enhance the quality of life of all of its citizens through mobility. Mobility is the most fundamental measure of freedom and Virginians have often led the nation in the pursuit of freedom. Freedom from European rule began at Jamestown, Virginia. The author of the Declaration of Independence (Thomas Jefferson), the "Father of the Constitution" (James Madison), the Commander in Chief of the Continental Army (George Washington), and four of the first five US Presidents all came from Virginia. NASA, America's frontier-challenging icon, got its start in Hampton and the nation's oldest launch facility is at Wallops Island, Virginia. Virginia has a long legacy of leading the nation into freedom and innovation and it will do it again with improvements in mobility.

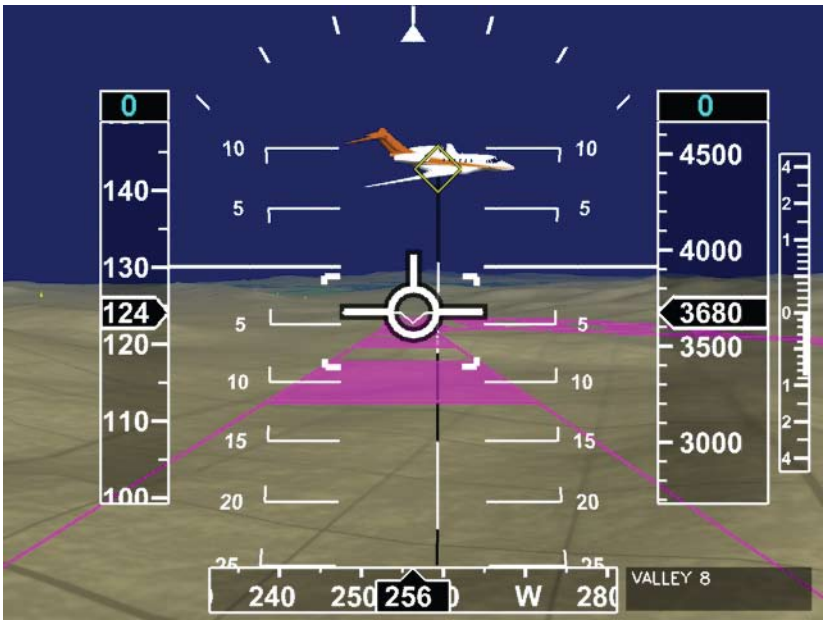
In this mobility vision, the automobile is expected to remain the transportation mode of choice for trips up to 150 miles. A recent review of over 40,000 air taxi service records indicates the average air taxi trip was 172 nautical miles. According to an MIT travel study[6], the automobile provides average trip speeds of less than 33 mph and an average daily radius of travel of only 40 miles. Even if it is assumed that people are occasionally comfortable being in a car for as many as three hours and can average 50 miles/hr, the extent of automotive comfort for many travelers is only about 150 miles.

For trips exceeding about 500 miles, scheduled air travel is expected to be the mode of choice. DOAV is working to provide all Virginians less than 45 minutes access to a scheduled service airport that can provide scheduled service and less than 30 minute access to a General Aviation airport. Even with convenient access to a scheduled service airport, however, airline service has its limitations. Though airlines travel at speeds approaching the speed of sound during cruise, hefty time penalties are levied in the drive to the airport, parking and transit to the terminal, and waiting in lines at the ticket counter, at the security checkpoint, in the jetway, on the taxiways, in the aircraft aisles, at the rental car desk, and in traffic leaving the airport. Average door-to-door speeds cannot compete with the automobile until the trip exceeds about 500 miles. Even then, the perceived cost difference keeps many Americans in their cars until the trip exceeds 1000 miles[6].

An attractive alternative to both of these modes is customized, on-demand air travel. As was studied for many years by NASA and its private-sector partners[7], on-demand air travel using small aircraft and small airports can offer premium convenience for trips of 150 – 600 miles. Understandably, most Americans consider that alternative too costly, today, but as is the case for any business, as the volume rises, the service will become more affordable. In this case, the business volume will rise when the perceived safety and reliability increase as long as the environmental (noise and emissions) impact is minimal.

Virginia's vision for on-demand air travel is to provide that reliability through the application of several technological and procedural improvements.

- All runway ends will have published procedures that allow operators to use the airport in conditions as poor as a 200' ceiling and a half mile visibility. Historically, this provides access to any Virginia airport at least 95% of the time[8].



- Virginia is investing in weather reporting systems for 100% of Virginia's airports. Weather will be reported from all Virginia airports and available remotely through the internet, phone, and on-board aircraft systems. Ultimately, most GA aircraft will gather weather information and provide that as input to systems that automatically generate "pilot reports" of the conditions they encounter.

- Staffed NextGen Towers will provide tower-like throughputs at non-towered airports in IMC.

- ADS-B In and synthetic vision systems will provide VFR-like throughputs as self-separation procedures are implemented which will capitalize on the new capabilities provided by the new technologies.

Through these improvements in capability, reliability and safety, Virginia communities will experience increases in the volume of business for on-demand air transportation, and resulting economic opportunities. Increased utilization and demand will make on demand air transportation more affordable and more accessible for Virginia businesses and citizens. NextGen technologies that will allow direct origin-to-destination navigation and direct approaches-to-landing will reduce trip fuel consumption and flight duration by 10%. These NextGen technologies will allow on-demand air travel costs to drop to the point that there will be an order of magnitude increase in air taxi bookings.

Virginia seeks to provide this level of mobility opportunity to all of its communities so that the quality of life for Virginians will be enhanced. All Virginian's will enjoy convenient access to all parts of the Commonwealth. Such access will also make all parts of Virginia attractive to businesses since businesses need access to a growing workforce, raw materials, and markets and since corporate executives prize personal mobility. Easier access to Virginia's historic and picturesque locations will also increase tourism revenues.

STRATEGY

Virginia's Department of Aviation will seek to accelerate the realization of this vision through alliances. It has an uncommon commitment to providing quality services and has been very innovative in initiating partnerships within Virginia's aviation community. DOAV was the second Virginia agency to achieve ISO 9001:2008 certification, and DOAV was the first State in the nation to achieve the coveted IS-BAO quality certification for business aviation. Some examples of Virginia's success in building beneficial partnerships are relationships with the Virginia Airport Operators' Council and the Virginia Aviation Business Association. DOAV also developed the Virginia Airport Owners Association, Virginia Small Aircraft Transportation System and the development of www.virginiaairtaxi.com to help bring together on-demand air transportation service providers and prospective customers. Under the Governor's Aerospace Advisory Council, DOAV is currently forming the Virginia Aviation/Aerospace Research Consortium which will facilitate partnering among Virginia's aeronautics and space researchers, manufacturers, and service providers. As a leader among states, DOAV's Director is also the Chairman of NASAO (National Association of State Aviation Officials).

DOAV is examining ways in which many partners – Federal, State, and Local Governments as well as Aviation Associations and Industries – can support the achievement of this air transportation vision. Core partners are expected to include the FAA, NASA, National Institute of Aerospace (NIA), Virginia Airport Operators Council, Virginia Small Aircraft Transportation System Lab, Virginia Aviation Business Association (VABA), The Virginia Aerospace Advisory Council and Virginia Economic Development Partnership. As the outreach program grows, the Commonwealth Aviation/Aerospace industries will be enrolled to tell the story of the economic development opportunities generated by achieving this Vision.

As new technologies are implemented in Virginia, it will become a unique proving ground for even more advanced technologies. Virginia plans to be an enabler to motivate GA operators to equip with ADS-B radios. Having a predominantly equipped fleet would provide controllers and pilots an aircraft position awareness that is equal to or better than that provided by radar and low-cost ground surveillance for airport operations. Up-to-date weather and weather forecasts would also be available in the cockpits of aircraft equipped with ADS-B In. Obviously, this enhanced situation awareness will enable simultaneous increases in both safety and operational efficiency.

One of the most significant challenges facing air charter and air taxi operators is accurate weather reporting at desired destination airports. DOAV is currently working to make weather information accessible from every Virginia airport. Currently, the FAA only makes an airport's weather information available through the NADIN, their web-based weather information system, if that airport has a full AWOS-3 weather station. Operators, however, report that they would benefit even by knowing just ceiling and visibility at an airport. DOAV considers getting an altimeter setting from every airport a necessity to enable airports to conduct business aircraft operations in poor weather conditions. In short, they would like the operator to be able to access any FAA-certified weather data measured at an airport. DOAV and NASAO are working with the FAA to allow weather information from any FAA certified sensor to be available through the NADIN.

In addition to encouraging GA aircraft owners to equip with ADS-B In and airports which will be uncommonly equipped with weather and approaches, Virginia provides a rich range of test conditions that will support the testing needs of many prospective partners. To list just a few, its geographic diversity includes access to large volumes of Special Use Airspace (SUA) over the Atlantic Ocean, vast coastal and inland plains, and imposing mountains. In addition to the expansive offshore Warning Areas, Virginia skies contain large inland SUAs (16 Restricted Airspaces and 9 Military Operations Areas) and much of the Special Flight Rules Area around Washington, DC. There are also two test ranges which have been developed specifically for the testing of Unoccupied Aerial Systems (UASs).

As DOAV pursues this vision, with all of the qualities Virginia offers, there are many opportunities for partners to also achieve their goals.

- The **FAA** has an opportunity to use this test bed to compliment its airline-focused test beds in Texas and Florida. Virginia is a high utilization area that is also conveniently located next to the FAA Headquarters where results can be closely watched and quickly incorporated into their outreach message. Specifically, a Virginia GA test bed will enable the FAA to
  - demonstrate the benefits of ADS-B to the GA community,
  - develop and evaluate digital communication strategies,
  - evaluate Staffed NextGen Tower operations across several airports simultaneously and in a mixed-equipage environment,
  - explore previously impractical wake vortex mitigation strategies,
  - field test new dynamic SUA management strategies,
  - streamline the transition of cargo and passengers between GA and scheduled carriers, and
  - test UAS operational concepts.
- **NASA** has the opportunity to mature technologies nearly ready for commercialization and to gather research data related to NextGen operations with the goal of increasing safety and capacity. NASA could use this unique GA operational environment to expand the relevance of its Aviation Safety

Program and Airspace Systems Program. It could gather the data needed to mature technologies that improve single-pilot safety such as enhanced and synthetic vision systems, digital communications, and cockpit automation.

- The **National Weather Service** has the opportunity to evaluate the usefulness of gathering low-altitude weather information from thousands of GA aircraft and possibly automatically generating Pilot Reports from that data.

- Since GA aircraft in America outnumber commercial carrier aircraft by a 30:1 margin, the potential exists for the GA market to become the most valuable market for avionics manufacturers selling many NextGen technologies. **Avionics manufacturers** could use Virginia's unusually large, equipped GA fleet as a test bed and as a marketing tool for its products. Given the likely visibility this progressive community will enjoy, participating in a NextGen GA test bed seems like a valuable opportunity for those hoping to capture a significant share of the new avionics market.

- Equipped **air service providers** offer the potential to generate a great deal of insight into the benefits and deficiencies of equipping. Virginia's GA operators can be enticed to gather and provide that data and experiences if they receive their equipment at reduced or no cost. Essentially, they can become an inexpensive, passive, diverse flight-test fleet.

Though Virginia plans to achieve its vision with or without external partnerships, there is a powerful opportunity to accelerate the technology implementation through partnerships. Early progress will support many agendas. As with all successful partnerships, all partners stand to multiply their accomplishments with just a fractional investment.

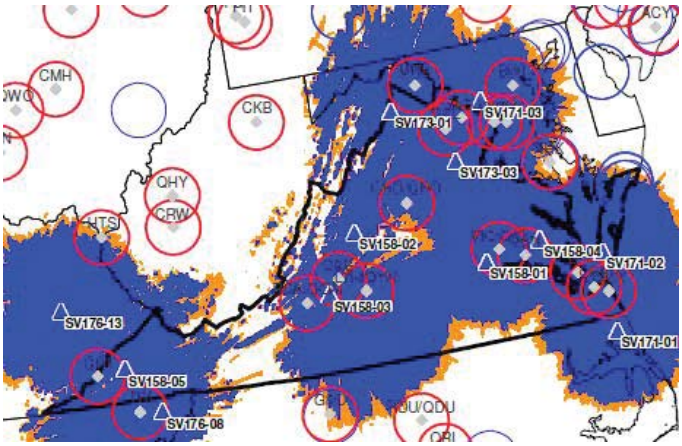
EARLY IMPLEMENTATION of NextGen TECHNOLOGY

There are several NextGen technologies which are mature and ready to implement. Since the investment in many of these technologies must be made by the individual aircraft and airport owners, those owners will need to see the value of investing before they will invest. DOAV proposes that Virginia serve as a location for extended demonstrations of those technology investments. The Commonwealth will make investments and DOAV will broker mutually beneficial alliances among other organizations that stand to benefit from NextGen. Careful measurements will be made to quantify the benefits of the technology investments and those findings will be used to inform future investments in other states. Virginia offers a variety of operational, geographic, airspace, and meteorological environments and is eager to partner in leading the nation into the next generation of airspace management. Listed below are some possible NextGen technologies that could be evaluated in a Virginia Early Implementation Project. Where these activities support specific NextGen roadmap objectives presented in Appendix 3, blue stars (★) can be found on the roadmap.

- ADS-B In and Out

Automatic Dependent Surveillance – Broadcast (ADS-B) radios will access aircraft information and send regular updates to a ground network and to other aircraft. ADS-B technology utilizing the UAT for com-

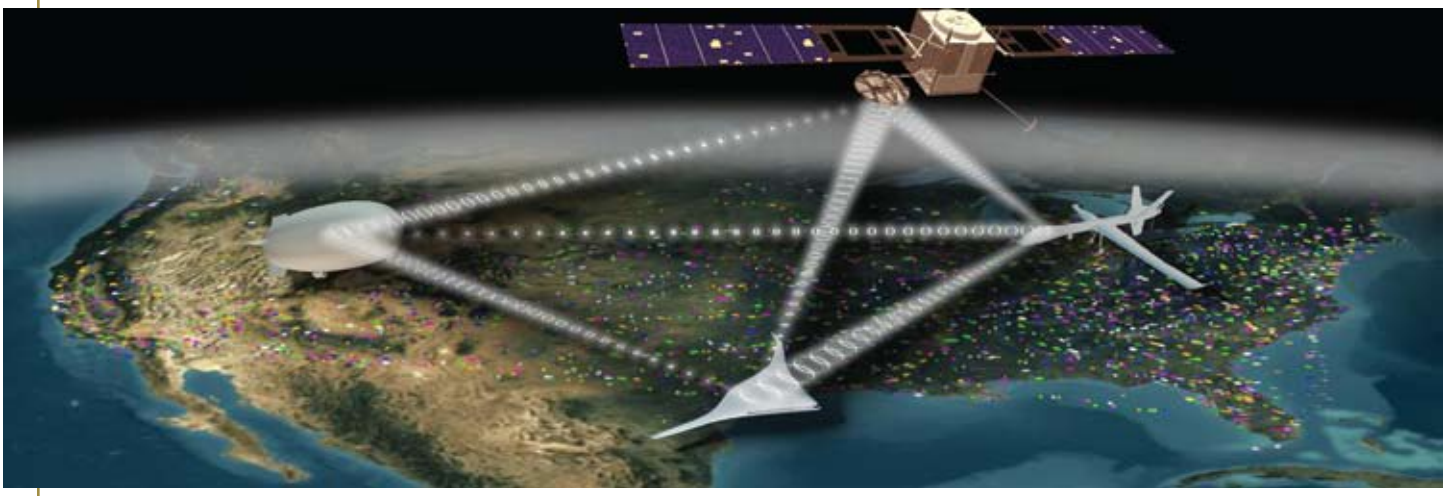
munications, as will be the case for most General Aviation aircraft, will have the capability to display both the weather and nearby traffic. Aircraft utilizing the 1090 ES technology, such as Commercial Carriers, will be able to display traffic from the ADS-B system. The information shared through ADS-B will improve safety and enhance communications with Air Traffic Control (ATC) because the pilot will be seeing the same information that is being seen and utilized by ATC. Future applications could be written which would combine data from the aircraft, other aircraft, and the ground in useful and unusual ways that assist the pilot in flying safely and enhance the convenience of flying. The possibilities for those applications are enormous.



ADS-B Out will provide the FAA (and other aircraft) significant data on the aircraft position and allow more efficient air traffic management.

Many potential partners have much to gain by helping equip the Virginia GA fleet.

- The FAA will benefit from an opportunity to demonstrate the value of the equipment and entice early adopters to equip quickly. Demonstrating the benefits of ADS-B equipage is designated the primary "overarching research topic" in the FAA 2010 ADS-B Applications Integrated Plan[9].
- Avionics manufactures will have an opportunity to establish their product first in what will almost certainly become a very large market.
- Virginia air-service providers will receive ADS-B equipment at a reduced cost as their compensation for their passive participation in demonstration and research activities.
- The Virginia General Assembly will have an opportunity to develop a test bed that will enhance the safety, economic opportunities, and quality of life of its citizens and will attract businesses, researchers, technology developers, and media attention to Virginia.

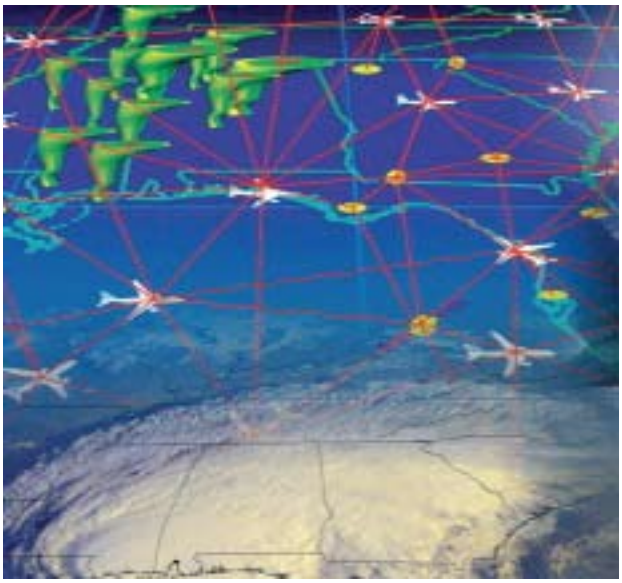


- GPS Routing and Terminal Procedures

Satellite-based augmentation systems (SBAS) have revolutionized air navigation. It is no longer necessary to fly from beacon to beacon. Any point in space can be designated as a destination and a direct path can be generated to that point. Curved paths can also be created that assist in avoiding restricted blocks of airspace and allowing more efficient and environmentally-friendly routing. Continuous descent approaches and continuous climb departures are all possible, saving fuel and reducing emissions.

Working closely with the FAA, Virginia is on track to become the first state in the nation to have GPS RNAV/RNP approaches to every runway end. Virginia is investing over $750,000 to remove obstructions around airports to allow safer instrument approaches to lower minimums so the airport is truly an all weather asset to the community. Our goal is to get every airport down to the lowest safe minimums possible. Where equipment such as WAAS and LAAS at or near the airport supports, GPS approaches can be flown to an MDA as low as less than 200' and cost a fraction of what previous ground based systems used previously such as Instrument Landing System or ILS. Depending upon the obstructions near the runway, some of these approaches may be down to 400' or 600' while some may be only be for daytime operations and down to only 1000' MDA.

- Enhanced Weather Reporting & Forecasting



Virginia's air transportation service providers have reported that the unavailability of weather information at what might be their preferred destination airport is the largest single impediment to their business. Without a quality forecast for their desired destination, they may select an airport that is not as close to the client's desired destination. Without good weather reporting the pilot must interpolate the weather from information provided among airports that surround their desired destination and may not be able to file an IFR flight plan to that desired airport. Many pilots report that many departure flights cancelled due to weather were cancelled for insufficient visibility even though they could see well enough down the runway to depart safely. Runway Visual Range (RVR) sensors could eliminate many of those cancellations by providing a more meaningful measure of visibility.

As with ADS-B, many stakeholders stand to benefit from implementing this technology.

- Virginia's commitment to safety and service reliability caused DOAV to pursue changing the FAA and National Weather Service (NWS) rules that exclude weather information from their network-accessible weather information system (NADIN). Currently, information that does not come from a full AWOS-3 weather station is excluded. DOAV has invested substantially in this effort al-

ready. Virginia has and will continue to systematically upgrade the weather systems at its airports and is working with the FAA to open the NADIN to any FAA/NWS-approved sensor.

- The NWS could improve its forecasts, if it had more data in the boundary layer (lower altitudes) of the atmosphere. Though many scheduled carriers gather atmospheric data, an equipped fleet of GA aircraft could gather useful data at low altitudes and near airports where scheduled carriers do not fly.
- The FAA can help make GA operations more reliable by improving the visibility measurements made at GA airports. Though RVR sensors have been used at large commercial airports, installing them at some of Virginia's busiest airports will give them insight into the impact better measurements would make on the broader aviation community.

- Enhanced GA Terminals

To promote GA as a primary air transportation option for most of Virginian's residents, DOAV is working with the airports to ensure the terminals provide services and amenities similar to those found at larger airports. They must provide comfort, internet and cellular services, ground transportation, 24-hour refueling operations and perhaps, local traffic monitoring. GA terminals need to be actively rebranded as business centers with meeting rooms and copying and fax machines.

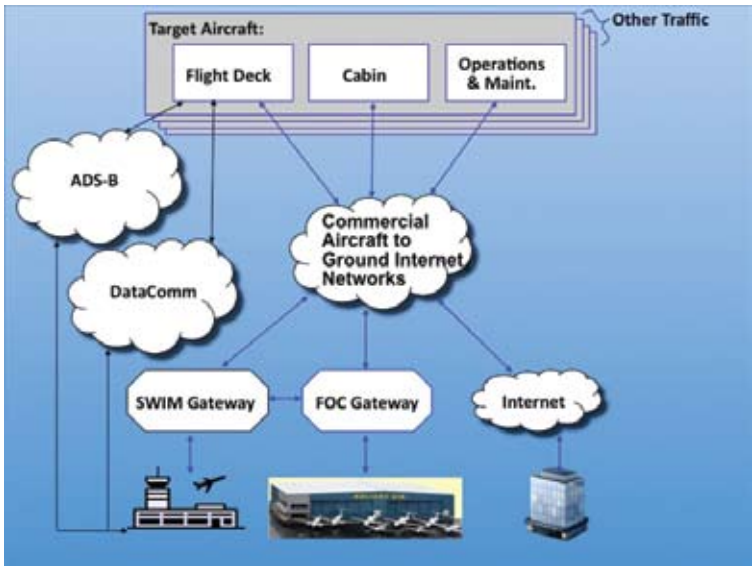
- Given DOAV's commitment to making on-demand travel more attractive to Virginians, they are willing to take the lead for promoting and funding these enhancements. DOAV will develop an aggressive marketing campaign highlighting the business utility of GA airports.
- Service providers such as car rental agencies and telecommunication service providers also could benefit from reaching additional customers. DOAV will work with those service providers to develop a mutually beneficial business case for these specialty offerings.

TEST BED ACTIVITIES

Several other technologies that will support NextGen are not yet mature enough for widespread implementation but will benefit from testing in an operational environment. The fleet of ADS-B equipped aircraft and the unusually well-equipped airports in Virginia provide just such an advanced operational environment. Listed below are examples of innovative communication, procedure, and equipment technologies that would benefit from a Virginia NextGen test bed. Where these activities support specific NextGen roadmap objectives presented in Appendix 3, blue diamonds (◆) can be found on the roadmap.

- Digital Data Communications (Data Comm)

The likelihood of a miscommunication between people is much greater than the likelihood that data will be lost or corrupted as it is sent from one computer to another. Though third world countries still use switchboard operators to route and manage phone calls, modern nations use automated switching. It would be difficult to argue that the telephone system performance is superior with humans and switchboards. The time has come and the technologies exist for airspace management to exploit the reliability and efficiency of computer-to-computer communications.



- As the ease of access, efficiency and affordability of Virginia GA increases, more Virginians will view GA as a viable travel choice. Safety and Reliability will also be drivers in increasing acceptance of on-demand air travel. Data Comm will increase efficiency, improve communications, and enhance overall operational safety. Virginia operators should work with the FAA to evaluate candidate Data Comm architectures to advance the implementation of an effective and efficient system.

- The FAA is committed to making the transition to digital communications as reflected in their 2010 NextGen Implementation Plan[10]. It is viewed as a means of offsetting the increased controller workload that would be generated by the expected increase in traffic. It is listed as one of their six Transformational Programs. They seek to evaluate VDL Mode 2 as a means of communicating between flight crew and ATC. Their vision is to integrate digital communications with an aircraft's FMS, but most GA aircraft do not have an FMS, so a GA Data Comm strategy is needed if the full potential of digital communications is to be realized. Also documented in their NextGen Implementation Plan[10] the FAA has also set goals for improving weather observations and improving forecasts. A reliable and efficient Data Comm system is an essential ingredient in those pursuits.

- The NWS sees value in gathering atmospheric data from the low altitudes in which most GA aircraft operate. An efficient digital communications path could be used to automatically transmit data from GA aircraft to the NWS via the SWIM (System-Wide Information Management).

- For data to be transmitted to the NWS, it must first be gathered on the aircraft. Currently, weather sensing systems are available for commercial carriers but not for GA aircraft. Commercial carriers who gather data are given access to superior weather nowcasts and forecasts. If a sensor system development company were to develop a similar system that would be attractive to the GA community, their potential market would be substantially larger.

- Remotely Staffed NextGen Tower for GA

ADS-B position reporting and modern networking (SWIM) make it possible to manage untowered airports and terminal airspaces as though they were towered airports assuming ADS-B coverage extends to the ground at those airports. This would enable increased IMC productivity where demand supports that enhancement.

- This technology provides the FAA with many benefits. They can dynamically assign terminal airspaces – combining several low-volume airports under one controller. The improved access that Remotely Staffed NextGen Towers would provide to GA operators will be a powerful motivator for them to invest in ADS-B radios. That would facilitate NextGen implementation. As the FAA moves toward delegated separation[1, 10], or self-separation procedures[9], the Virginia test bed provides excellent technology maturation opportunities.

Night Image
Before (above) and after (below)

- Single Pilot Safety through Low-Cost Enhanced Vision

Most GA aircraft are flown with a single pilot where technology could assist in workload management and improve the safety environment for single pilot operations. Serious aviation safety initiatives should focus on reducing pilot workload and increasing the safety environment of single pilot operations in GA aircraft. Accidents fall into a variety of categories, but most common among them involve poor visibility. A technology called Enhanced Vision has been developed by NASA[11] and is nearly ready to be demonstrated in actual operations. It uses a common, visible-light camera and is aimed at the cost-conscious GA community. Images are processed in real time to help the pilot see through darkness and haze. Hazards and runways are also enhanced.

- NASA is always eager to transfer its technologies to the private sector and should be willing to support this technology demonstra-

tion. Successful technology transfers motivate engineers and researchers, demonstrate relevance to their stakeholders, and may generate technology-licensing royalties.

- It is in the vision statement of the Virginia DOAV to continually strive to improve aviation safety and to be a leader among states. Being a champion of any GA safety initiative, be it enhanced vision, synthetic vision, electronic flight bag, vehicle health monitoring, intelligent autopilot, or emergency recovery system would provide the opportunity to advance toward the goal of a much safer operating environment for all aviation.
- Naturally, the operators have the most to gain from safety enhancements and should be willing to support data gathering during normal operations.

- Wake Encounter Mitigation Research

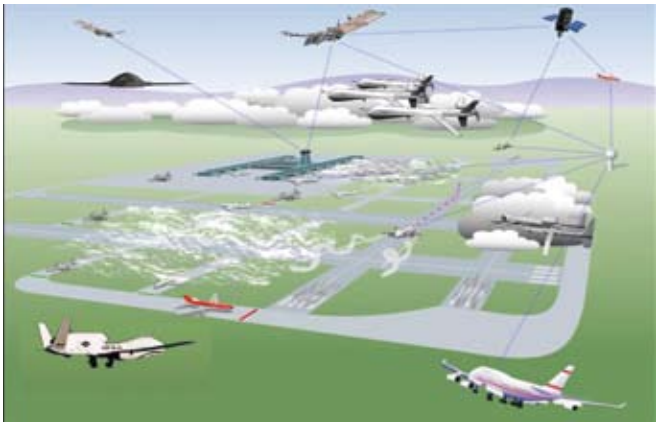
- The WEMR Project will evaluate airborne, ADS-B-based wake separation concepts with the objective of augmenting safety and fuel/time savings for Part 135/91 operators. Fifty-one percent of the operations at Washington Dulles International (IAD) are GA, so large productivity and safety gains are possible.
- The Research Project will:
  - Develop Wake Encounter Hazard metric - define a “dangerous” encounter and related spacing metrics.
  - Integrate metric into detection, calculation, and display systems and procedures.
  - Estimate potential productivity and safety gains.
  - Conduct flight testing in 2014-15.
- Target partners: VSATS, FAA ATO-P, NASA, WakeNetUS, ADS-B transponder manufacturer(s), wake physics CFD providers.

RESEARCH

Many other ideas are so new that they are not even ready to be evaluated in an operational environment. These are the technologies that will enable the later stages of NextGen and the airspace beyond NextGen. Some of these are at the prototype stage of development and, while prototyping an aircraft technology takes only one vehicle, prototyping an airspace management technology requires a participating, equipped fleet of vehicles. Some of the technologies to carry American aviation beyond NextGen are modeling and testing and forecasting methods. A Virginia equipped as a NextGen test bed will provide the opportunity to gather valuable data to baseline the existing and to quantify the effects of changes. As travel habits change, new areas of research will become apparent. A few possible research areas are sketched below.

Where these activities support specific NextGen roadmap objectives presented in Appendix 3, blue triangles (▲) can be found on the roadmap.

- UAS in the NAS



UASs provide a tremendous opportunity to improve the safety and efficiency of conventional aviation operations and to make possible many other missions. This opportunity is too great to ignore. Unoccupied and even occupied yet autonomously operated land vehicles are showing that even the strict navigation and the heavy sense-and-avoid workload required to stay within a lane, operate within current traffic laws, and respond to other traffic is possible in both urban and interstate environments[12, 13]. Military operations are showing the possibilities in aviation. Domestic pressures now exist to allow the use of these vehicles for security monitoring, infrastructure inspection, and environmental remote sensing. In the future, these vehicles may be used to move cargo, provide communication network services, and monitor developing weather systems. To meet these needs, however, sense-and-avoid technologies must be refined and operational procedures must be developed and validated for safety. Once developed, these technologies will augment safety in piloted operations. DOAV is eager to support that research and development. The aircraft-to-aircraft digital communications made possible by ADS-B and a predominantly equipped GA fleet will support the development and evaluation of the essential sense-and-avoid algorithms.

- NASA is formulating a UAS research project, NASA Langley's Crew Systems and Aviation Operations Branch has developed procedures for distributed air traffic management, and Langley's Research Services Directorate has developed a surrogate UAS using a remotely-flown SR-22 with a safety pilot in the cockpit. New procedures could be tested in simulated mixed-fleet operations at IAD and at rural uncontrolled airports in Virginia using these assets.

- The FAA has listed in its 2010 NextGen Implementation Plan[10] that it will develop a UAS 4-dimensional ATM research plan between 2011 and 2015 and that it will conduct demonstrations of the integrated enabling UAS technologies including ADS-B/4-dimensional FMS and ADS-B/NAS Voice Switch in the same time period. A GA fleet largely equipped with ADS-B radios would also be very useful for meeting those objectives.

- As the potential of UASs is contemplated, it quickly becomes apparent that their economic development potential extends well beyond transportation. Virginia will benefit from their usefulness in performing remote monitoring, security patrolling, and wind energy harvesting[14]. Being national leaders in addressing the challenges of integrating UAS operations into the NAS will position Virginia to have the greatest benefits.

- Dynamic SUAs

Obviously, the shortest distance between an origin and a destination is a straight line. Unfortunately, for many GA trips, taken at low altitudes, blocks of Special Use Airspace are often in the way. Many, if not most of these SUAs are designated Restricted Airspace and, as such, may not be used for large blocks of time, sometimes daily, without receiving permission in advance. These SUAs are restricted whether they are in use on a particular day or not. Optimally, these areas would dynamically become restricted only when they are actually in use. During all other times, it would be obvious to the pilot or flight crew that the airspace was available for their use. No permission would need to be requested before entering. In essence, they would become Prohibited Airspace when in use and would become normal Class A-G Airspace, otherwise. Research into this improvement requires that alliances be built, procedures and information pathways be developed, economic and environmental benefits be estimated, and data-gathering flights be flown. If the Data Comm advances from its Test bed stage of maturity (described above), it will meet the "information pathway" need for this capability.

- Multiple NASA projects are seeking means to reduce aviation's environmental impact, including the Concepts and Technology Development (CTD) project within the Airspace Systems Program, the Environmentally Responsible Aviation (ERA) project under the Integrated Systems Research Program, and the Subsonic Fixed Wing (SFW) project under the Fundamental Aeronautics Program. This improvement supports that objective.
- The FAA has the ongoing goal of moving aircraft through the airspace more efficiently and with fewer interventions. In addition, its Continuous Low Energy Emissions and Noise (CLEEN) initiative has the specific objective of exploring advanced approaches for en route operations that reduce emissions and of quantifying the potential environmental benefits.
- Air service providers stand to gain the most from more direct routing. They can use less fuel and provide customers with quicker travel. In so doing, they could even increase the average number of revenue flights their aircraft can be used for in a given day. It is reasonable to expect that these providers would be willing to support the necessary research by gathering useful data during their normal operations.

- Equivalent Visual Operations at GA Airports

Throughput at untowered GA airports suffers during IMC as remote controllers allow only one aircraft at a time access to the taxiways, runways, and terminal airspace. Because radar coverage at those airports does not extend to the ground and remotely located controllers cannot visually monitor surface movements, the time separation between operations can increase by an order of magnitude. Often, this is not a problem, but in some situations, such as in a college town during a major sporting event or graduation, the demand for access to the airport can swell. The air traffic controller workload needed to maintain a high level of safety increases, passengers suffer long inconveniences, and operators burn excessive fuel and generate unnecessary emissions. As mentioned above, as a Test bed technology, Staffed NextGen Towers provide the possibility of mitigating the productivity impacts of IMC at GA airports by making it practical for controllers to remotely monitor even the ground movements at airports if all participating aircraft are

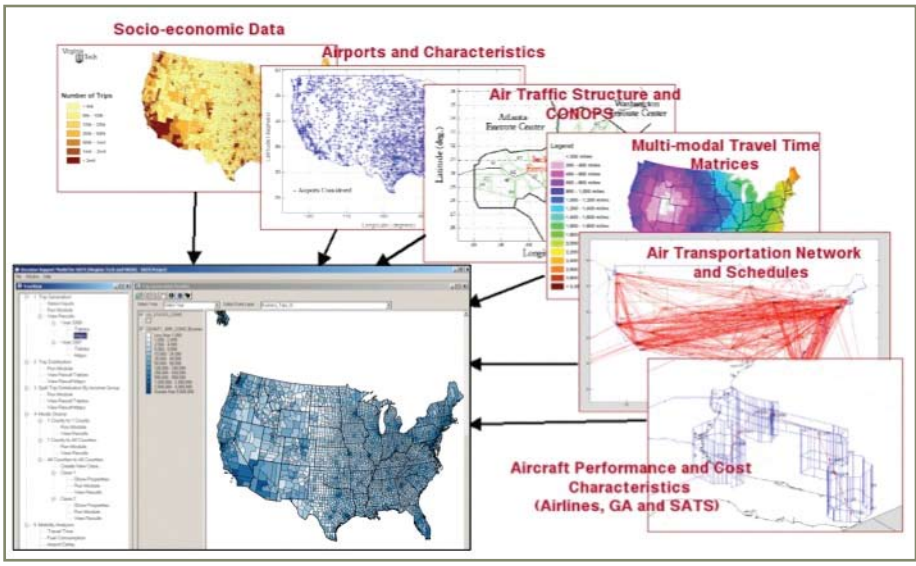
equipped with ADS-B radios. However, if all participating aircraft are equipped with ADS-B In radios and displays, they can theoretically manage their own spacing as would be done in visual conditions. A procedure for doing this was demonstrated by NASA in 2005[8] but has never been tested more widely or over an extended period of time. Of course, such research will only be possible if the participating GA fleet is predominantly equipped with ADS-B In radios. The possibility of conducting operations with mixed levels of equipage generates significant challenges that need to be resolved when developing new procedures for this capability.

Enhanced vision systems, like the one described above as a possible test bed technology development project, augment this capability by enabling pilots and flight crews to visually acquire hazards and runways much sooner in IMC than is possible with the naked eye.

o The NASA Safety Program and the Airspace Systems Program may benefit from this research. Because of its potential to reduce loiter times, it also supports the Integrated Systems Research Program.

- Traffic Demand Model Calibration

The ability to accurately estimate the future demand for air travel is critical to infrastructure planners and to those considering investing in a service-providing business. NASA and Virginia Tech have developed a mode choice transportation demand model[15] that has been used to analyze automobile, scheduled air, and on-demand air taxi. The model has been calibrated with FAA data for scheduled airlines as a mode choice. On-demand air taxi numbers generated as part of the SATS program indicated a substantial demand for Virginia localities. NextGen technologies and capabilities, however, hold additional potential for making significant changes in air transportation. An environment rich in NextGen technologies such as ADS-B, RNAV/RNP procedures, remotely-staffed towers, reduced sensitivity to IMC, and streamlined transfers between GA and scheduled carriers at hub airports could change the way GA is used. Further calibration of the model for air taxi would aid in the development and expansion of



an on-demand air taxi system by identifying demand (by price point) for that service by city or county. Transportation mode choice in the modeling is not restricted to air and auto, but includes options such as high-speed rail or premium bus service. Further validation of the model could result in a transportation planning tool capable of examining all transportation modes to develop the mix and location to best serve the traveling public's needs.

- Though these models were used to inform JPDO designers what the future air traffic management system would need to accommodate, they will now be needed by the FAA to plan for the impact of NextGen on the nations aviation infrastructure.
- Accurate modeling will also support the development of business cases for prospective and expanding on-demand travel service providers.

OPPORTUNITIES TO LEVERAGE RESOURCES

The Virginia DOAV is committed to continuously improving their air transportation system for the benefit of all Virginians and will pursue this vision as aggressively as resources allow. Many others will benefit from this future, as well. The envisioned future state is beneficial to the Commonwealth because it will enhance the economic opportunity, safety, and quality of life for Virginians and will continue Virginia's tradition of being an aviation leader among states. It will also directly support the published goals of the FAA, NASA, the NWS as well as the implicit goals of many private sector interests – to increase their profitability. The opportunity exists to realize this vision, sooner, for the benefit of many and with a reduced investment from each.

Much like the "Green Aviation" public/private partnership Senator Warner supported in a recent interview[16], a partnership in advancing NextGen would similarly benefit many stakeholders. "I think it's a great opportunity for Virginia," Warner said. Listed below are examples of partnerships with various stakeholders that will be pursued to accelerate the realization of this vision. Each organization has much to gain from a widespread implementation of NextGen technologies in Virginia and the benefits to GA operators that it can demonstrate.

The **FAA** is responsible for the timely implementation of NextGen while maintaining its extraordinary record of safety. A significant element of that implementation is outreach and education to the aviation community. To date, as described above, the FAA has been challenged in motivating the GA community to invest in the ADS-B technology that the FAA needs to be able to move its surveillance task from the current centralized, ground-based infrastructure to a distributed, aircraft-based infrastructure. This program will provide that motivation by demonstrating multiple benefits of equipping. The specific stages of outreach support that this program offers the FAA are outlined in the next section of this document.

The specific capabilities that the FAA can bring to an alliance whose goal is to achieve this vision in Virginia include ADS-B certification for specific aircraft and avionics and airspace redesign, validation, and implementation. If sufficient outreach benefits can be articulated, the FAA may even sponsor limited ADS-B avionics equipage of Virginia aircraft and data collection equipage at Virginia airports. As beneficial uses for the ADS-B communication path are identified, the FAA could provide an interface to ITT for message management programming. In support of the goal to make weather available from all airports via the web, the FAA would be a strong advocate for reducing the obstacles to getting airport weather into NADIN and may support limited installations of RVR sensors at GA airports in Virginia. Finally, the FAA may also see sufficient benefit to also add the resources necessary to assure the successful management of the design and implementation program.

NASA also has much to gain by the successful implementation of NextGen. NASA is committed to maximizing the relevancy of its research and to transferring technologies that improve the quality of life of Americans. A partnership will provide another opportunity for collaboration among NASA researchers and the broader research community and will facilitate this technology transfer. Since NASA developed many of the NextGen technologies, a collaboration would accelerate their implementation and showcase their contribution to safety and increased productivity. Such a concentrated NextGen environment would also provide an exceptional test bed for the development of the new technologies that will be necessary to take American aviation beyond even the vision of NextGen.

Specific expertise that NASA could bring to an alliance include distributed air-ground traffic management, human-in-the-loop simulation, human-factors research, flight test expertise, transportation demand modeling, sensor development, vehicle automation, vehicle health monitoring, conflict detection and resolution, Data Comm, crew systems interface, systems analysis, safety analysis, and project management. Langley's atmospheric scientists could bring expertise in satellite data and advanced sensors to detect weather conditions hazardous to aviation.

The National Weather Service is responsible for providing high quality weather data and forecasts to the NextGen 4D Weather Cube. Using aircraft as a network of weather sensors has long been realized to be a way of gather more real-time data than is practical with ground-based systems. To a limited extent, this is being done using scheduled carriers, but very little data is being gathered at low altitudes and over rural regions. This is where GA aircraft fly and this atmospheric boundary layer data would greatly enhance their forecasts.

Specific expertise that NWS could bring to an alliance includes weather sensing strategies, airborne weather sensing equipment, forecast tool development, and local forecast products for rural areas.

Clearly, **Avionics Manufacturers** have much to gain from a successful implementation of NextGen particularly applied to GA. Participating ADS-B manufacturers could establish market leadership in the GA community which represents >90% of the market for ADS-B radios. Participating companies will receive early product feedback that will enable rapid prototyping. They also will generate brand familiarity through demonstration sponsorship and the reporting of program success.

Specific contributions that Avionics Manufacturers could provide to an alliance include discounted ADS-B In/Out systems, ADS-B application-development support and integration support, and system certification expertise.

ITT stands to grow its business as the usefulness of the 2-way digital data communications capability of ADS-B radios grows. As operators seek to access the information available in SWIM, GA owners will resist solutions that require installing additional equipment in their aircraft and will seek ways to capitalize on their investment in ADS-B. ITT is in a position to be the interface of choice between ADS-B and SWIM and ultimately, the internet. This could result in new service offerings and a demand for additional ground radios.

The specific expertise that ITT could bring to an alliance includes support in separating and appropriately routing ADS-B surveillance messages and messages intended for other recipients and in coordinate additional ground station placement in Virginia with the Virginia DOAV.

Several **Universities** in Virginia have substantial expertise in research that will contribute to the successful implementation of NextGen. For example, Virginia Tech, University of Virginia, and Old Dominion University all have Aerospace Engineering degree programs, with faculty and students conducting research that affects the design of future aircraft. Partnerships with faculty at these universities will significantly impact the future success of NextGen, while also directly contributing to the education and training of future engineers who will soon be joining the aerospace workforce.

NextGen OUTREACH

Implementing NextGen is as much a cultural challenge as it is a technical challenge. Currently, the FAA has a Director of NextGen Outreach who is responsible for communicating the advantages of investments in NextGen. As benefits are identified and quantified in the Virginia program, they shall be shared with that FAA office for inclusion in their outreach message. In addition, the participants in the Virginia program will seek opportunities to discuss the goals and outcomes of the program at meetings of those in the aviation communities in the nation. That outreach will be conducted in three phases organized by the level of maturity of the projects. Those phases are as follows.

- Phase I – as soon as the Partnership is established

- Conference papers describing the program and the plan
- NASAO leadership
- Explain to the R&D community the opportunity Virginia will become as a technology test bed and build excitement around developing new ADS-B applications.
- Meet with AOPA, NBAA, VABA, JPDO NextGen Institute
- Build into FAA NextGen outreach videos

- Phase II – 2-5 years after Partnership is established

- Share early in-progress results at conferences
- Seek additional partnering opportunities
- Continue progress reporting to aviation organizations and provide articles for their publications.

- Phase III – 5-7 years after Partnership is established

- Analyze metrics and define technology-generated improvements
- Publish in technical journals for legitimacy
- Present at technical conferences
- Present to Congressional Committees responsible for NexGen
- Build into FAA and JPDO outreach
- Present to aviation organizations

SUMMARY

NextGen is essential to the meet the increased demand for air transportation and continued prosperity of Virginians and, in fact, of all Americans. For the first time in modern history, a generation is facing the possibility of enjoying less mobility and access to products, markets, and essential services than its preceding generation. Virginia has a long legacy of leading the nation and wants to, once again, lead the nation into the future. It recognizes the potential that the air transportation made possible by NextGen will improve aviation safety and enhance the quality of life for Virginians. That potential has been developed into an exciting vision which elevates the usefulness of GA as a primary element of transportation.

Achieving that vision quickly will also serve federal and state governments, aviation service providers, and avionics manufacturers. Virginia is eager to work with partners to expedite the early implementation of NextGen technologies in the Commonwealth, create a NextGen test bed for the FAA and industry and create the Virginia Aviation/Aerospace Research Consortium to conduct research for emerging technologies in Aviation/Aerospace.

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ABREVIATIONS

ADS-B	Automatic-Dependent Surveillance-Broadcast
ADS-R	Automatic-Dependent Surveillance-Rebroadcast
AOPA	Aircraft Owners and Pilots Association
ATC	Air Traffic Control
AWOS	Automated Weather Observation System
CLEEN	Continuous Low Energy Emissions and Noise
Data Comm	Digital Data Communications
DOAV	The Virginia Department of Aviation
FAA	Federal Aviation Administration
FMS	Flight Management System
FOC	Flight Operations Center
GA	General Aviation
GPS	Global Positioning System
IMC	Instrument Meteorological Conditions
IS-BAO	International Standard for Business Aircraft Operations
ISO	International Standards Organization
ITT	International Telephone and Telegraph Corporation
JPDO	Joint Planning and Development Office
LAAS	Local Area Augmentation System
LP	Lateral Precision
LPV	Lateral Precision, Vertical guidance
MDA	Minimum Decision Altitude
MIT	Massachusetts Institute of Technology
MOA	Military Operations Area
NADIN	National Airspace Data Interchange Network
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NBAA	National Business Aviation Association
NextGen	Next Generation Air Transportation System
NIA	National Institute of Aerospace
NWS	National Weather Service
RNAV	Area Navigation
RVR	Runway Visual Range
RNP	Required Navigation Performance
SBAS	Satellite-Based Augmentation Systems
SUA	Special Use Airspace
SWIM	System-Wide Information Management
UAS	Unoccupied Aerial System or Unmanned Aircraft System
VABA	Virginia Aviation Business Association
VDL	VHF Digital Link
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
WAAS	Wide Area Augmentation System
WEMR	Wake Encounter Mitigation Research

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Randall Burdette

MBA from Lindenwood University

2010-2011 Chairman of the NASAO Board of Directors

Director of the Virginia Department of Aviation responsible for 1) Cultivating an advanced, aviation system that is safe, secure and provides for economic development; 2) Promoting aviation awareness and education and; 3) Providing flight services for the Commonwealth Leadership and State Agencies. His vision for the agency is to become the standard for excellence amongst State Aviation Agencies and make the Virginia aviation system the model air transportation system providing Virginia communities economic development opportunities and convenient access to the National air transportation system. Appointed Director on August 11, 2004. Responsible for providing timely information to the Governor, Secretary of Transportation, the Virginia Aviation Board and the citizens of Virginia on all maters related to aviation. Serves as the state and federal legislative liaison for the agency. Works in coordination with the Administration, Federal and State legislators, airport sponsors and local jurisdictions on numerous aviation issues including government affairs, airport capital improvements, aviation policy and air service development. Participates with the FAA and JPDO in the design and implementation of the Next Generation aviation system to meet our nation's future aviation demand.

Fred Brooks

U.S. Naval Officer - retired

Positions include aircraft carrier jet pilot, corporate pilot, lead systems engineer for the NASA Advanced General Aviation Transport Experiments (AGATE) project, chief engineer for the Small Aircraft Transportation System (SATS) Projects, GA aircraft manufacturer airworthiness acceptance test pilot, and currently the Director of FAA Programs at the National Institute of Aerospace (NIA). An active, aggressive aviation enthusiast with a wide spectrum of aerospace experience.

Vicki Crisp

BS, Mathematics and Computer Science, CNU

Positions include Systems Analysts, NASA's Technical Advisor on the FAA Research, Engineering and Development Advisory Committee, NASA's Scientific Advisor to the JPDO Environmental Working Group, Deputy Program Manager for the Fundamental Aeronautics Program, and currently serving as the Director of Aeronautics Research at NASA Langley Research Center. Experience includes helping to establish a vision for US leadership in Aeronautics as a key contributor to the National Plan for Aeronautics R&D sponsored by the National Science & Technology Council Aeronautics Science & Technology Subcommittee, Strategic and technical leadership of NASA aeronautics R&D programs and projects, and leadership of research that supports innovations in aircraft performance and environmental impact, NextGen, and human and robotic space exploration. Specialties are systems analysis, organizational and team dynamics, strategic planning, and program/project management.

Guy Kemmerly

BS, Aerospace Engineering from Virginia Tech

MS, Flight Sciences from GWU

Positions include NASA Langley Project Manager, Research Branch Head, acting Deputy Director of Aeronautics Research at NASA Langley, and currently detailed to the Virginia Department of Aviation working to revolutionize Virginia's aviation community. Conducted subsonic aerodynamic research for fifteen years on military configurations and on a new Supersonic Civil Transport and developed a new technique for better modeling how airplanes fly when close to the ground. For seven years following that work he supervised branches of researchers in developing new test techniques and other research support tools. He then became the Manager of NASA's SATS (Small Aircraft Transportation System) Project and of NASA's Airportal Project, both aimed at moving American's and products more efficiently.

Keith McCrea

BS Florida State University

DOAV Manager, Air Service and Policy
Executive Director, Virginia SATSLab, Inc.
Manages agency NextGen cooperative initiatives
Serves as agency legislative liaison to the General Assembly
Manages agency legislative, regulatory, and intergovernmental programs
Manages statewide commercial air service/cargo monitoring & research
Manages economic development initiatives pertaining to aviation
Serves on the VA State emergency/disaster response team

Gregory Campbell

A graduate of Bridgewater College.

Executive Director of Shenandoah Valley Regional Airport.

Has been involved in approximately $25 million in capital improvements, which has expanded or rehabilitated most every area of the Airport. He was also responsible for the creation of the Airport's Marketing and Air Service Development Program which led to their departure from a subsidized commercial Airport to a self-sustaining level prior to September 2001.

President of the Virginia Airport Operators Council which is the organization representing Virginia's airports.

A certified member of the American Association of Airport Executives.

A board member for the Shenandoah Valley Partnership, Blue Ridge Community College Foundation and the Harrisonburg Rockingham Chamber of Commerce.

Past President of the Greater Augusta Chamber of Commerce.

Thomas "Mike" Mickel, Jr.

BS from Virginia Commonwealth University

President and CEO, Dominion Aviation

Mike founded Dominion Aviation in 1983 as an aircraft management and charter company. Today, Dominion Aviation is a full service Fixed Base Operation located at the Chesterfield County Airport and operates a diverse fleet of business jets and turboprops. Mike, a 30 year veteran of corporate aviation, is an experienced pilot with over 9,000 hours of flight time, is Airline Transport rated and certified to fly numerous corporate jets and helicopters. Mike served as President of the Virginia Aviation Business Association from 2006 through 2010, and is currently on the association's Board of Directors.

Bruce Holmes

DE from University of Kansas

CEO and Chief Strategist of NextGen AeroSciences, LLC (www.nextaero.com)

Principal in Holmes Consulting LLC, supporting a variety of industry, government and university clients in strategy, technology, aviation systems development, and partnerships.

Senior Advisor for FOCUS, LLC - Investment Bankers, in their Government-Aerospace-Defense Group, and for The Chicago Corporation, a Midwest investment banking firm.

Former Chief Strategist for DayJet Corporation, supporting the launch of the industry's first per-seat, on-demand air carrier business model.

Retired from public service of 33 years with the National Aeronautics and Space Administration (NASA) as a member of the federal Senior Executive Service; his last position was Chief Strategy Officer at Langley Research Center. He led the creation of the NASA AGATE (Advanced General Aviation Transport Experiments) public-private partnership and the SATS (Small Aircraft Transportation System) Project.

James Meer

BA from Boston University

JD from University of Denver

Executive Director of the Airborne Internet Consortium – The Airborne Internet Consortium's purpose is to accelerate the rate of absorption of internet technologies into aviation and to provide the necessary research, certification, policy, regulation, advocacy, influence and guidance to achieve this acceleration.

Principal, Microflight - Microflight facilitates use of commercial computer technology in aviation and how this technology will impact air traffic control, flight deck avionics, cabin entertainment infrastructure, certifying authorities, and government policy. Predicting the impact of commercial computer and communication technologies that will evolve is critical to understanding the ramifications for the aviation industry both in leveraging cost-effective technology and in delivering features customers, pilots and certification authorities will expect.

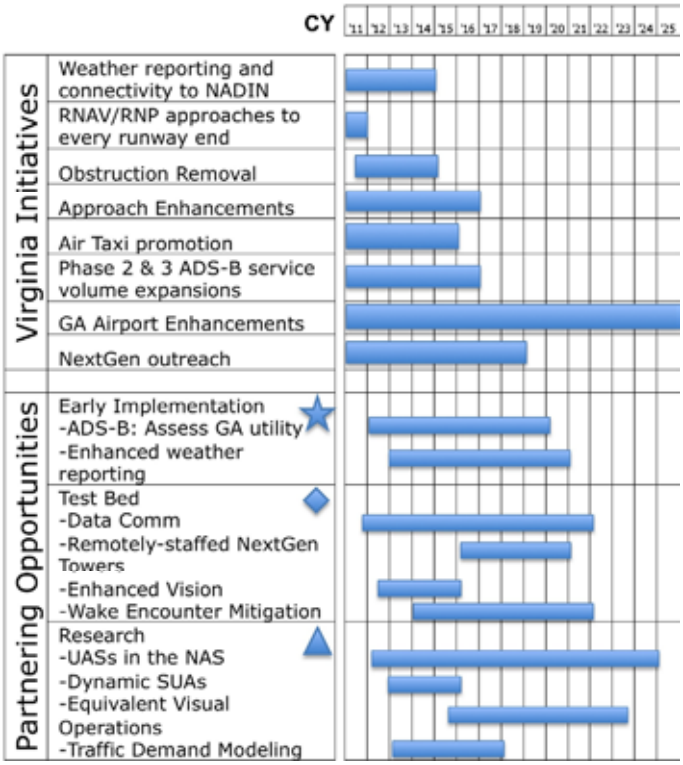
Appendix 2

Virginia Opportunities Timeline

The Aviation Vision described herein is obtainable by capitalizing on Virginia's rich pool of aviation and aerospace resources. Key personnel resources, academic institutions, governmental research organizations and a significant inventory of aviation and aerospace businesses in the Commonwealth are all resources that make Virginia so competitive in our industry. DOAV will implement many of these improvements and will advocate for the implementation of the others.

DOAV has already started to implement plans to upgrade the ADS-B systems in its aircraft; improve weather reporting and implement RNAV/RNP procedures at its GA airports, making many of its GA terminal facilities more business-friendly; gather quantitative data on flight operations at select GA airports, develop the ground infrastructure necessary to support Data Comm capabilities as they are fielded; and implement an aggressive marketing campaign aimed at increasing the utilization of GA for travel. We will also work with the FAA to implement Staffed NextGen Towers as that technology matures. DOAV will work to develop National collaborators and partners to advance our vision. At the same time, DOAV will continue developing our aviation system toward our vision with partners within the Commonwealth.

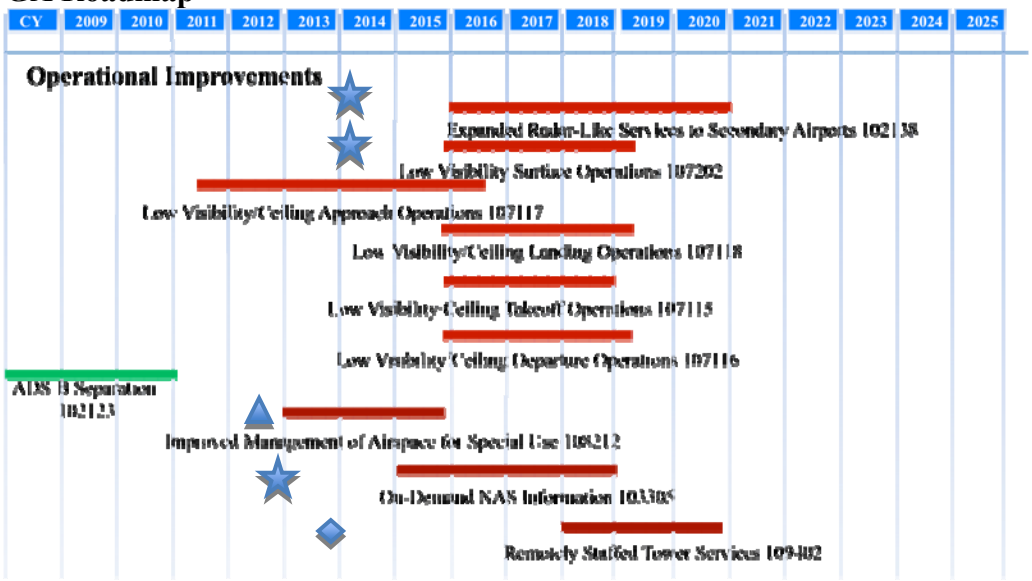
The symbols on the schedule, below, indicate their alignment with the elements of the implementation strategy described in the body of this document. They also show the alignment with symbols on the roadmaps in Appendix 3.



Appendix 3

FAA Technology Roadmaps

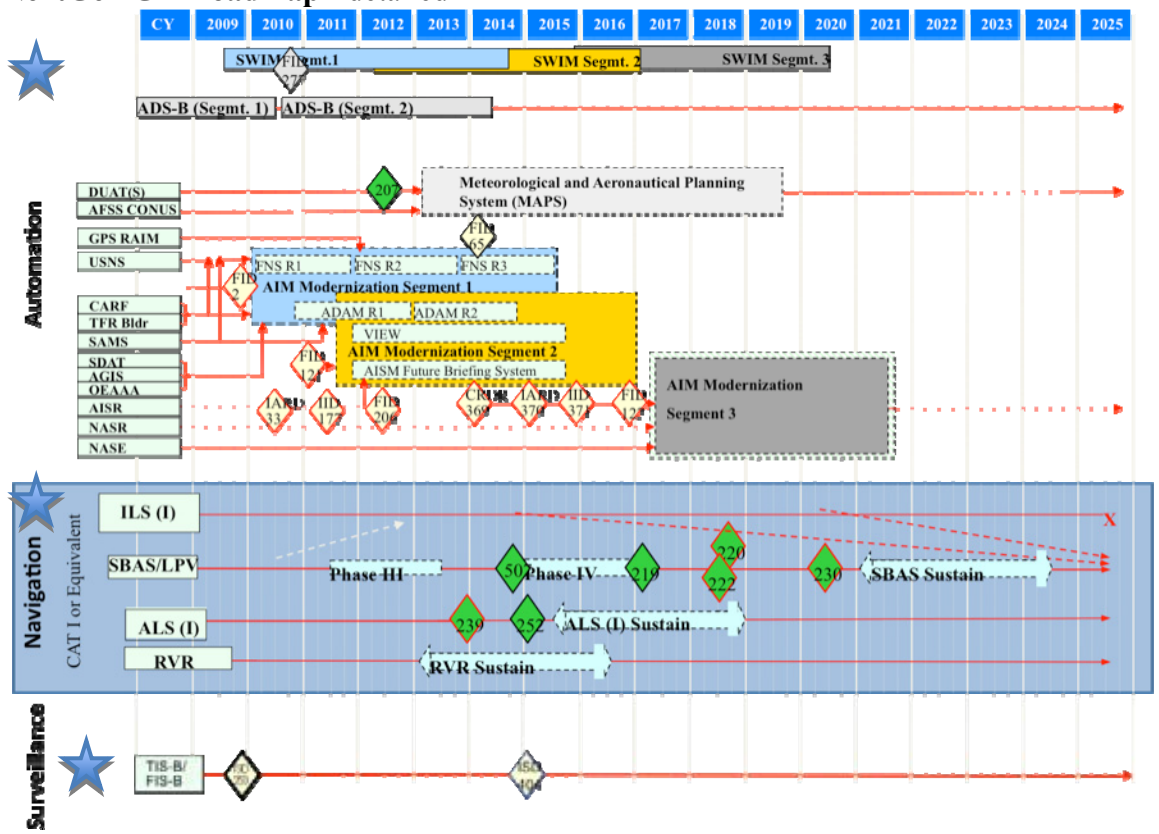
NextGen GA Roadmap

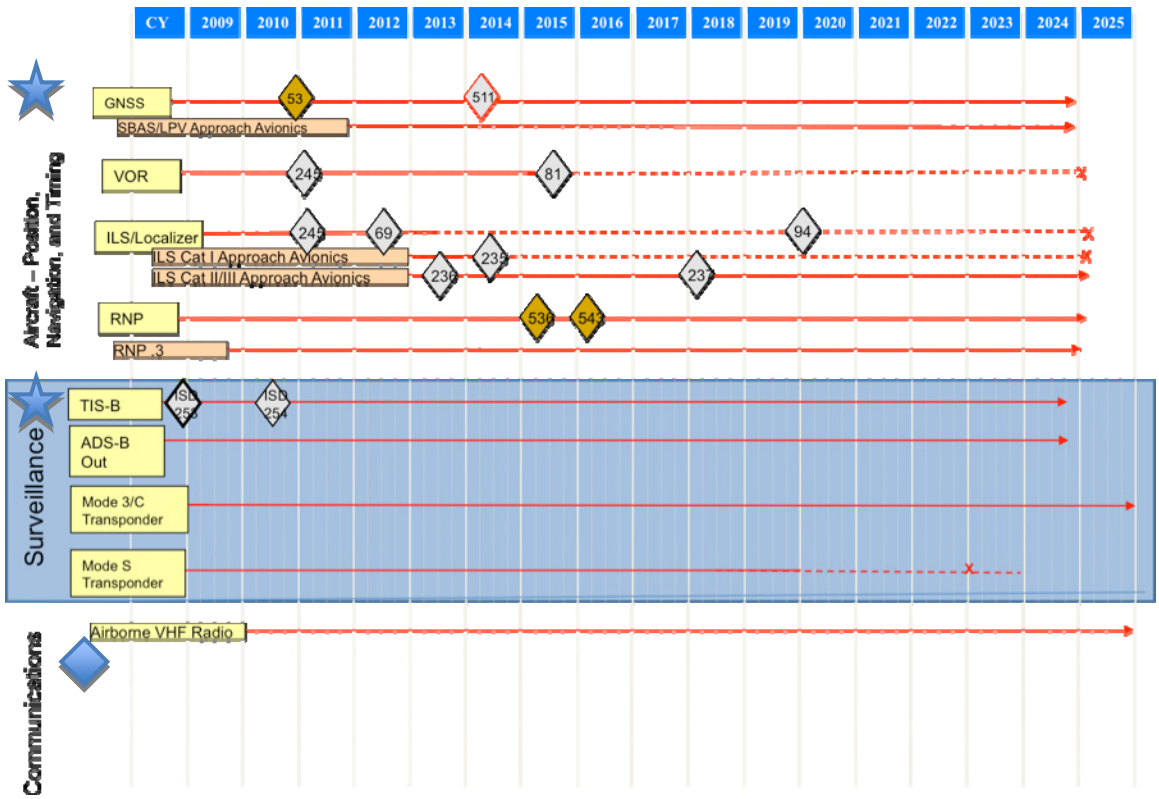


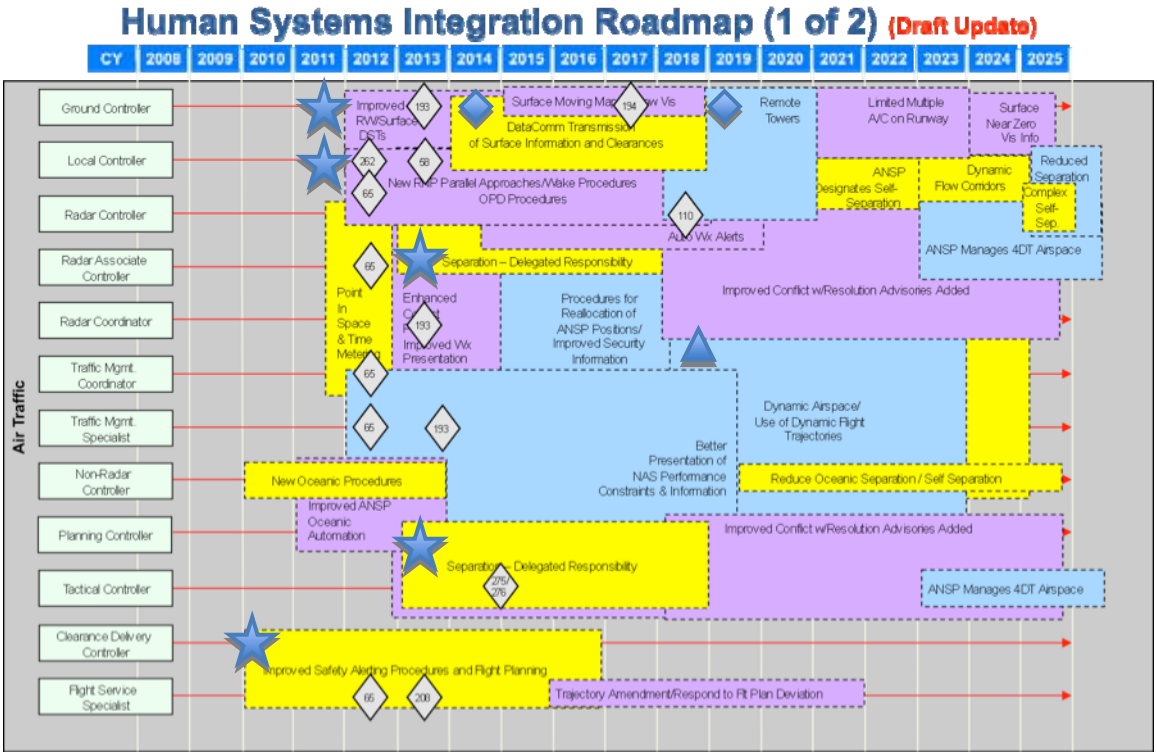
Enabling Activities

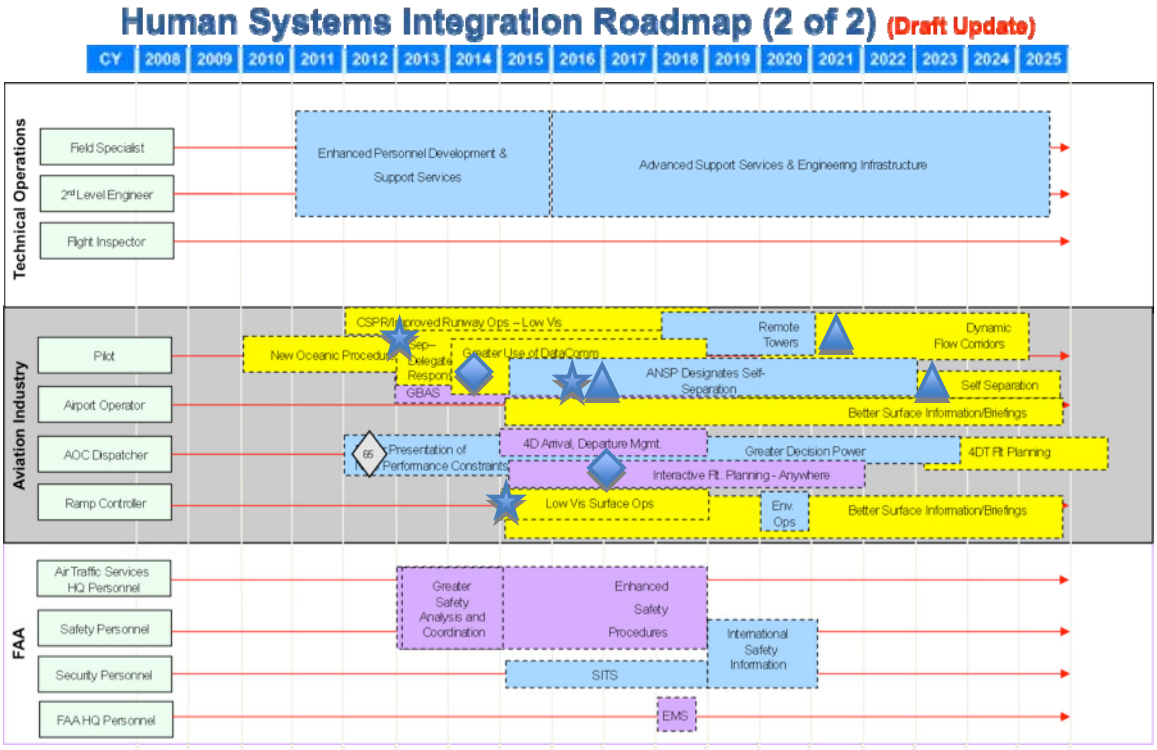
- TIS-B to provide Aviation Situational Awareness
- FIS-B to provide Weather & NAS Situational Awareness
- NAS Status via Digital NOTAM's
- Improved Weather Information and Sharing
  - XM Weather

NextGen GA Roadmap - detailed

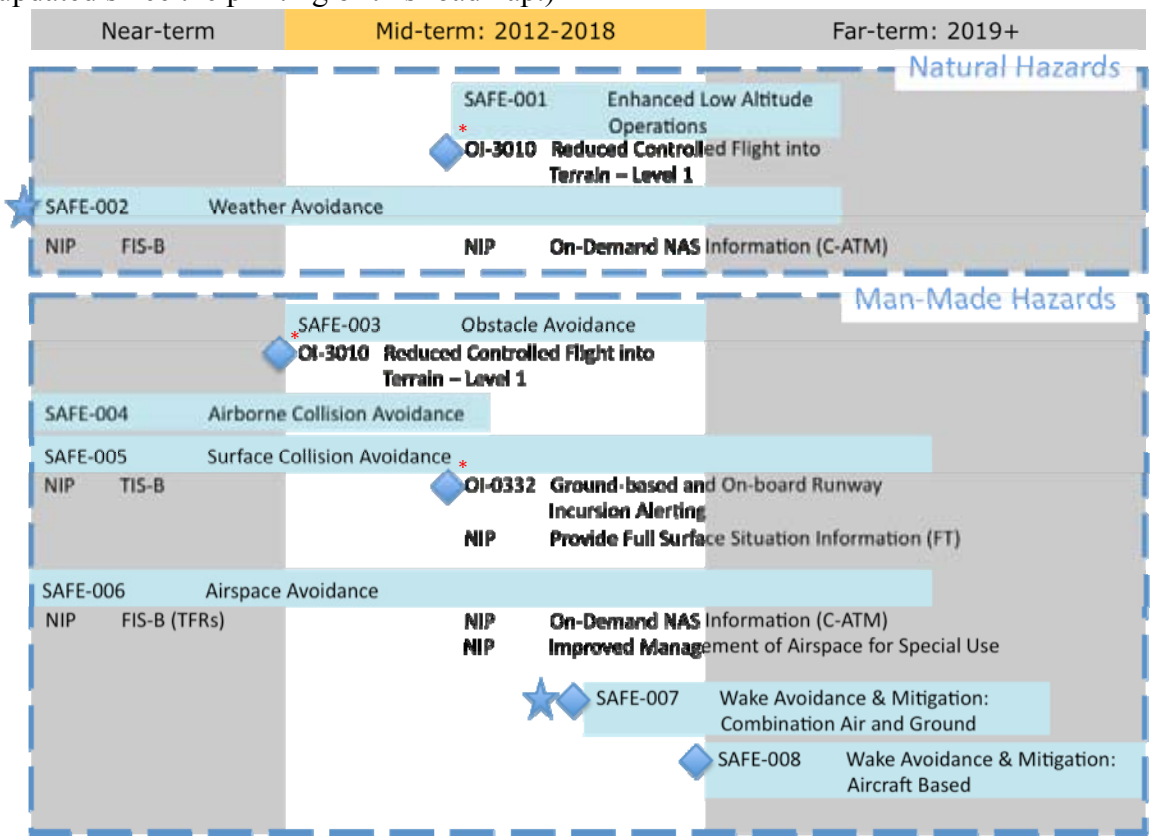





Human Systems Integration Roadmap (1 of 2) (Draft Update)
CY 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Air Traffic
Ground Controller
Local Controller
Radar Controller
Radar Associate Controller
Radar Coordinator
Traffic Mgmt. Coordinator
Traffic Mgmt. Specialist
Non-Radar Controller
Planning Controller
Tactical Controller
Clearance Delivery Controller
Flight Service Specialist
Improved RW/Surface DSTs
Surface Moving Map Low Vis
DataComm Transmission of Surface Information and Clearances
Remote Towers
Limited Multiple A/C on Runway
Surface Near Zero Vis Info
New RNP Parallel Approaches/Wake Procedures OPD Procedures
ANSP Designates Self-Separation
Dynamic Flow Corridors
Reduced Separation Complex Self-Sep
Adv Wx Alerts
ANSP Manages 4DT Airspace
Separation – Delegated Responsibility
Improved Conflict w/Resolution Advisories Added
Point in Space & Time Metering
Enhanced Ground Radar
Improved Wx Presentation
Procedures for Reallocation of ANSP Positions/ Improved Security Information
Dynamic Airspace/ Use of Dynamic Flight Trajectories
Better Presentation of NAS Performance Constraints & Information
New Oceanic Procedures
Reduce Oceanic Separation / Self Separation
Improved ANSP Oceanic Automation
Improved Conflict w/Resolution Advisories Added
Separation – Delegated Responsibility
ANSP Manages 4DT Airspace
Improved Safety Alerting Procedures and Flight Planning
Trajectory Amendment/Respond to Flt Plan Deviation


Human Systems Integration Roadmap (2 of 2) (Draft Update)
CY 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Technical Operations
Field Specialist
2nd Level Engineer
Flight Inspector
Enhanced Personnel Development & Support Services
Advanced Support Services & Engineering Infrastructure
Aviation Industry
Pilot
Airport Operator
AOC Dispatcher
Ramp Controller
CSPR/Improved Runway Ops – Low Vis
New Oceanic Procedures
Sep – Delegated Responsibility
Greater Use of DataComm
GBAS
Remote Towers
Dynamic Flow Corridors
ANSP Designates Self-Separation
Self Separation
Better Surface Information/Briefings
Presentation of NAS Performance Constraints
4D Arrival, Departure Mgmt.
Greater Decision Power
4DT Flt Planning
Interactive Flt. Planning - Anywhere
Low Vis Surface Ops
Env. Ops
Better Surface Information/Briefings
FAA
Air Traffic Services HQ Personnel
Safety Personnel
Security Personnel
FAA HQ Personnel
Greater Safety Analysis and Coordination
Enhanced Safety Procedures
International Safety Information
SITS
EMS

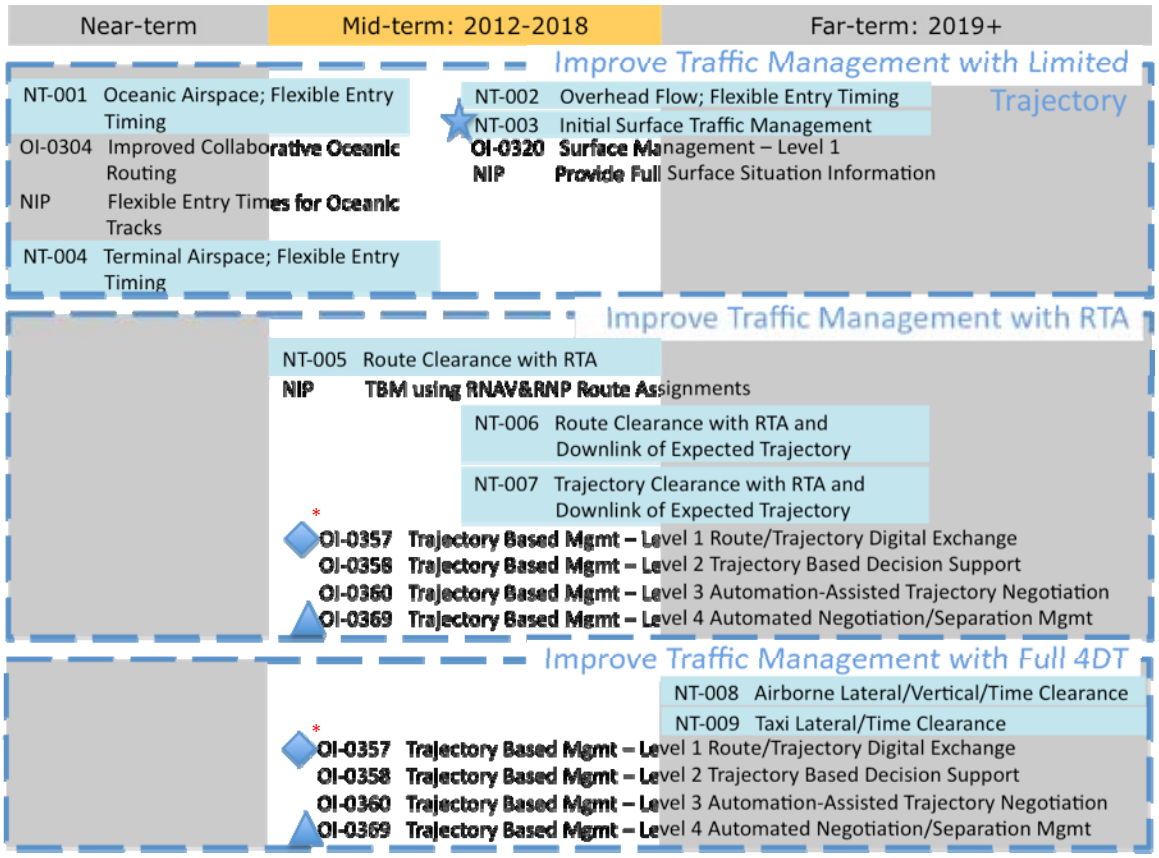
2010 NextGen Avionics Roadmap – Reference 1 (Some NextGen OIs have been updated since the printing of this roadmap.)



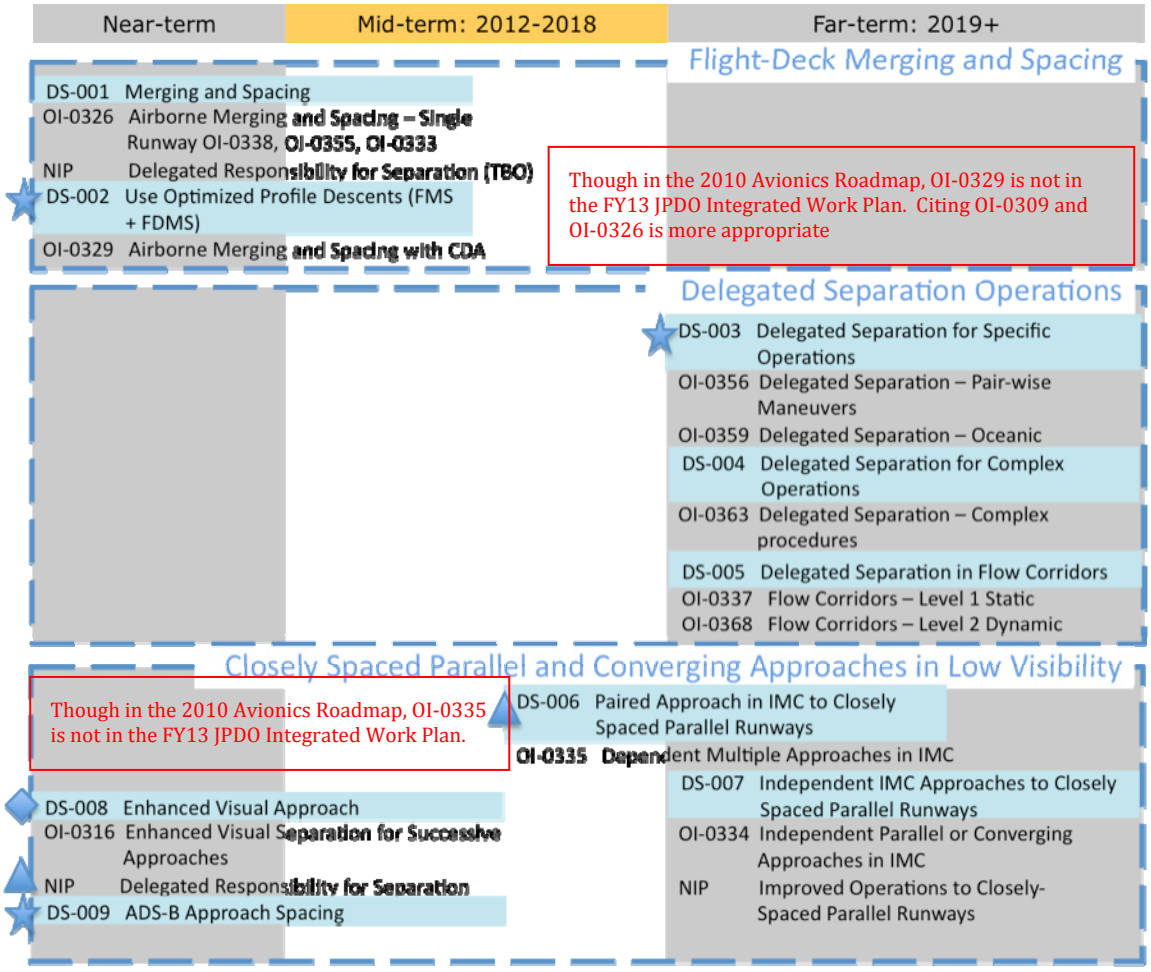
* Though in the 2010 Avionics Roadmap, OI-3010 is not in the FY13 JPDO Integrated Work Plan.

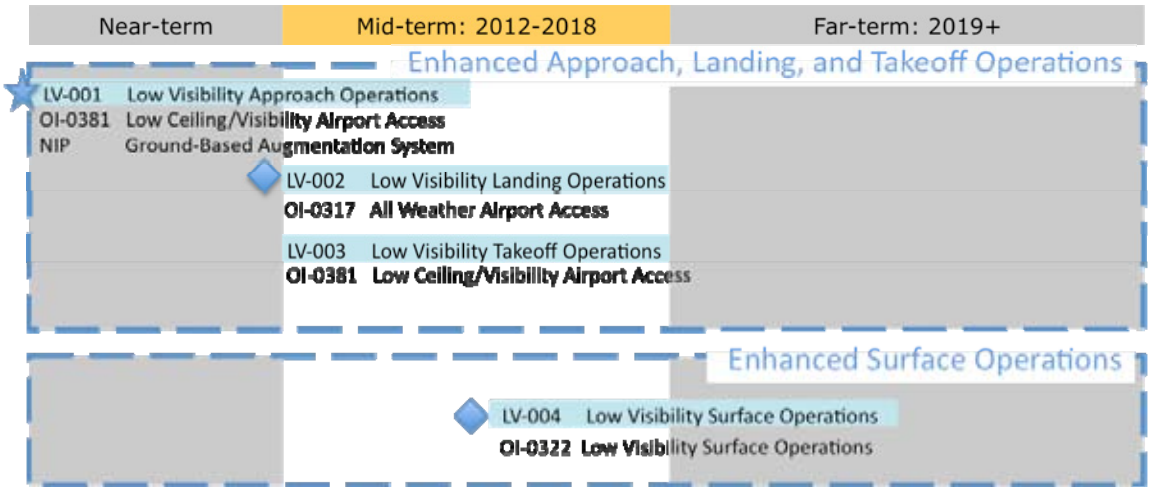
* Though in the 2010 Avionics Roadmap, OI-0332 is not in the FY13 JPDO Integrated Work Plan. Citing OI-0383 and OI-0384 is more appropriate.

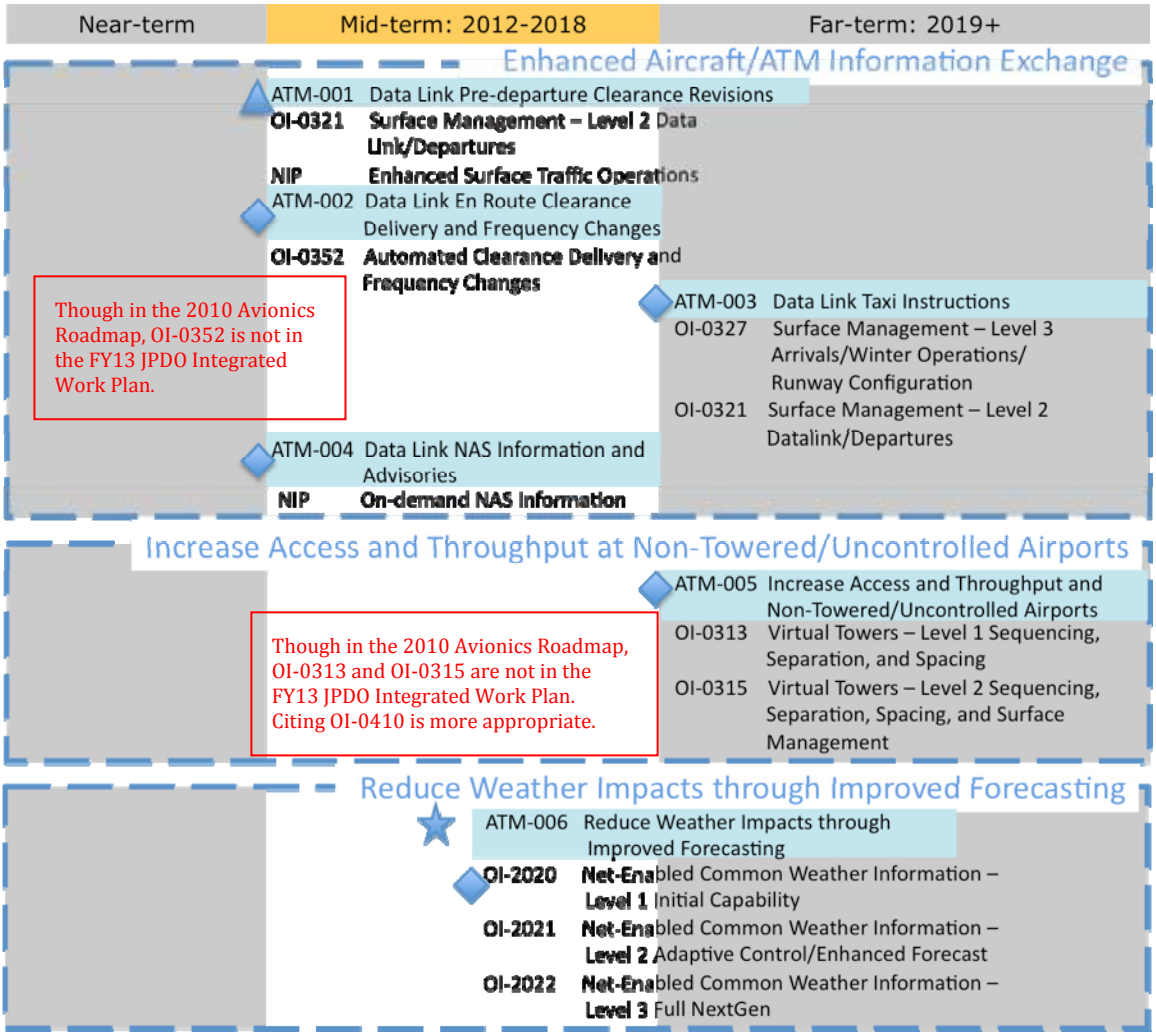
Near-term	Mid-term: 2012-2018	Far-term: 2019+
	RNAV and RNP SIDs and STARS	
	PRP-001 Reduce Lateral Track Spacing Using RNP	
	OI-0348 Reduced Separation – High Density Terminal, Less Than 3 Miles PBN RNP-2 Routes PBN RNP-1 or Lower SIDs/STARs where beneficial	
	PRP-002 Integrated Arrival/Departure Airspace Management	
	OI-3011 Enhanced Arrival/Departure Routing and Access NIP Hi Density: Integrated Arrival/ Departure Airspace Management PBN Enhanced automation incorporating aircraft navigation capabilities PBN RNAV SIDs/STARs at many of the top 100 airports	
	PRP-003 Closed Loop Lateral Offsets for Time of Arrival Control	
	NIP Hi Density: Time Based Metering with RNAV/RNP NIP 3D PAM Demonstration at DFW PBN Airspace redesign and procedures for RNAV and RNP with 3D, CDA, and time of arrival control	
PRP-004 Optimized Descent Profiles (FMS Only)		
OI-0330 Time-Based and Metered Routes with CDA NIP Flex: Use Optimized Descent Profiles PBN Concepts for RNAV and RNP with 3D, constant descent arrivals (CDA), and time of arrival control	OI-0330 Time-Based and Metered Routes with CDA NIP Tailored Arrivals PBN Airspace redesign and procedures for RNAV and RNP with 3D, CDA, and time of arrival control	
	PRP-005 3D RNP Arrival and Departure Operations PBN Airspace redesign and procedures for RNAV and RNP with 3D, CDA, and time of arrival control	



* Though in the 2010 Avionics Roadmap, OI-0357 is not in the FY13 JPDO Integrated Work Plan.


Near-term
Mid-term: 2012-2018
Far-term: 2019+
Flight-Deck Merging and Spacing
DS-001 Merging and Spacing
OI-0326 Airborne Merging and Spacing – Single Runway OI-0338, OI-0355, OI-0333
NIP Delegated Responsibility for Separation (TBO)
DS-002 Use Optimized Profile Descents (FMS + FDMS)
OI-0329 Airborne Merging and Spacing with CDA
Though in the 2010 Avionics Roadmap, OI-0329 is not in the FY13 JPDO Integrated Work Plan. Citing OI-0309 and OI-0326 is more appropriate
Delegated Separation Operations
DS-003 Delegated Separation for Specific Operations
OI-0356 Delegated Separation – Pair-wise Maneuvers
OI-0359 Delegated Separation – Oceanic
DS-004 Delegated Separation for Complex Operations
OI-0363 Delegated Separation – Complex procedures
DS-005 Delegated Separation in Flow Corridors
OI-0337 Flow Corridors – Level 1 Static
OI-0368 Flow Corridors – Level 2 Dynamic
Closely Spaced Parallel and Converging Approaches in Low Visibility
Though in the 2010 Avionics Roadmap, OI-0335 is not in the FY13 JPDO Integrated Work Plan.
DS-006 Paired Approach in IMC to Closely Spaced Parallel Runways
OI-0335 Dependent Multiple Approaches in IMC
DS-007 Independent IMC Approaches to Closely Spaced Parallel Runways
OI-0334 Independent Parallel or Converging Approaches in IMC
NIP Improved Operations to Closely-Spaced Parallel Runways
DS-008 Enhanced Visual Approach
OI-0316 Enhanced Visual Separation for Successive Approaches
NIP Delegated Responsibility for Separation
DS-009 ADS-B Approach Spacing


Near-term
Mid-term: 2012-2018
Far-term: 2019+
Enhanced Approach, Landing, and Takeoff Operations
LV-001 Low Visibility Approach Operations
OI-0381 Low Ceiling/Visibility Airport Access
NIP Ground-Based Augmentation System
LV-002 Low Visibility Landing Operations
OI-0317 All Weather Airport Access
LV-003 Low Visibility Takeoff Operations
OI-0381 Low Ceiling/Visibility Airport Access
Enhanced Surface Operations
LV-004 Low Visibility Surface Operations
OI-0322 Low Visibility Surface Operations


Near-term
Mid-term: 2012-2018
Far-term: 2019+
Enhanced Aircraft/ATM Information Exchange
ATM-001 Data Link Pre-departure Clearance Revisions
OI-0321 Surface Management – Level 2 Data Link/Departures
NIP Enhanced Surface Traffic Operations
ATM-002 Data Link En Route Clearance Delivery and Frequency Changes
OI-0352 Automated Clearance Delivery and Frequency Changes
Though in the 2010 Avionics Roadmap, OI-0352 is not in the FY13 JPDO Integrated Work Plan.
ATM-003 Data Link Taxi Instructions
OI-0327 Surface Management – Level 3 Arrivals/Winter Operations/ Runway Configuration
OI-0321 Surface Management – Level 2 Datalink/Departures
ATM-004 Data Link NAS Information and Advisories
NIP On-demand NAS Information
Increase Access and Throughput at Non-Towered/Uncontrolled Airports
ATM-005 Increase Access and Throughput and Non-Towered/Uncontrolled Airports
OI-0313 Virtual Towers – Level 1 Sequencing, Separation, and Spacing
OI-0315 Virtual Towers – Level 2 Sequencing, Separation, Spacing, and Surface Management
Though in the 2010 Avionics Roadmap, OI-0313 and OI-0315 are not in the FY13 JPDO Integrated Work Plan. Citing OI-0410 is more appropriate.
Reduce Weather Impacts through Improved Forecasting
ATM-006 Reduce Weather Impacts through Improved Forecasting
OI-2020 Net-Enabled Common Weather Information – Level 1 Initial Capability
OI-2021 Net-Enabled Common Weather Information – Level 2 Adaptive Control/Enhanced Forecast
OI-2022 Net-Enabled Common Weather Information – Level 3 Full NextGen

2010 FAA NextGen Implementation Plan – Reference 13

NextGen Transformational Programs

Implementation Commitments

Project	FY09	FY10	FY11	FY12-15
Automatic Dependent Surveillance-Broadcast (ADS-B)	✓ Implemented Traffic Information Services-Broadcast (TIS-B) and Flight Information Services-Broadcast (FIS-B) in Miami area	• Complete In-Service Decision for Critical Services • *Continue to deploy ADS-B ground infrastructure* • Provide Initial Operating Capability ✓ Louisville ✓ Houston/Gulf of Mexico o Philadelphia o Juneau • Publish final ADS-B Out rule in Federal Register • *Begin exploring state and local cost-sharing partnerships which could expand surveillance services (e.g., Colorado WAM initiative) into low-altitude, non-radar airspace*	• *Continue to deploy ADS-B ground infrastructure* • *Pursue ADS-B program expansion to provide surveillance services in non-radar airspace*	• *Complete NAS-wide deployment of ADS-B, TIS-B and FIS-B* • Provide Initial Operating Capability for Surface Alerting
System Wide Information Management (SWIM)	✓ Completed a final investment decision for Segment 1B	• Develop and test the Aeronautical Information Management portion of the Special Use Airspace (SUA)	• Provide Corridor Integrated Weather System publication • Provide Reroute Data Exchange Capability • Provide Flight Data Publication Initial Flight Data Services • Provide Integrated Terminal Weather System publication	• Publish data for the following: o Pilot Weather Report o Traffic Flow Management (TFM) o Flight Data o Runway Visual Range • Provide Terminal Data Distribution Capability • Provide Flight Data Services with PUB/SUB • Provide Flight Data Publication HADDS/FDIO and AIM SUA Client
Data Communications (Data Comm)	✓ Conducted operational and regulatory activities ✓ Conducted operations and human factors research	• Release solicitation for Data Comm Network Service Provider	• Initiate development of revised departure clearance capability in tower • *Deliver a final investment decision on Data Comm Segment 1*	• Initiate development of en route automation enhancements • *Enable revised departure clearance capability in the tower environment via VHF Data Link – Mode 2 (VDL-2) for aircraft equipped with Future Air Navigation System (FANS) 1/A+* • *In 2016, enable revised departure clearance capability via VDL-2 for aircraft equipped with Aeronautical Telecommunications Network (ATN)* • *In 2016, provide airborne reroutes for TFM in the en route environment for Data Comm equipped aircraft (FANS 1/A+ or ATN) via VDL-2*
NextGen Network Enabled Weather	✓ Published weather data standards and Web services guidelines ✓ Demonstrated data sharing of the 4-D Weather Data Cube, including interagency interoperability	• Conduct demonstration to validate interoperability data standards and Web services with the development of the interagency 4-D Weather Data Cube • Complete weather data and design standards	• Begin service adaptor development for candidate systems	• Complete development of service adaptors for key FAA weather systems (e.g., Automated Surface Observing System) to ensure operational compatibility within the 4-D Weather Data Cube • Final investment decision for proposed implementation of the FAA's portion of the interagency 4-D Weather Data Cube
NAS Voice Switch			• Complete initial investment decision • Release screening information request	• Complete final investment decision • Deliver system and initial operating capability
Collaborative Air Traffic Management Technologies (CATMT)		• Complete CATMT Work Package 1 with the development of the Impact Assessment and Resolution capability • *Initiate the analysis necessary to develop the requirements needed to implement proven decision support tools and data sharing capabilities*	• Continue CATMT Work Package 3 concept engineering and planning to support the following capabilities: o Modernization of the decision support tool suite o Collaborative information exchange • *Continue the analysis necessary to develop the requirements needed to implement proven decision support tools and data sharing capabilities*	• Deploy CATMT Work Package 2 capabilities to include: o Arrival uncertainty management o Weather integration o Collaborative airspace constraint resolution o Airborne reroute execution • *Upgrade the existing Traffic Flow Management System to include an initial electronic negotiation capability for more efficient flight planning*

Airspace Enhancements and Procedures

Implementation Commitments

Project	FY09	FY10	FY11	FY12-15
Airspace Enhancements	New York/New Jersey/Philadelphia Stage 1 ✓ Established procedural changes in core facilities and RNAV overlays Chicago Airspace Project Stage 2: South Enhancements ✓ Added southbound departures ✓ Published Southeast high and wide arrival procedures for Chicago O'Hare west flow (supports triple arrivals from east with new Runway 09L/27R) Houston Area Airspace Transition System (HAATS) Phase 3B ✓ Added third eastbound departure route ✓ Created New Severe Weather Avoidance Plan (SWAP) arrival route from the southeast ✓ Realigned southeast arrivals and departures to accommodate new routes High Altitude Airspace Management Program ✓ Transitioned point-to-point second J80 route to Q42 ✓ Started transition of New York choke point routes to point-to-point navigation routes using Navigation Reference System (NRS) ✓ Started transition of national playbook routes to point-to-point navigation using NRS	*New York/New Jersey/Philadelphia Stage 2* • Relocate and expand west airways • Reconfigure Philadelphia airspace *Western Corridor – Southern Nevada Airspace* • Optimize existing airports and airspace *HAATS Phase 3C* • Expand airspace to the west by establishing College Station approach control services at Houston TRACON and modifying certain airspace boundaries • Provide third westbound departure route • Shift southwest arrivals to Houston International and Houston Hobby southwest of current location to support new departures • Provide new SWAP arrival route from the southwest • Provide dual capacity arrival routes from the northwest	*New York/New Jersey/Philadelphia Stage 3* • Relocate and expand north airways • Facilitate Stage 4 elements	*New York/New Jersey/Philadelphia Stage 4* • Relocate and expand south and east airways • Change altitude restrictions • Create optimal descent procedures *Chicago Airspace Project Stage 3* • Provide west and north enhancements • Provide additional westbound departures • Provide high and wide arrival procedures for Chicago O'Hare east flow (supports triple arrivals from west with new Runway 10C/28C)
RNAV and RNP	✓ Published 50 RNAV Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs) including: o Chicago O'Hare o Newark o San Diego o Teterboro ✓ Developed helicopter route implementation plan for Simultaneous Non-Interfering Operations ✓ Published 50 Required Navigation Performance (RNP) Authorization Required (ARs) including: o Monterey o Chicago Midway o Houston o Phoenix ✓ Published 12 RNAV routes	• Begin development and implementation of an integrated procedures concept for Performance Based Navigation (PBN) with the goal of moving toward NextGen capabilities • *Create initial set of stakeholder tiger teams to address PBN procedure optimization at locations prioritized by need, cost benefit, budget and other considerations* • *Assemble expert procedure design teams to facilitate the long-term development, integration and optimization of PBN procedures* • *Continue to review existing work plans and make adjustments as appropriate to ensure the development of high-value procedures* • *Initiate integrated airspace and procedures projects at key sites, considering recommended metro areas, an integrated approach to procedural optimization, decoupling of operations between airports, and advanced features* • Continue to develop RNAV STARs with Optimized Profile Descents (OPDs) where feasible • *In collaboration with stakeholders, deliver nationwide strategy for implementation of RNAV Q and T routes*	• *Create implementation teams that execute the results of the initial set of tiger teams* • *Leverage expert design team structure to complete development on remaining scheduled legacy procedures* • *Continue integrated airspace and procedures projects at key sites, considering recommended metro areas, an integrated approach to procedural optimization, decoupling of operations between airports, and advanced features* • Expand implementation of OPDs • Apply RNP SIDs and STARs where user equipage (e.g. advanced features) supports and RNAV implementation cannot maximize benefits • Include RNAV (GPS) and RNP approaches within existing standards for parallel dependent and simultaneous independent operations • *In collaboration with stakeholders, determine the usefulness of the NRS to the GA community, and/or determine an alternative for low altitude users*	• *Leverage expert design team structure in moving toward implementation of integrated airspace procedures* • Expand en route PBN capabilities between metroplexes and selected city pairs to improve capacity and access to overhead streams to move toward implementation of integrated airspace procedures • *Continue implementation and evaluation of PBN-based routes to support NextGen transition to a primarily satellite-based navigation National Airspace System for cruise operations* • *Continue implementation of PBN integrated procedures/ routes/ airspace* • Complete safety case studies to support closer runway spacing for simultaneous independent approaches • Complete research and development for Paired Approach concept using RNP and ADS-B to operate closely spaced parallel approaches
Localizer Performance with Vertical Guidance (LPV)/Localizer Performance (LP) Procedures	✓ Published 500 LPV/LP procedures	• *Maintain a goal of at least 300 new LPV approaches per year, placing highest priority on the value of new procedures* • *Work with the aviation community to prioritize the schedule of runway ends slated to receive LPV procedures*	• *Consistent with priorities established with the aviation community, maintain a goal of at least 300 new LPV approaches per year, placing highest priority on the value of new procedures*	• *Consistent with priorities established with the aviation community, maintain a goal of at least 300 new LPV approaches per year, placing highest priority on the value of new procedures*

Airfield Development

Implementation Commitments

Project	FY09	FY10	FY11	FY12-15
Airfield Development	✓ Completed Washington Dulles Runway 1L/19R ✓ Completed Seattle-Tacoma Runway16R/34L ✓ Completed Chicago O'Hare Runway 9L/27R ✓ Completed Dallas-Fort Worth end-around taxiway ✓ Completed Philadelphia Runway 17/35 extension ✓ Completed New York (JFK) airfield improvements o Taxiway YA extension o JFK Taxiway K/KA ✓ Obtained Record of Decision for extension of Fort Lauderdale Runway 9R/27L ✓ Completed environment assessment for Portland Runway 10L/28R extension	• Complete FACT-2 next steps, to include coordination of airport action plans and integration with NAS Enterprise Architecture and NextGen Implementation Plan • Complete Charlotte Runway 17/35 • Fund metro area airport infrastructure improvements at other than OEP airports • Continue Southern Nevada supplemental environmental impact statement (EIS) • Continue Philadelphia EIS • Continue Houston International EIS • Continue West Palm Beach EIS • Complete Phase II of the San Francisco Bay Area Regional Airport Plan • Conduct a Phase II study providing feasibility analysis for potential airport sites that can aid Atlanta to accommodate future unmet demand • Continue surveys to support development of WAAS/LPV approaches to increase access to airports. Consider obstruction removal needs so that airports with LPV approaches can achieve lower minimums	• Begin FACT-3, including update of the NAS-wide analysis of constrained airports in consideration of taxiways, gates, airspace as well as initial evaluation of curb-to-gate issues • Continue fiscal year 2010 planning and environmental projects	• Complete FACT-3 and identify follow on strategic planning initiatives • Continue planning and environmental projects • Complete Chicago O'Hare Runway 10C/28C • Complete Fort Lauderdale/ Hollywood International Runway 9R/27L

Initiate Trajectory Based Operations (TBO)

Project	FY09	FY10	FY11-15
Modern Procedures (Separation Automation Enhancements, D- & R-Sides)	✓ Initiated activity to support ERAM Post ✓ Release 3 final investment decision. These deliverables include program requirements, implementation strategy and planning, a concept of operations (CONOPS) and a business case analysis report.	• Complete development to support final investment decision for ERAM Post Release 3. This material will include system requirements, business case, alternatives analysis, safety case and enterprise architecture elements.	• Conduct separation management engineering activities necessary to support the en route NextGen mid-term baseline. Candidate functional areas include PBN, conflict probe enhancements, conflict alert enhancements, and flight data display enhancements to support future investment decisions.
High Altitude	✓ Developed High Altitude CONOPS ✓ Initiated preliminary airspace design analyses	• Develop requirements for display information and decision support tool for Phase I of High Altitude Airspace Specialty • Prototype and evaluate display change requirements and decision support tools for early transition to support Phase I of High Altitude Airspace Specialty	• Conduct pre-task HITLs, fast-time simulations, safety and cost-benefit and airspace design analyses to continue to derive display, information and decision support tool requirements for High Altitude TBO operations • Finalize requirements to support the investment decision and proposed implementation of advanced concepts in High Altitude Airspace
Automation Risk Mitigation Interface Requirements			• Identify risks associated with interfacing to ARTS IIE sites, TAMR, ERAM and ATOP • Develop mitigation strategies for associated risks
Oceanic Tactical Trajectory Management	✓ Completed a demonstration plan for Automatic Dependent Surveillance – Contract (ADS-C) In-Trail Procedures (ITP) to support the Pacific operational trial ✓ Developed Oceanic Trajectory Management-4D (OTM-4D) in-flight metrics baseline	• Conduct ADS-C ITP operational trials • Develop initial requirements for Pre-Departure OTM-4D capability • Develop initial requirements for In-Flight OTM-4D capability • Develop CONUSE for Web-enabled Collaborative Trajectory Planning • Develop oceanic airspace management concept	• Expand operational trials to support ICAO adoption of ADS-C ITP procedures for pre-departure OTM-4D • Develop prototype to conduct In-Flight OTM-4D human-in-the-loop simulation, and operational trials
Conflict Advisories		• Prototype conflict resolution advisory capabilities (such as pre-probed altitude and speed amendments) that can be transferred verbally by controllers • Evaluate the impact that simple conflict resolution advisories have on the Computer-Human Interface design	• Continue engineering evaluations and prototyping of conflict resolutions for more basic aircraft maneuvers • Continue engineering evaluations and prototyping of approaches to implement aircraft conflict resolution advisories for more complex maneuvers with higher equipage and more data communications • Conduct safety and benefit assessments of aircraft conflict resolution advisories automation
NextGen Distance Measuring Equipment (DME)	✓ Initiated business case activities in support of NextGen DME. This material includes shortfall analysis, a concept of use, initial requirements and safety analysis.	• Procure 23 of 51 DME systems • Establish service availability for approximately 3 DMEs in support of RNP	• Procure final 28 of 51 DME systems • Establish service for approximately 28 DMEs in support of RNP

Increase Arrivals/Departures at High Density Airports (HD)

Project	FY09	FY10	FY11-15
Surface Tactical Flow	✓ Developed concept of operations (CONOPS) for surface trajectory based operations ✓ Developed demonstration plan for collaborative departure queue management ✓ Completed demonstration of collaborative departure queue management at Memphis ✓ Completed the installation of surface prototype capabilities at Orlando	• *Demonstrate collaborative departure queue management at Memphis and Orlando to refine concept of use (CONUSE) and develop functional requirements and procedures* • *Initiate evaluation of the benefit of FAA-funded infrastructure to provide surface surveillance coverage in non-movement areas, including taking into consideration any radio spectrum capacity constraints*	• Continue Surface Trajectory Based Operations requirements development for Data Comm, Surveillance, Weather and NAS Data systems • Refine the 2D Taxi Route Generations, Departure Runway Assignment, and Airport Configuration CONUSE • Conduct field demonstrations at Memphis and Orlando to support business case development • *Complete evaluation of the benefit of FAA-funded infrastructure to provide surface surveillance coverage in non-movement areas, including taking into consideration any radio spectrum capacity constraints*
Surface Conformance Monitoring	✓ Developed CONOPS for surface conformance monitoring ✓ Developed plan for an initial surface conformance monitoring simulation	• Conduct human-in-the-loop simulations to refine the surface conformance monitoring CONUSE and develop functional requirements and procedures	• Continue Surface Trajectory Based Operations requirements development for Data Comm, Surveillance, Weather and NAS Data systems • Finalize documentation for proposed implementation decision of surface conformance monitoring
Surface Data Sharing		• *Deploy initial data dissemination infrastructure for current Data Distribution Units (DDUs) equipped ASDE-X locations to enable surface data sharing via a single SWIM interface* • *Initiate development of data rights and data release policies in support of data sharing goals*	• Develop and implement the longer term data dissemination capability needed to provide a more reliable and robust data infrastructure • *Continue installing DDUs, leveraging the plan for ASDE-X and ASDE-3/Multilateration locations (34 of the 35 OEP airports) and at six additional non-OEP airports* • Complete information-sharing governance policies for the dissemination of surface event data • *Complete development of data rights and data release policies in support of data sharing goals*
Arrival Tactical Flow	✓ Developed CONOPS for Point-in-Space metering and metering with RNAV and RNP ✓ Completed documentation for concept and requirements definition phase ✓ Completed the investment analysis readiness phase ✓ Completed development of the documentation for final investment decision phase ✓ Completed the update to the Time-Based Flow Management program (TBFM) concept engineering plan	• *Achieve a final investment decision for TBFM. Conduct cost-benefit analysis for:* o *Implementation of additional Adjacent Center Metering (ACM) capabilities, which extends TBM beyond the boundaries of a single en route center.* o *Deployment of TMA to additional airports* o *Integration of TMA data with traffic flow management systems* • *Analyze and review CAP performance at Memphis and Atlanta centers with the goal of expanding CAP to additional locations* • *Develop data rights and sharing policies for CAP* • *Work with industry to develop RTA/CAP performance metrics* • *Deliver RTA Safety Management System (SMS) analysis*	• *Dependent on positive cost benefit analyses:* o *implement ACM* o *deploy TMA to additional airports* o *integrate TMA data with traffic flow management systems* • Extend the arrival metering horizon beyond today's capability and implement the integrated arrival and departure capability via the TBFM program • Achieve an investment decision for the integrated enterprise solution to initiate integration of metering functionality into NAS automation systems • *Complete an improved training program for FAA traffic management coordinators at sites where TMA is deployed, with the goal of increasing the consistent use of TBM*
Oceanic Tailored Arrivals		• Develop a transition plan and business case to implement Oceanic Tailored Arrivals at additional coastal locations	• Implement automation changes necessary to optimize the use of Oceanic Tailored Arrivals • Expand the use of Tailored Arrivals at additional locations • *Transition Tailored Arrivals from a demonstration project to full operational use (Miami, San Francisco, Los Angeles)* • *Identify potential required changes to automation platforms necessary to support operational implementation of use of oceanic Tailored Arrivals* • *Collaborate with industry to identify additional coastal airports where there is a positive business case for the implementation of Tailored Arrivals. Due to the dependence of Tailored Arrivals on FANS equipment, these procedures are currently limited to use at airports that support transoceanic traffic*
Integrated Arrival and Departure Airspace Management		• Conduct a preliminary operational safety assessment and develop functional automation requirements	• Complete software engineering analysis for automation system software changes including Surveillance Data Processing, Traffic Management Advisor, Conflict Probe and Flight Data Processing upgrades and Computer-Human-Interface changes to support integrated arrival/departure management with operations • *Complete studies and further refine expanded use of reduced separation rules, surveillance data fusion and automation convergence in support of future NextGen applications*

Increase Flexibility in the Terminal Environment (FLEX)

Project	FY09	FY10	FY11-15
Arrivals (RNAV and RNP with 3D Required Time of Arrival)	✓ Developed a CONOPS for RNAV and RNP with 3D Required Time of Arrival (RTA)	• Complete initial report on human-in-the-loop (HITL) simulation of Air-Ground Synchronization • Develop proposed standards to support RTA • Deliver initial business case report on RTA capability	• Begin limited implementation of 4D FMS Trajectory Based Operations using new ground automation support if available • Analyze human factors and flight deck automation requirements to support the safety management assessment • Conduct RTA proof-of-concept demonstration • Leverage demonstration results to conduct engineering and analysis necessary to support the development of initial RTA capability • Implement limited RTA capability (dependent on the establishment of a positive business case, approved SMS analysis, automation system enhancements and aircraft equipage)
Surface/Tower/ Terminal Systems Engineering	✓ Completed development of preliminary requirements necessary for the system design, scope and specifications for the Tower Flight Data Management (TFDM) engineering model	• *Initiate leveraging existing research and development activities and initiate development of plans to field integrated airport surface standards, processes and decision support tools.* • Develop TFDM engineering model and prototype initial Arrival/Departure Management Tools to support future operational demonstrations • *Work with the Surface Collaboration Decision Making Team (SCT) to define and gain consensus on a work plan to develop information exchange requirements* • Develop trajectory modeling in the terminal area for requirements and prototype design • Develop functional requirements through HITL simulation and a field demonstration at one site	• *Continue leveraging research and development activities and development of plans to field integrated airport surface standards, processes and decision support tools by 2018.* • Conduct HITL simulations and field demonstrations at additional sites to collect data to finalize TFDM CONOPS, functional requirements, benefits projections, cost estimates, safety analysis, procedures, training curriculum, and enterprise architecture elements • *Conclude and execute information exchange requirements work plan* • *Work with the SCT and the TFDM development team to define interoperability standards for surface operational data exchange* • *Conduct interoperability testing between the FAA and flight operations centers* • *Complete final investment decision and initiate deployment of the TFDM across the NAS* • *Execute field implementation of surface operational data sharing*
Closely Spaced Parallel Operations (CSPO)	✓ Chartered cross-agency team to integrate all CSPO-related activities ✓ Initiated safety analyses to update FAA order 7110.65 for RNAV/RNP/LPV or ILS ✓ Completed HITL tests to evaluate operational application for dual ILS and data collection for evaluating blunder assumptions ✓ Completed safety analyses for FAA order 7110.308 for dependent operations for Newark 4/22, Memphis, Seattle 34C/16C	• Conduct analysis to evaluate target level of safety for CSPO operations, leveraging: o *Current program plans to implement Converging Runway Display Aid at Memphis and Newark and evaluate for proposed use at Boston, Baltimore and New York (JFK).* o *Approval of additional dependent staggered approached (7110.308) for additional runway ends at airports already using the procedure as well as at other qualifying airports* o *Safety analyses to update FAA order 7110.65 to allow any combination of RNAV/RNP/LPV/ GLS or ILS* Perform data collection to support a decision on extended use of multilateration using Precision Runway Monitor – A • Continue Blunder Testing for CSPO	• *Complete analyses to re-evaluate the blunder model and determine operational impacts, refine blunder assumptions via modeling and analyses* • Approve Wake Turbulence Mitigation for Arrival procedures at additional airports and additional airport runway pairs using 7110.308 for dependent staggered approaches • Develop performance requirements for independent and paired approaches • *Implement an update to FAA Order 7110.65* • *Evaluate collected data in support of additional potential deployment* • *Update FAA Order 7110.65 to approve any combination of RNAV (with vertical navigation)/RNP/LPV/GLS/ILS for simultaneous independent and dependent approaches to closely spaced parallel runways*
Approaches, Ground Based Augmentation Systems (GBAS)	✓ Completed GBAS system design approval and approved GBAS for use in the NAS ✓ Completed Safety Risk Management for CAT I ✓ Initiated draft of CAT III System Specification	• Conduct cost and benefits analysis • Update CAT III concept of operations • Update CAT III requirements document	• Finalize CAT III ground facility specification and complete validation of CAT III avionics interoperability standards

Increase Flexibility in the Terminal Environment (cont'd)			
Project	**FY09**	**FY10**	**FY11-15**
Approaches, Optimize Navigation Technology	✓ Initiated draft specifications for Medium-Intensity Approach Lighting System with Runway Alignment Indicator (MALSR) and Precision Approach Path Indicator (PAPI) Light Emitting Diode (LED) to meet the Energy and Security Act of 2007 ✓ Completed PAPI implementation strategy plan	• Continue development and design of MALSR and PAPI LED Lamp Solution • Determine a test strategy and coordinate development of standards for conversion to LED	• Develop and design a Solid-State LED based MALSR Solution • Develop and design of ALSF-2 LED Lamp Solution • Continue development and design of: Solid-State LED based MALSR Solution, and ALSF-2 LED Lamp Solution
Approaches, NextGen Navigation Initiatives	✓ Initiated demonstration activities for lower visibility minima approaches using special authorization	★ Add navigation infrastructure, i.e. Runway Visual Range, to complete implementation of FAA Order 8400.13D at additional airports • Procure subsystems to support RNAV approaches at limited sites • Begin test and demonstration for RNAV DME-DME in terminal area	• Define current arrival variability, runway occupancy times (day/light, clear/low-visibility) as a baseline to improving exiting from the runway • Define a future set of taxi-out and taxi-in time-based performance requirements that reduce variability in surface operations. Use these requirements to assess the current performance at OEP airports to define how much change will be needed and the feasibility of those changes
Wake Turbulence Mitigation for Departure (WTMD)	✓ Developed investment plan	• Prototype WTMD demonstration system at William J. Hughes Technical Center	• Continue evaluations of WTMD to support investment decision
Terminal Enhancements for RNAV ATC (TERA)		• *Demonstrate Relative Position Indicator at a minimum of two terminal sites*	• *Leverage data collected from demonstration activities to develop an RPI requirements document to enable field implementation in 2012* • Complete operational evaluation and deployment of RPI • Provide initial operating capability for RPI
Wake Turbulence Mitigation for Arrival		• Install WTMA feasibility prototype in simulated airport environment	◆ Complete WTMA feasibility prototype evaluation.

Improve Collaborative Air Traffic Management (CATM)

Project	FY09	FY10	FY11-15
Strategic Flow Management Integration	✓ Continued to develop pre-departure reroute initial capability from Traffic Flow Management (TFM) to Air Traffic Control (ATC) to aircraft	• Develop CONOPS for airborne reroutes and altitude modification • Continue development of algorithms for pre-departure reroute capability from TFM to ATC to aircraft	• *Deploy the ability for traffic managers to electronically transmit reroutes from the traffic flow management automation to en route automation for delivery to the pilot and dispatcher: 2011- Predeparture reroutes (tower), 2014- Airborne reroutes (en route), 2016- More complex RNAV clearances, dependent on Data Comm* • Implement pre-departure and airborne reroute capability in ERAM • Support Terminal Automation investment decisions by conducting requirements analyses and developing the business case for airborne reroutes
Strategic Flow Management Enhancement	✓ Completed a field evaluation of marine stratus algorithm for ground delay program (GDP) at San Francisco ✓ Initiated route blockage and congestion as part of an integrated departure management decision support tool (DST)	• Develop a TFM road map and components integration plan • Develop San Francisco GDP with probabilistic forecast stratus field evaluation report • Develop final findings on information analysis for Departure Feedback • Develop departure route planning prototype cost-benefit analysis and implementation plan	• Develop San Francisco GDP with probabilistic forecast stratus field implementation plan • Conduct demonstrations to evaluate the business logic for balancing capacity and demand predictions • Develop integrated TFM CONOPS document • Design, develop and deploy an automated strategic flow enhancement capability • *In collaboration with aviation stakeholders, deliver a mid-term traffic flow management capabilities roadmap that outlines improvements that can be accomplished in the 2014-2018 timeframe*
Common Structure and Status Data	✓ Initiated analysis for use of aeronautical data and information exchange capability and developed initial CONOPS ✓ Initiated analysis for enterprise architecture elements for digital Letter of Agreements and Standard Operating Procedures (LOA/SOP) leading to an investment decision for AIM modernization ✓ Initiated information modeling efforts for candidate data elements such as LOA/SOP, runway configurations and status	• Develop Aeronautical Information Exchange Model to support the movement of digital LOA/SOP data, which will lead to an investment decision for AIM modernization • Develop CONOPS and enterprise architecture for national Special Activity Airspace (SAA) • Demonstrate capability to provide standardized, consistent and managed digital SAA definitions for external stakeholders and users • *Initiate SAA business case assessments for implementation at RTCA recommended priority sites (Minneapolis, Denver, Albuquerque, Los Angeles, Seattle, Salt Lake City) for implementation in coordination with the Department of Defense (DoD) and industry stakeholders based on a concept of operations developed in collaboration with the SAA community*	• Support the investment analysis decision that enables the implementation of airport, airspace and pilot briefing systems resulting from the pre-implementation work developed in this program • Complete data model and concept for digital capture of constraints and rules contained in facility location-specific digital LOA/SOP • *Provide common services for aeronautical data delivery and performance metrics calculations* • Support improvements for digitally managing, coordinating and scheduling airspace for SAA • *Complete SAA business case assessments for implementation at RTCA recommended priority sites (Minneapolis, Denver, Albuquerque, Los Angeles, Seattle, Salt Lake City) for implementation in coordination with the DoD and industry stakeholders* • *In collaboration with the SAA community, conduct an initial benefits analysis and review policy, and develop metrics and requirements* • *Develop common digital information exchange services for coordinating and disseminating SAA usage and activation data for planning and tactical use* • *Integrate SAA status information into air traffic decision support tools to enable strategic and tactical airspace management*

Improve Collaborative Air Traffic Management (cont'd)			
Project	**FY09**	**FY10**	**FY11-15**
Advanced Methods		• Develop flight data service CONOPS	• Develop and refine advanced algorithms and requirements for display to support the area flow and planner DSTs • Refine advanced algorithms to support the area planner DST
Flight Object	✓ Demonstrated initial flight object (surface movements) interaction with international ANSP ✓ Developed CONUSE for NAS flight object	• Update CONUSE for NAS flight object • Host Flight Object industry day – technical interchange meeting with industry on FAA plan for Flight Object activities and standards development • Develop initial Flight Object Data Dictionary	• Design preliminary requirements, standards, and access rights for operational Flight Object Management System to support information sharing of flight object data. • Demonstrate the international Flight Object usage outside the laboratory environment • Obtain investment decision for proposed Flight Object implementation
Integrated NAS Design & Procedure Planning			• Develop concepts for best-equipped, best-served • Initiate analyses and procedures on airspace and procedures design • Assess concepts and procedures • Conduct human in the loop simulations • Develop functional requirements
Dynamic Airspace		• Develop concepts of operations for the Airspace Resource Management System (ARMS) • Analyze ARMS system interdependencies	• Define requirements and criteria/metrics for evaluating radio spectrum coverage • Evaluate processes for moving sector boundaries and airspace configurations
Joint Network Enabled Operations (NEO)	✓ Developed NEO concept of use ✓ Developed NEO system architecture ✓ Developed NEO program plan	• Initiate concept of operations for applying NetCentric concepts to Unmanned Aircraft Systems • Initiate safety and hazard analysis • Initiate demonstration strategies and program roadmap	• Develop Unmanned Aircraft Systems 4D ATM research plan • Develop enterprise architecture human factors assessment • Conduct Spiral 3 flight trials and update deliverables with Communities of Interest

Reduce Weather Impact (RWI)

Project	FY09	FY10	FY11-15
Observation Improvements	✓ Completed master plan on the optimization of weather sensors to support activities and decisions required for the sensors network to meet mid-term and far-term milestones	• Complete sensor gap identification report for ground-based and airborne sensors for the terminal, en route and airborne areas • Continue evaluation of Multi-Phased Array Radar for weather and surveillance needs	• Develop NextGen right-sizing prototypes, and conduct demonstrations based on strategy report to enable improvement in weather observation quality and to inform future investment decisions • Develop NextGen concept for automatic adaptive sensing to field a sensor network that automatically responds to weather conditions to generate the required observations, on-demand rather than on-schedule, resulting in savings to operations and maintenance • Initiate strategy for optimization of volcanic ash sensing improvements impacting Alaska and Pacific routes. Complete prototyping for optimization of volcanic ash sensing improvements impacting Alaska and Pacific routes • Initiate concept for space weather in NextGen to enable efficient use of transpolar routes • Initial investment decision for surface observations consolidation
Forecast Improvements	✓ Completed establishment of 0-6hr advanced convective forecast summer demonstration capabilities	• Conduct advanced convective weather forecast demonstration to provide further information (benefits, HITL) on weather integration requirements for decision support tools for collaborative decision making • Complete ATM-Weather Integration Plan v2 to provide concept of weather integration into NextGen Solution Set activities (e.g., CATM)	• Conduct prototyping weather integration activities for the ATM Integrated Departure Route Planning tool and implement into weather integration portion of the tool in operations to reduce workload and obtain higher quality predictions of constraints and capacity in departure routes • Develop, test and finalize ATM requirements for a 0-8hr convective weather forecast for use in FAA systems and decision support tools • Develop NextGen concept of weather impact translation to automate a weather-related ATM impact statement to be used directly by decision makers and decision support tools to enable optimal use of airspace in both the terminal and en route airspace. Develop prototype NextGen weather impact translator, evaluate capability and provide software for proposed implementation

Improve Safety, Security and Environmental Performance (SSE)

Project	FY09	FY10	FY11-15
Security Integrated Tool Set (SITS)	✓ Completed development of SITS air domain security program requirements document ✓ Completed development of initial enterprise architecture elements for SITS in support of investment decision	• Conduct an evaluation of preliminary engineering development candidate concepts and systems, refine operational concepts and requirements, and obtain investment analysis readiness decision for SITS • Initiate the design and development of the SITS system	• Continue evaluation of preliminary engineering development candidate concepts and systems, refine operational concepts and requirements, and obtain initial investment decision for SITS • Complete the design and development, and initiate deployment of the SITS system

Transform Facilities (FAC)

Project	FY09	FY10	FY11-15
Future Facilities Investment Planning	✓ Developed enterprise architecture elements and other supporting engineering documents to assess network facilities concepts	• Conduct comprehensive analyses to support the NextGen facilities concepts and objectives	• Complete requirements analysis for NextGen facilities
Integration, Development and Operational Analysis Capability	✓ Developed initial operational capability of the NIEC in support of FAA unmanned aircraft system simulation	• Focus on integrating new technologies into existing NIEC capabilities that will enable the customer to: o Validate iterative designs to evaluate concepts and alternatives o Design and conduct experiments to assess software, hardware and prototypes for research, system analyses, and/or definition and refinement of requirements • Provide inter facility capabilities	• Enhance and sustain the NIEC at the Technical Center • Provide inter-facility capabilities
Test Bed Demonstration	✓ Completed alternatives assessment for location of NextGen Test Bed	• Conduct planning activities to establish initial Test Bed infrastructure (Florida) for NextGen Test Bed: o Develop initial operational concept o Develop near-term strategy o Define initial system requirements	• Perform site installation, maintenance and capability upgrades • Establish interconnectivity between sites • Perform arising NextGen technology integration and demonstration activities

NextGen System Development

Project	FY09	FY10	FY11-15
ATC/Tech Ops Human Factors	✓ Completed Initial Human Factors Plan and Gap Analysis ✓ Conducted initial simulation of Future Terminal Workstation. ✓ Completed Human Error database and results of Preliminary Human Hazard Analysis ✓ Conducted initial Strategic Job Analysis	• Deliver initial NextGen common workstation requirements document • Deliver initial human error safety analysis of mid term operations • Deliver initial tower workstation requirements	• Measure efficiency improvements from implementation of a NextGen common workstation that incorporates human factors requirements • Demonstrate collaborative ATM efficiencies enabled by common situational awareness Demonstrate efficiencies through new procedures to enable introduction of 4D dynamic air traffic environment
New ATM Requirements	✓ Completed Future Collision Avoidance System (CAS) Logic Research ✓ Developed Concepts of use for C-band airport surface wireless communications, including preliminary requirements and supporting architecture documentation. ✓ Conducted operational evaluation of SWIM Enhanced Data Exchange	• Provide recommendations for an aeronautical mobile airport communications system standard • Define baseline Requirements for Future Traffic Alert and Collision Avoidance System • Develop initial airborne SWIM concept of use	• System architecture and requirements definition for common trajectory implementation • Determine conflict resolution approaches using aircraft intent data • Conduct trade studies to determine approaches to future air-ground and ground-ground communications requirements implanting flexible terminal management
Ops Concept Validation Modeling	✓ Completed NAS Mid-term end-to-end Operational Concept Narrative ✓ Developed Data Communications (Data Comm) Segment 2 Preliminary Requirements ✓ Developed Data Comm Research Management Plan	• Develop detailed operational scenarios for the mid-term • Refine Mid-term NextGen Concept of Operations • Develop Time Based Flow Management Integrated Research Plan • Conduct Part-task Human-in-the-loop simulations of Trajectory Based Operations • Begin developing detailed scenarios for 2025	• Develop Data Comm Segment 2/3 requirements Conduct human in the loop simulations of trajectory based operations for integrated time-based flow management • Validate concepts through detailed analyses including analytical modeling, fast-time simulations, and human-in-the loop simulations and demonstrations
Staffed NextGen Towers	✓ Developed a comprehensive research management plan for NextGen towers ✓ Continued ASDE-X certification tests at DFW ✓ Completed concept development activities such as cognitive walkthrough, functionality analysis, and scenario development to support field demonstration	• Conduct demonstration activities • Continue detailed engineering analysis and requirements validation activities	• Continue to develop and evaluate quantitative metrics to define and validate human performance, usability, workload and safety • Continue detailed engineering analysis and requirements validation activities • Design and conduct experiments to assess software, hardware and prototypes for research, system analyses
Environment & Energy - Environmental Management System (EMS) and Advanced Noise and Emissions Reduction	✓ Evaluated potential benefits of Continuous Lower Energy Emissions and Noise (CLEEN) aircraft technologies and alternative fuels on the NAS ✓ Conducted analysis to explore advanced algorithms and integrated approaches for surface, terminal and en route operations that reduce noise and emissions and to quantify potential environmental benefits ✓ Initiated expansion of integrated models to analyze regional noise and emissions impacts of NAS operations ✓ Applied new metrics for health and climate impacts of aviation to advance EMS	• Assess NAS-wide benefits of CLEEN aircraft technologies and alternative fuels, developed under R&D programs • Identify opportunities for environmental gains for surface (taxi/ramp) and terminal area operations, and conduct a significant exploration and demonstration of environmental control algorithms for en route procedures • Analyze NextGen environmental impacts and metrics for EMS application • Conduct analysis, planning, and testing to develop and refine EMS	• Mature NAS-wide analysis of environmental impacts of CLEEN technologies and alternative fuels, developed under R&D programs • Mature significant exploration and demonstration of environmental control algorithms for surface and terminal areas and en route procedures • Continue to explore NAS-wide implications of environmental standards, policies and market measures to mitigate aviation environmental impacts • Refine and implement facets of EMS • Analyze environmental impacts and metrics for use in NextGen EMS and NEPA compliance

NextGen System Development (cont'd)			
Project	**FY09**	**FY10**	**FY11-15**
Wake Turbulence Re-categorization	✓ Developed Program Plan ✓ Developed initial safety arguments ✓ Developed initial benefits Case ✓ Delivered initial set of safe wake categories and associated separation minima	• Develop recommendation for an alternative set of wake separation standards • Provide recommendation to ICAO for action	• Determine optimal set of aircraft flight characteristics and weather parameters for use in setting wake separation minima • Develop metrics for setting tailored leader/follower aircraft wake mitigation separation standards • Determine changes to FAA ATC systems necessary for the ICAO implementation of revised wake separation standards • Complete development of leader/follower aircraft wake mitigation separation standards along with implementation planning for procedures and processes
Safety Management System Transformation	✓ Continued to refine and document the ASIAS enterprise architecture artifacts ✓ Continued to integrate the first commercial carrier data into ASIAS	• Begin implementing enhanced ASIAS, including the selected support architecture and requirements for information security, near real-time operations, and new and expanded participants	• Complete implementing enhanced ASIAS, including the selected support architecture and requirements for information security, near real-time operations, and new and expanded participants • Provide ability for ASIAS stakeholders to conduct custom analyses using selected ASIAS-provided fused data and tools • Expand ASIAS to achieve statistically significant coverage of NAS operations
Operational Assessments		• Develop and apply models to support the operational performance, safety and environmental integrated assessments of NextGen airspace/procedure and system changes	• Develop model enhancements to support the operational, safety and environmental assessment of NAS-wide airspace and procedural changes • Apply integrated operational assessments of proposed NextGen airspace/procedure and system changes

NextGen Demonstrations

Project	FY09	FY10	FY11-15
NextGen Demonstrations	✓ Conducted over 1000 Tailored Arrival (TAs) Flights in San Francisco, Miami and Los Angeles (LAX) ✓ Conducted surface conformance (2D) HITL Simulation ✓ Collected 3D Path Arrival Management Flight Trial Data ✓ Demonstrated optimized profile descent of Trans-Atlantic flight into Miami ✓ Conducted Surface Management Flight Operator Surface Application (FOSA) interface and Collaborative Departure Queue Management at Memphis ✓ Initial UAS demonstration coupled with 4D Trajectory Based Operations Flight Management System (7/09)	• Conduct of Integrated UAS demonstration plan o Enabling Technologies, ADS-B/4DT FMS o Incorporating ADS-B and NVS • Conduct Joint Gate-to-Gate Demo with Single European Sky Air Traffic Management Research (SESAR) • Conduct 2D Aircraft Flight Trial in Denver • Continue TAs at LAX, San Francisco and Miami • Perform HITL simulation of Surface Conformance (2D) plus hold short and give way instructions • Conduct second demonstration of Surface Management FOSA interface and Collaborative Departure Queue Management at Memphis • Evaluate Collaborative Departure Queue Management concept at Orlando and Memphis. • Perform HITL simulation of 2D Taxi Route Generation Tool and of decision support tools for Departure Runway Assignment, Airport Configuration and Departure Sequencing • Evaluate Flight Operator Surface Application (FOSA) Version 2 Interface concept, Collaborative Departure Queue Management Version 2 concept, and Weather Data Integration at Memphis and Orlando. • Demonstrate Staffed NextGen Tower at Dallas/Fort Worth	Conduct of integrated UAS demonstration plan Demonstration of advanced avionics systems Demonstration of synthetic vision systems Conduct of collaborative end-to-end domain systems and management , including oceanic 4D trajectory management • Standards and alternatives development

Task Force Overarching Commitments

Activity	Actions	Date
Post-Task Force Recommendations	Provide a comprehensive proposal for future NextGen engagement with the aviation community	Spring 2010
	Initiate work with the aviation community to determine which metrics to use and/or develop in order to track NextGen performance, both from a programmatic and an operational perspective	Spring 2010
Consistently Achieving 3- and 5-Mile Separation	Complete Air Traffic Safety Action Plan implementation	Spring 2010
Streamlining	Develop program plan for Navigation Procedures Project	March 2010
	Begin implementation of all Lean process changes for Navigation Procedures Project	September 2010
	Complete initial review of National Environmental Policy Act (NEPA), and make recommendations on the most efficient scale, scope and processes for NextGen NEPA activities	September 2010
Standardization	**Plan for NextGen Standards** The FAA agrees that timely and cost-effective standards for new capabilities are essential. As part of the NextGen Implementation Plan, the FAA will maintain a plan for all of the standards for aircraft systems and operational approval. This plan (Appendix A) is coordinated as a part of the NextGen program in an effort to provide the standards at the right time, when sufficiently mature to achieve safe and cost-effective solutions.	✓ January 2010
Headquarters/Field Coordination	**Coordination: Operational Approvals** The Flight Standards Service will implement NextGen branches in each Regional Office. These branches will concentrate experts in new technologies and procedures to support the operational review and approval of NextGen throughout the region. They will also work with other NextGen branches, and their activities will be coordinated through a National NextGen focal point in the office of Flight Technologies and Procedures.	✓ Fall 2009
	Coordination: Aircraft Certification The Aircraft Certification Service will implement a NextGen Policy Team to coordinate across the Directorates (responsible for different types of aircraft), and will identify, in 2011, NextGen specialists in aircraft certification offices with significant NextGen activity. In FY10, the implementation plan for NextGen specialists will be completed including the number and location of specialists.	✓ January 2010
	Coordination: System Safety Assessments The FAA will create a cross-agency team responsible for coordinating across all lines of business and performing organizations. This team will facilitate timely integration and execution of safety assessments. The cost and schedule risks associated with ensuring a safe system can best be mitigated by addressing safety from the onset of the program. This ensures that the requisite performance, robustness, human factors and mitigations are built into the system and the operation.	✓ Fall 2009
	Procedures for Coordination of New Technology Certification Projects The FAA will publish new procedures for coordinating aircraft certification projects that introduce new NextGen technologies, to ensure coordination between the field office conducting the project and the offices responsible for NextGen standards (through issue papers). Through early coordination, we will be able to provide more effective feedback on innovative projects early in their application process, as well as utilize the experience from these projects in developing national policy. (FAA Order on Standardized Usage of Issue Papers)	June 2010

Task Force Overarching Commitments (cont'd)		
Activity	**Actions**	**Date**
Tracking/ Transparency	**Tracking Operational Applications** The FAA will provide status reports at certain milestones to applicants for operational approvals that require Flight Standards Service Regional Office and/or Headquarters level concurrence. At a minimum, these updates should be provided monthly; upon receipt of an application package at regional and headquarter levels; and once final concurrence is provided. Note: These and other applicants may receive an update within three days of a request for status.	September 2010
Industry Coordination	**Coordination of Policy** The FAA commits to coordinate draft policy and guidance material with appropriate industry forums during development of the policy when possible. For example, the FAA will continue to coordinate PBN documents with the Performance-Based Operations Aviation Rulemaking Committee. Recognizing that no single forum represents all industry stakeholders, the FAA will also provide for public comment on all draft policy.	✓ January 2010
Training	**Aviation Safety- Communication** The FAA will develop a Web site to describe and coordinate progress of NextGen-related projects and policy within the Office of Aviation Safety.	September 2010
	Aviation Safety- Training Plan The FAA will develop a training plan to identify NextGen training requirements for the Office of Aviation Safety workforce.	September 2010
Bundling Applications/ Approvals	**Consolidated, Electronic Application Process** A review of the capabilities of Web-based automated Operations Safety System will be conducted to determine the feasibility of multiple, electronic applications for various NextGen operations.	September 2010
Re-Examining Approval Process	**Process Review: Lean Process Review for Instrument Flight Procedures** The FAA will conduct a review of processes, tools and procedures related to standards, policies, development, approval, publication and utilization of instrument flight procedures such as RNAV and RNP. A cross-agency team with representation from all affected offices will review the end-to-end process with the objective of establishing a Lean process that provides efficiency and consistency for development and implementation of all instrument flight procedures.	December 2010
Adequate Resources	**Aviation Safety Plan for NextGen** The Office of Aviation Safety will develop an integrated plan for the activities, schedules and resources needed to support the timely implementation of NextGen. The plan will encompass all safety oversight activities within the office and include plans for required policy, resources, training, etc.	March 2010
Early Adopter Programs	**Early-Adopter Procedure for Coordination** The FAA will develop coordination procedures for all projects to ensure early involvement of aviation safety representatives when the FAA is funding development or implementation of technology or procedure.	September 2010

FAA ADS-B Application Integrated Work Plan, version 2.0 – Reference 9

Excerpt from Reference 9:

"A major goal of the AIWP is to establish research priorities and requirements. A significant amount of research still needs to be accomplished to further mature many of these applications, and there are some general research topics applicable to virtually every application. The overarching research topics include the following:

- Revise and refine the cost-benefit assessment metrics in order to enable a prioritization of the broad set of applications and associated enablers. Specifically, more detailed estimates of the maturity and benefits of the applications are needed. In many cases this will require a more detailed definition and analysis of detailed operational concepts, in order to enable these more accurate estimates. In addition, better estimates are needed for avionics enabler costs to understand the full benefit/cost picture for a set of applications.
- Establish priorities for the development of the applications based on these estimates.
- Develop avionics standards for selected applications."[9]

Application Integrated Work Plan identified Research Topics

	Research Topic	Traffic Situation Awareness-Basic	Traffic Situation Awareness for Visual Approach	Airport Traffic Situation Awareness	Airport Traffic Situation Awareness with Indications and Alerts	Oceanic In-Trail Procedures	Flight Deck Based Interval Management -Spacing	Traffic Situation Awareness-Alerts	Flight Deck Based Interval Management -Delegated Separation	Indendent Closely Spaced Routes	Paired Close Spaced Parallel Approach	Inependent Close Spaced Parallel Approach	Delegated Separation - Crossing	Delegated Separation - Passing	FIM-DS with Wake Risk Management	ADS-B Integrated Collision Avoidance	Flow Corridors	Self-Separation
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	Develop Concept of Operations (i.e. OSED)				Near complete		Near complete		Initiated	X	X				X	X	X	
B	Determine additional ADS-B Message Set Needs						X		X		X				X			X
C	Develop and/or Refine Enablers		X		X		X	X	X	X	X	X	X	X	X	X	X	X
D	Conduct Simulations, Testing and Evaluation						X	X	X	X	X	X						X
E	Analyze Application Operational Safety and Performance information				Near complete		Near complete	X	X	X	X	X	X	X	X	X		X
F	Research Interoperability and Integration of Applications to determine potential enhancements to applications capabilities						X		X									
G	Assess Applications Benefits/Risks/Costs									X	X	X	X	X	X			
H	Determine needed modifications to Ground-based ATM and ATC Equipment						X		X	X	X		X	X				X
I	Definition of Comm/Nav/ Surveillance requirements												X	X				X
J	Collision Risk Modeling							X	X	X	X	X	X	X	X	X		X

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