



Federal Aviation  
Administration



# NATIONAL AIRSPACE AND PROCEDURES PLAN

2010

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## Forward

Over the next two decades the Federal Aviation Administration (FAA) will face major challenges meeting future demand while improving safety, reducing delays, and protecting the environment. The Next Generation Air Transportation System (NextGen) is the FAA's primary means to transform the national air transportation system. NextGen is a highly complex, multilayered, long-term process, developing and implementing new technologies and changing the operating environment.<sup>1</sup> Modern airspace and Performance-Based Navigation (PBN) are key building blocks for NextGen.

The need for modern, performance-based airspace has been voiced unanimously by all members of the aviation community. Groups representing specific constituents, such as Air Transport Association and the National Air Traffic Controllers Association, as well as broader consensus groups such as RTCA Inc., have recognized the importance of well-planned, evolutionary airspace improvements. The Department of Transportation's Inspector General states in both the September 2008 Report and March 2009 Testimony that the FAA's airspace redesign projects and performance-based initiatives are required steps to move forward with NextGen and are key programs that will enhance system capacity.<sup>2</sup>

This initial version of the *National Airspace and Procedures Plan* will provide a comprehensive accounting of the "current" state of airspace and PBN procedures enhancements. Over the next two years, the *National Airspace and Procedures Plan* will change significantly, broadening to include additional details on NextGen Metroplex airspace and procedures efforts, expanding to integrate all procedure production, and including the FAA's NextGen facilities plans. In time, the *National Airspace and Procedures Plan* will contain a listing of all ongoing and planned airspace projects and associated procedures. This inaugural version is the first important step in a strategically managed National Airspace that meets NextGen safety, efficiency and capacity goals.

### *National Airspace and Procedures Plan Overview*

Modernizing the nation's airspace and procedures requires a cohesive, high-level evolutionary strategy paired with specific tactics to deliver the desired products. The purpose of the *National Airspace and Procedures Plan* is to articulate the FAA's system-level strategy concerning airspace and procedures in order to deliver NextGen's safety, efficiency and capacity goals in the near-, mid-, and far-term.

The *National Airspace and Procedures Plan* is a compilation of current and future activities supporting NextGen's goals. These enhancements in airspace and procedures provide their own benefits but also form the foundation for the other technological improvements in NextGen. The *National Airspace and Procedures Plan* offers a narrative description and visual depiction of current and future airspace, along with PBN activities that will evolve the National Airspace towards NextGen. The plan outlines the scope and expected impacts of each effort, lays out specific schedules, and supports multi-year funding.

*National Airspace and Procedures Plan* will be maintained by a cross-agency collaborative process and will be produced under the concurrence of existing NextGen managing bodies. The lead Air Traffic Organization Operations group feeding the plan will be the National

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<sup>1</sup> Cox, March 2009 Testimony.

<sup>2</sup> Department of Transportation's Inspector General Testimony (AV-2008-087 and March 2009).

Operational Airspace Council (NOAC). The NOAC is a Director-level planning body, chartered to provide an integrated, systems approach for airspace projects and associated PBN. Along with the NOAC, input from the FAA's NextGen Planning, Airports, Policy and Safety organizations will ensure that *National Airspace and Procedures Plan* projects are benefits-based and that they deliver results that are consistent with NextGen and other FAA modernization policies.

In order to meet the overarching NextGen goals, the *National Airspace and Procedures Plan* must support other national aviation and aerospace planning efforts. At its most basic level, the *National Airspace and Procedures Plan* provides descriptions of airspace and procedures efforts that form a narrative to further explain the *National Airspace System Enterprise Architecture (NAS EA) Airspace and Procedures Roadmap*. The plan reflects the principles of the FAA's *Flight Plan* and also is consistent with the *Mid-Term Operations Concept*.

The most pivotal document describing NextGen is the *NextGen Implementation Plan*. The *National Airspace and Procedures Plan* reflects and informs the *NextGen Implementation Plan*, see Figure 1. The *NextGen Implementation Plan* provides a description of NextGen, illustrates the expected benefits of NextGen, lays out the aircraft avionics equipage needs, summarizes the FAA's commitments and plans to deliver future capabilities. On the release of the *NextGen Implementation Plan* in January 2009, the FAA requested that RTCA establish a government-industry Task Force to "forge community-wide consensus on the recommended NextGen operational improvements to be implemented during the transition between now and 2018.<sup>3</sup>" The findings and recommendations of the Task Force were delivered to the FAA in September 2009. Several of the recommendations have direct relevance to airspace and procedures implementation across the National Airspace System (NAS). The contents of the *National Airspace and Procedures Plan* will address the Task Force's recommendations and will provide an additional level of detail concerning the FAA's response plans.

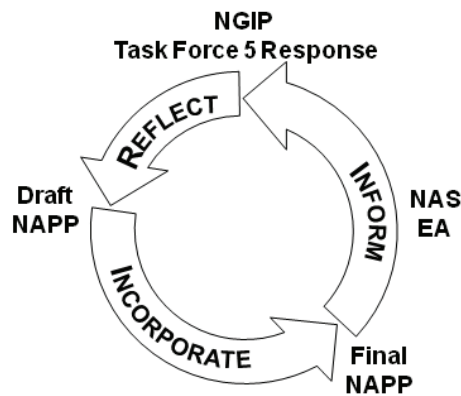


Figure 1. NGIP/NAPP/NAS EA Relationships.

### *National Airspace and Procedures Plan Organization*

The first part of the *National Airspace and Procedures Plan* provides an overarching summary of the progress of the National Airspace to NextGen through the near- and mid-term. This overview sets the framework for the remainder of the plan, describing the integrated transition of operations currently supported by conventional navigation and static airspace to performance-based operations supported by dynamic airspace design and management.

<sup>3</sup> Task Force 5 Final Report, September 2009.

The primary content of the plan is organized into two subsections, each addressing one of two problem areas, Metroplex and Cruise. The definition of these two problem “hemispheres” is taken from the *RTCA NextGen Mid-Term Implementation Task Force Report*.<sup>4</sup> Within each of the hemispheres are solutions, made up of specific airspace and PBN procedures activities. These solutions represent the FAA’s agreements to modernize airspace and associated procedures. The milestones listed reflect three types of FAA agreements:

- Commitments: Milestones which are fully sanctioned and resourced. For these mainly Operations resourced efforts, Commitments will be those milestones that have current fiscal year (FY) resources.
- Targets: Milestones which are part of a sanctioned or chartered project, but that may not have all the necessary resources or potential risks (operational, technical, environmental, or other) mitigated.
- Proposals: Milestones which are associated with planned activities. These milestones have not been approved, sanctioned or resourced, but represent the potential schedule for an effort.

The final section of the plan includes transition efforts such as applied research activities, concepts and demonstrations related to airspace and procedures to solve problems in key areas. The appendices of the *National Airspace and Procedures Plan* include additional project details for each effort highlighted in the plan. There are various guidelines and orders that are used to develop and maintain the life-cycle of these efforts. A summary of those resources is included in Appendix D.

Figure 2 highlights the structural elements of the plan.

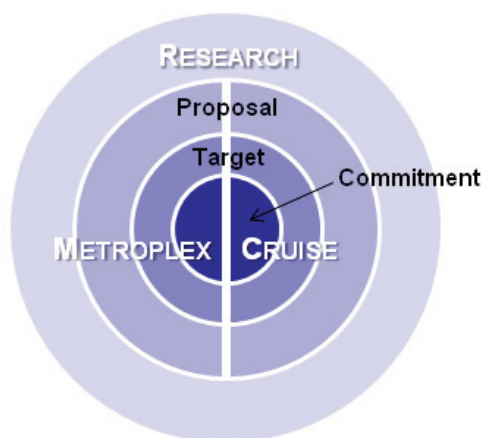


Figure 2. National Airspace and Procedures Plan Layout.

### Integrated Transition to NextGen Airspace and Procedures

The evolution described in this plan spans the near- and mid-term time periods, 2010 through 2018. Figure 3 contains a snapshot taken from the NASEA Airspace and Procedures Roadmap, covering 2010 through 2018. This evolution is a key part of the FAA’s overall plans to meet safety, efficiency and capacity goals. An overarching consideration for the FAA is the commitment to conduct the appropriate level of environmental review and preparation

<sup>4</sup> Task Force 5 Final Report, September 2009.

of the associated documentation in transition to the NextGen Airspace and Procedures. The potential environmental impact will be evaluated and tracked, along with operational changes of airspace and procedures enhancements. This continued commitment is a key tactic to address environmental constraints and noise abatement procedure challenges.

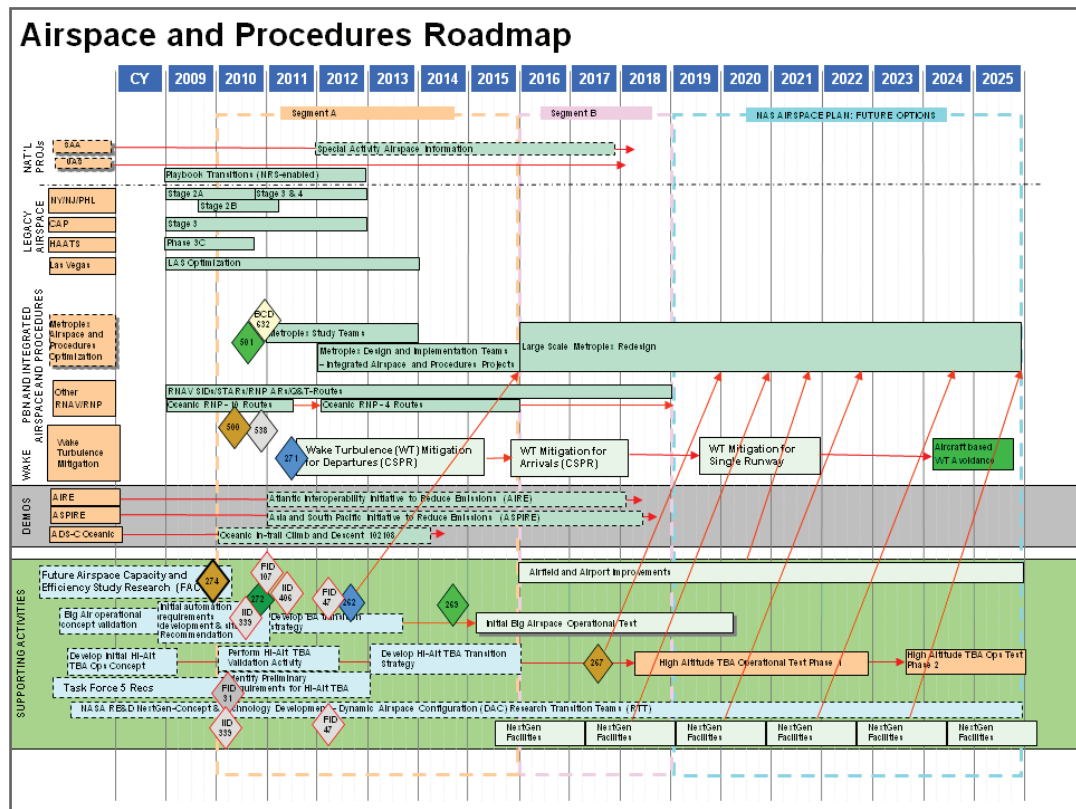


Figure 3. Excerpt from NAS EA Airspace and Procedures Roadmap.<sup>5</sup>

Through 2012, the focus will be on continuing the legacy Airspace Management Program (AMP) airspace projects and meeting the PBN procedure and route commitments in the FAA's Flight Plan. The AMP legacy projects include the New York/New Jersey/Philadelphia (NY/NJ/PHL) Metropolitan Area Airspace Redesign, the Chicago Airspace Project (CAP), the Houston Area Air Traffic System (HAATS) Airspace project, and the Las Vegas Optimization project.

In 2010, the annual procedure development goals from the FAA Flight Plan are 50 Required Navigation Performance (RNP) Authorization Required (AR) approach procedures, 50 area navigation (RNAV) Standard Instrument Departure/Standard Terminal Arrival (SID/STAR) procedures, and 12 RNAV routes. Throughout 2010, the focus on production goals will be transitioned to benefits-based service goals that will better support NextGen goals. One of the first steps to maximizing operational benefits is the emphasis on optimizing altitude profiles for planned procedures. In the near-term, Optimized Profile Descents (OPDs) which minimize the level segments on arrivals allowing a continuous, descending path, will be pursued as a priority in PBN procedures development.

Introduced in 2010 will be Integrated Airspace and Procedures projects – the future direction for all large-scale airspace and procedures efforts. The Integrated Airspace

<sup>5</sup> NAS Enterprise Architecture, working draft June 2010.

and Procedures approach provides a geographic focus to problem solving with a systems view of performance-based navigation initiatives and the design of airspace. This approach moves RNAV/RNP procedure design away from individual overlays into multi-airport, arrival/departure, and city pair networks, and moves airspace design towards NextGen with an emphasis on PBN procedures design. The key characteristics of this unified approach are that it:

- Utilizes additional transition access/egress points that are not tied to ground-based navigational aids
- Considers concurrent development and implementation of SIDs and STARs to ensure an integrated approach to procedural optimization
- Decouples operations between primary and secondary/satellite airports serviced by complex terminal airspace
- Develops high-altitude routes and procedures through congested airspace that better connect metropolitan areas


The first trial of an Integrated Airspace and Procedures project was initiated in 2010 in Denver. Additional Integrated Airspace and Procedures projects will be determined and prioritized by a process consistent with the recommendations from RTCA's Task Force 5. The Metroplex Airspace and Procedures Optimization effort is an expedited approach for Integrated Airspace and Procedures projects and will initiate optimization efforts targeting operational beneficial PBN procedures and effective airspace to support those enhancements. Metroplex Airspace and Procedures Optimization sites will also be influenced by projections of airfield and airspace capacity needs, environmental constraints/concerns, plans for new runways and customer recommendations of areas of interest.

Also in direct response to Task Force 5 recommendations, the near-term will shepherd in the first large scale implementation of PBN routes into the en route environment since the mid-2000s. Q-routes are high-altitude RNAV routes that start and end at a point in space. Their development and implementation initiates the transition from conventionally-based en route routing to performance-based en route routing, replacing the existing Jet and Victor airway system with RNAV/RNP routing systems.

Q-routes implemented within the near-term will address immediate en route chokepoints and will tie together terminal improvements associated with the legacy AMP projects (e.g., Q-routes connecting the NY/NJ/PHL Metropolitan Area Airspace Redesign and the CAP). En route flexibility will continue to be supported by RNAV point to point routing. The near-term will include collaboratively determined uses for the existing Navigational Reference System (NRS) waypoints. The NRS is a grid of RNAV waypoints that were implemented across the NAS in 2003/2004. Use of the NRS waypoints will also support the transition of the National Playbooks from conventional ground-based-navigation to PBN in the near-term.

A key component of 2012-2015 is pervasive use of PBN to improve flight operations. By 2015, all expected deliverables for the legacy AMP airspace projects should be completed. The transition to the Integrated Airspace and Procedures approach should be complete and all major large scale airspace projects will be employing this method of design and development. Integrated Airspace and Procedures projects will include the concurrent implementation of RNAV STARs and SIDs, utilization of PBN procedures (including RNP where beneficial) to deconflict airport operations within a metropolitan area, and optimized





vertical profiles to expedite departures and support efficient arrivals. Efficiencies gained in the terminal environment will be continued into the en route domain with the next increment of en route PBN routes, providing additional interconnectivity between metropolitan areas and key city pairs.

By the end of 2012, results of demonstration efforts and concept exploration experiments should be available to inform decisions about inclusion of future concepts (e.g., High Density Integrated Arrival and Departure Operations and High Altitude Trajectory Based Airspace) in design and development work planned for the second half of the mid-term.

Benefits from the deliverables associated with the Integrated Airspace and Procedures projects started in the 2012 will materialize between 2015 and 2018. Integrated Airspace and Procedures projects will continue to proliferate across the NAS, addressing operational issues in all the major metropolitan areas and at the top commercial airports. In this timeframe, airspace and procedures changes will incorporate the validated concepts tested in the early mid-term, possibly including High Density Integrated Arrival and Departure Operations, High Altitude Trajectory Based Airspace, and Tailored Arrivals (depending upon programmatic decisions associated with each of these concepts).

By 2018, several additional airfield enhancements may be commissioned. These airports with new runways in planning or environmental stages include Philadelphia International Airport, George Bush Houston Intercontinental Airport, and Denver International Airport. By 2018, NextGen will have implemented several enabling capabilities (e.g., Relative Position Indicator) that will provide improvements in collaborative decision-making, routing options, surveillance accuracy, data communications, flight path accuracy, sector design, and the distribution of aeronautical information. Airspace and procedures changes in this period will leverage these operational enhancements. Features inherent to these new systems, in particular automation and communications systems, will enable more dynamic design and management of airspace. In the event these features are delayed, any changes to the airspace or PBN procedures that are dependent on those features will also be delayed. Additionally, it is expected that all airspace will be performance-based by 2018.<sup>6</sup> Under this assumption, while most airspace will provide service to all aircraft, some airspace is envisioned to have such high demand that it will have exclusionary performance requirements, e.g., requiring aircraft to be capable of adhering to four-dimensional trajectories.

### **Metroplex**

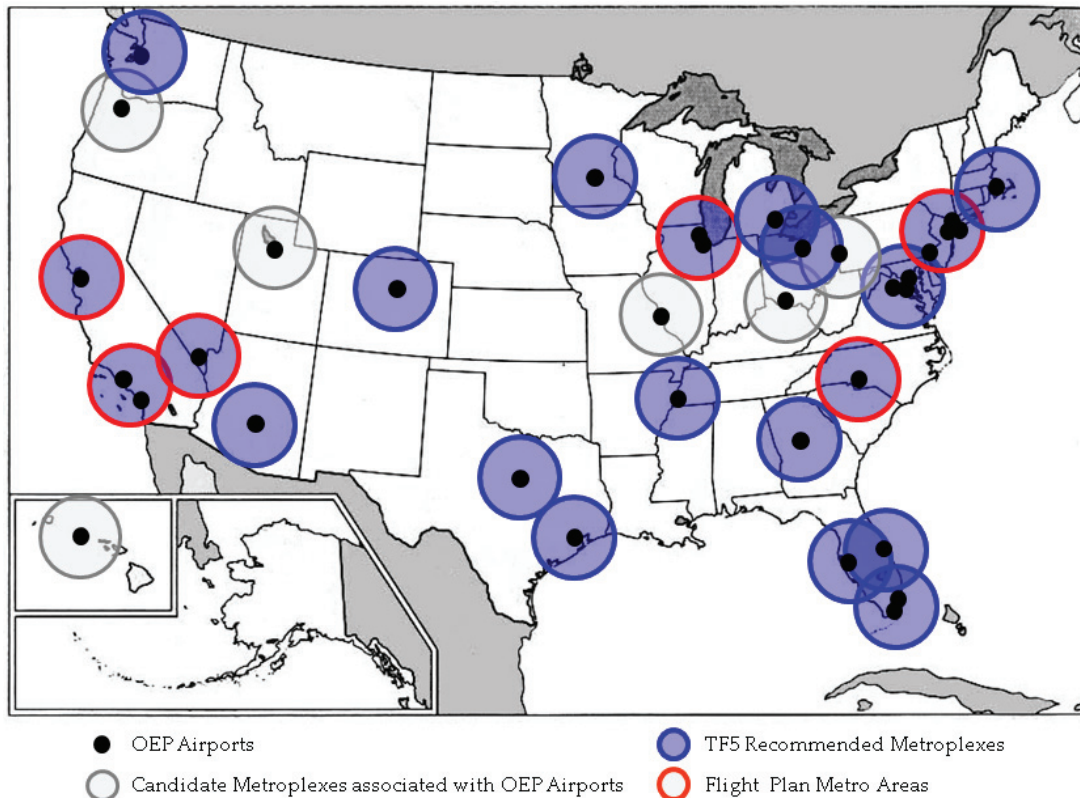
The Metroplex Section of this plan addresses airspace and procedures supporting the major metropolitan areas including operations at the major, reliever and satellite airports and ingress and egress airspace. Metroplex activities are not restricted to terminal efforts, as successful efficient operations require smooth transition to and from the en route environment. There are over two dozen major metropolitan areas that cover the 35 Operational Evolution airports defined by the *FAA Flight Plan* and the *Future Airport Capacity Task Force (FACT)*. Figure 4 shows these important metropolitan areas and airports.

The Task Force 5 Report identified several challenges in current and future busy metroplex areas. A summary of these issues include:

- Volume and projected growth across all airports in a metropolitan area, not limited to the major carrier airports

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<sup>6</sup> Mid-term Operations Concept, 2010.

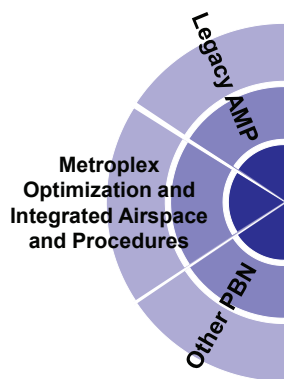


**Figure 4. Major NAS Metroplexes.**

- Complexity associated with diverse operations and mixed equipage
- Reduced-visibility conditions and severe weather that limits flexibility and throughput
- Adjacent airports in close proximity that share the same airspace
- Imbalance of traffic flows across ingress and egress points that hinder best use of available capacity
- Environmental constraints and noise abatement procedures

The Task Force 5 Report documented two specific recommendations for Metroplex airspace and procedures. To paraphrase, the Task Force recommended that the FAA, in collaboration and partnership with operators (e.g., airlines, general aviation, military, etc.):

- Optimize PBN procedures, focusing on the quality and emphasizing benefit.
- Implement integrated PBN-based airspace that uses the most efficient separation standards and procedures.



There is a three-pronged approach that will be used to address these recommendations:

- Completion of legacy AMP airspace projects.
- Introduction of Integrated Airspace and Procedures projects and Metroplex Optimization of Airspace and Procedures.
- Implementation and optimization of PBN procedures outside Metroplex and AMP efforts.

The remainder of this section lists the commitments, targets and proposals addressing Metroplex problems.

**Legacy AMP Projects:** The AMP legacy projects include projects started prior to the formation of the NOAC in August 2009: the NY/NJ/PHL Metropolitan Area Airspace Redesign, CAP, HAATS Airspace project, and the Las Vegas Optimization project. The majority of milestones in these projects should be completed by 2013, and all of them completed by 2015.

**Metroplex Optimization of Airspace and Procedures:** These efforts are a form of Integrated Airspace and Procedures projects, but with an expedited life-cycle of two to three years from planning to implementation. The focus of these efforts is on implementation of optimized PBN arrivals and departures and airspace changes to support optimal routings. This concept is based on a two-team approach:

- **Study Teams:** Provide a comprehensive but expeditious front-end strategic look at each major metroplex. The Study Teams will analyze the operational challenges and situations, assesses current/planned airspace and procedures efforts, explore new solution opportunities in a consistent manner, and provide recommendations to the FAA's collaborative decision process.
- **Design and Implementation Teams:** Provide a systematic, effective approach to the design, evaluation and implementation of PBN-optimized airspace and procedures. Using the results of the Study Teams, the Design and Implementation teams will execute the procedure optimization and Integrated Airspace and Procedures projects. The activity will cover a wide range of potential solutions and their execution time could be several months to over a year. Design and Implementation Teams will be responsible for the design, evaluation and implementation portions of these projects, including conducting all appropriate operational, safety and environmental analyses and assessments.

Each on-site Study Team will have access to a set of centralized analysis and expertise. The National Analysis Team will be focused on data analysis, modeling and evaluations supporting on-site teams. The Specialized Expertise Cadre will provide input in key areas such as airports, safety, environmental, policy, certification, standards, rulemaking and military issues.

In FY10, the initial set of Study Teams will be charged. Two prototype Study Teams will be started in FY10. These two initial teams, deployed in the Dallas-Fort Worth and DC metroplexes, will have two objectives, to conduct study reports and to continue the learning process. Lessons learned from the prototype Study Teams will form the foundation of the remaining efforts. In subsequent years, it is assumed that six to eight additional metroplexes

per year will undergo Study Teams. The first Design and Implementation Teams are expected to start in FY11. All major metroplexes are expected to be studied by the end of FY13, and a majority of Design and Implementation Teams are expected to be underway or completed by 2016.

The number of metroplexes that will be included in this effort is a subset of those identified in Figure 4. The order in which the metroplexes will be studied will be determined using an understandable and repeatable prioritization process, focusing on use of objective criteria, but including subjective considerations as appropriate. The objective criteria will include indicators and metrics describing operational need, metroplex connectivity, site readiness/potential, and other factors of interest. A wide range of FAA and industry input has been solicited for final determination of the prioritization criteria. The prioritization of metroplexes will be influenced by the priorities identified by industry in the Task Force 5 Final Report and by other FAA planning efforts such as the FACT. Future airport capacity planning and the Metroplex Optimization efforts are closely coupled. Going forward, Study Team recommendations will be incorporated into the next iteration of FACT. Similarly, any potential airspace and procedures optimization opportunities that are identified in FACT will be provided to the ongoing Study Teams for consideration.

The Metroplex Airspace and Procedures Optimization efforts will receive guidance and governance from two overarching FAA teams. Operational review and planning will be provided through the NOAC and the management structure that it reports through. Cross-agency coordination and collaboration will be provided by the Metroplex Core Team, consisting of representatives from FAA lines of business determined by the NextGen Management Board.

**Integrated Airspace and Procedures Projects:** While there are no officially chartered Integrated Airspace and Procedures Projects at this time, the initiatives started in 2010 in Denver are a best representation of what this type of effort will bring. The integrated RNAV SID/STAR implementation will include optimization and concurrent procedure development, two of the key characteristics of the Integrated Airspace and Procedures approach. The effort that was started in late January will target the removal of 6-8 level offs per RNAV STAR and increase terminal ingress and egress access. This will require complex negotiations with operators, and all levels of facilities. The Metroplex Team concept will be the main source for the initiation of Integrated Airspace and Procedures Projects. It is expected that the results of the FY10 and FY11 Metroplex Study Teams will translate into the start of three or more Integrated Airspace and Procedures Design and Implementation teams in FY11.

**Other PBN Procedures:** The National Airspace and Procedures Team (NAPT)<sup>7</sup> maintains a list of all the PBN procedures scheduled for publication in the NAS. This list is used to manage and track the publication of new PBN procedures as well as amendments to existing procedures. Currently, the NAPT list includes procedures planned through 2012. Currently many of the NAPT list procedures are singular site procedures. For example, these PBN procedures address location-specific requirements stemming from safety concerns (e.g., conflict alerts), infrastructure constraints (e.g., terrain, runway closure, constructions and crane operations, runway ends not serviced by precision approach systems, etc.) and other needs that must be addressed in the immediate term. These legacy procedures also seek to add efficiency with new PBN procedures and to optimize existing initial capability PBN

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<sup>7</sup> The NAPT was established by Order 8260.43A Flight Procedures Management Program.



procedures. In the future, the percentage of procedures on the NAPT list associated with Integrated Airspace and Procedures projects and Metroplex Optimization of Airspace and Procedures efforts will increase.

### Summary of Metroplex Milestones and Deliverables

Table 1 contains a summary of the major milestones. Additional details are included in Appendix A (legacy AMP projects) and Appendix B (NAPT procedures). For the PBN procedures shown in the table:

- Commitments are those procedures with chart dates on or before the second charting date in FY11 (procedures that are assumed to be funded with FY10 monies).
- Targets are those procedures with chart dates on or before the last charting date in calendar year (CY11) (procedures that are assumed to be funded with FY11 monies).
- Proposals are all other procedures included in the last NAPT list of February 2010.

**Table 1. Metroplex Milestones.**

|  | COMMITMENT        | TARGET                                | PROPOSAL           |
|--|-------------------|---------------------------------------|--------------------|
| NY/NJ/PHL Metropolitan Area Airspace Redesign                                    |                   | Stage 2A and 2B                       | Stage 3<br>Stage 4 |
| Chicago Airspace Project   |                   | Stage 3                               |                    |
| HAATS Airspace   | Stage 3C          |                                       |                    |
| Las Vegas Optimization   |                   | EA completion<br>Henderson procedures | Implementation     |
| PBN: Major Metroplexes   | 57 PBN procedures | 191 PBN procedures                    | 37 PBN procedures  |
| PBN: Other Areas   | 82 PBN procedures | 178 PBN procedures                    | 28 PBN procedures  |
| Metroplex Study Teams  | 2 prototype teams | 6-8 teams per year                    |                    |
| Metroplex Design and Implementation Teams for Integrated Airspace and Procedures |                   | 2-4 teams per year                    |                    |

### Cruise

The Cruise section of this plan addresses airspace and procedures supporting national cross-cutting operational issues. This includes the design and management of routes and structures, such high altitude performance-based routing and national airspace policies. The Cruise activities are primarily focused in the en route domain, but have strong interconnectivity with the terminal and oceanic operational environments.

The Task Force 5 Report identified several challenges in cruise operations. A summary of these issues include:

- Chronically congested or complex airspace
- Congestion created by a largely conventionally-based routing system that unnecessarily concentrates traffic flows over some waypoints

- Circuitous routings that increase flight times and miles flown resulting in inefficiencies and increased emissions
- Static airspace and manual procedures with an inability to adapt to rapidly changing conditions, including increased access to Special Activity Airspace (SAA)
- Inefficient information about changing airspace information, including availability of SAA

The Task Force 5 Report documented several recommendations to address Cruise problems, but identified two specific recommendations for airspace and procedures. To paraphrase, the Task Force recommended that the FAA:

- Implement an RNAV-based en route system, building structure only where it is needed and balancing flexibility and predictability.
- Implement real-time status and scheduling of SAA to increase awareness and predictability of SAA usage.



There are two specialized efforts to address these recommendations: High Altitude Airspace Performance-based Routing and the National Special Activity Airspace Project (NSAAP). The remainder of this section describes these two efforts and lists the commitments, targets and proposals addressing Cruise problems.

**High Altitude Airspace Performance-based Routing:** This effort reinitiates a national, top-down effort to redesign high altitude airspace and procedures, providing overarching connectivity between regional airspace and procedures efforts. The work is generated from a dissection of airspace concepts implemented under the High Altitude Redesign (HAR) project from 2003-2005. High Altitude Airspace Performance-based Routing covers two constructs: continued development and implementation of Q-routes as the national routing backbones and instantiation of the NRS as a key transitional element in NextGen evolution.

**Special Activity Airspace:** One of the key national airspace efforts is the development of the NSAAP. SAA is defined as any airspace with defined dimensions within the NAS wherein limitations may be imposed upon aircraft operations. SAA may be restricted areas, prohibited areas, military operations areas, air traffic control (ATC) assigned airspace, and any other designated airspace areas. The NSAAP is committed to developing increased cooperation and operational partnerships between the identified SAA Community of Interest (COI), which includes FAA and NAS customers, both civilian and Department of Defense (DoD). NSAAP has a diverse set of stakeholders and intersects with many NextGen efforts, including the Joint Planning and Development Office (JPDO).

## Summary of Cruise Milestones and Deliverables

Table 2 contains a summary of the major milestones and additional details are included in Appendix C.

**Table 2. Cruise Milestones.**

|                            | COMMITMENT                                    | TARGET        | PROPOSAL                                       |
|----------------------------|---|---------------|--|
| Q-Routes                   |   | 13 new routes | Additional routes to provide national coverage |
| Playbook Transition to PBN | New York Wind Route Options Playbook          |               | Additional Playbook transitions                |
| NSAAP                      | Operations Concept<br>Functional Requirements |               |  |

### Research and Transition Efforts

The activities described in this section include concept evaluation efforts, demonstrations, or research studies. These efforts are yet to be directly chartered as solution approaches to either Metroplex or Cruise problem areas, but have other associated decisions that will impact policies or processes governing airspace or procedure design. For this version of the *National Airspace and Procedures Plan*, concept exploration and demonstrations are discussed at a high-level and a listing of additional research activities is provided. Additional information on the research efforts are provided in other reference material.<sup>8</sup> Also included in this section of the plan is a description of a subset emerging tools and capabilities that may have impacts on future airspace and procedures.

**Concept Exploration Efforts:** Air Traffic Organization (ATO) Planning has two major concepts concerning airspace and procedure evolution: High Density Integrated Arrival and Departure Operations and High Altitude Trajectory Based Airspace.

High Density Integrated Arrival and Departure Operations is a mid-term operational concept for super density integrated arrival/departure operations in major metropolitan areas. The concept calls for improving operational efficiencies in major metropolitan areas by expanding the lateral and vertical limits of arrival and departure airspace, including transition airspace. High Density Integrated Arrival and Departure Operations completed concept validation experiments and cost/benefit analyses in September 2007. Automation requirements, surveillance requirements, site selection analyses and safety studies started in FY08 and FY09. Results and associated executive level decisions are planned in FY10.

High Altitude Trajectory Based Airspace: This concept blends the principles of Ultra High Altitude Airspace with Trajectory Based Operations. A key enabling technology is Segment 2 Data Communications and two key principles are generic airspace and flexible airspace. High Altitude Trajectory Based Airspace is just entering the concept validation portion of the effort. Studies are underway in FY10 to understand the implications on airspace design, procedures, and human roles and responsibilities. Experimental design and factor analysis is planned for FY10 and experiments are planned for FY11.

<sup>8</sup> Metron National Airspace and Procedures research descriptions and CAASD National Airspace and Procedures documentation.

**Demonstrations and Trials:** This section includes demonstrations or operational trials that support the future NextGen implementation.

There are several FAA sponsored NextGen demonstration projects, exploring many research elements related to future Integrated Airspace and Procedures efforts. Some of these topics include 3D RNAV/RNP with Required Time of Arrival and seamless integration of Unmanned Aircraft Systems/Remotely Piloted Aircraft into the NAS. One of the most relevant set of demonstrations involves International Air Traffic Interoperability and Oceanic Trajectory Based Operations. These demonstrations directly related to a number of PBN routing and procedures advancements including procedures developed under Atlantic Interoperability Initiative to Reduce Emissions (AIRE) and Asia and South Pacific Initiative to Reduce Emissions (ASPIRE).

There are also two externally sponsored demonstration efforts.

- Greener Skies over Seattle: Alaska Air Group, in partnership with the Port of Seattle and the Boeing Company is seeking to improve efficiency through shorter flight paths and reduced fuel burn; and to reduce the environmental impact of aircraft approaches at Seattle-Tacoma International Airport. Alaska Airlines has developed an initial design of RNAV and RNP OPDs and has completed one set of operational trials.
- Early RNP Adoption Project: Southwest Airlines has made a commitment to fully operate their fleet with RNP by the end of 2013. As part of that commitment, Southwest Airlines has invested in necessary equipage and pilot training efforts, and contracted for the third-party development of RNP procedures. The initial focus has been on the Dallas Love airport to Houston Hobby airport corridor with planned expansion throughout the Southwest Airlines system (64 airports in 8 regions).

The FAA is engaged at both the local and headquarters levels on these demonstration efforts. It is expected that the outcome of these efforts will have a direct impact on mid-term airspace and procedures efforts.

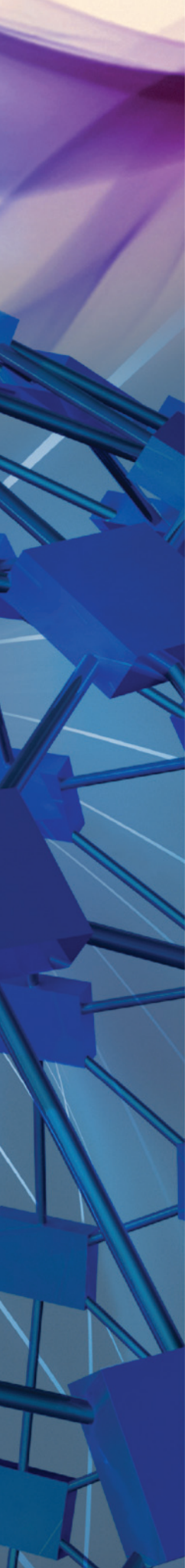
**Research Efforts:** JPDO's Dynamic Airspace Configuration (DAC) program is a collection of research efforts and concepts with the goal of enabling service providers to supply needed airspace capacity in the NAS. There are several research components in DAC:

- Generic Airspace targets resource flexibility by determining information needed to manage generic airspace and by prototyping automation to provide that needed information.
- Dynamic Airspace targets temporal flexibility. This research includes pre-coordinated dynamic airspace constructs such as airspace playbooks and dynamic airspace units.
- Restructured Airspace targets structural flexibility by exploring multiple classes of airspace operations including delegated separation, mixed operations, flow corridors, and dynamic Special Use Airspace

These research efforts target operational changes in the far-term NextGen timeframe, at the earliest 2019-2020. The results of this research will have a high level of relevance to future airspace and procedures efforts.







**Emerging Capabilities:** In the near- and mid-term timeframe, there are a number of emerging capabilities and technologies that will be implemented. It is expected that these capabilities may enable new airspace and procedural constructs, and may provide additional efficiencies to currently planned airspace and procedural enhancements. These capabilities reinforce basic infrastructure, enhance controller abilities to use new procedures, and encourage new concepts in airspace management. The *NextGen Implementation Plan*, the *NAS Enterprise Architecture Infrastructure Roadmaps* and other resources provide a comprehensive listing of tools and associated detailed descriptions.

### Summary

The *National Airspace and Procedures Plan* provides a descriptive outline for the evolution of performance-based airspace, concentrating on domestic terminal and en route domains. The plan presents a depiction of the major airspace and procedures efforts, categorized based on the progress of each effort. By examining efforts in three categories, this version of the plan presents an accurate rendering of the ongoing airspace projects and PBN procedure development efforts, and provides a glimpse into the future of Integrated Airspace and Procedure projects. Later versions of the plan will include additional information about oceanic airspace, international harmonization efforts, and outyear planning through the full NextGen implementation time.

## Appendix A

### Legacy Airspace Management Program Projects and 2009 Airspace Reviews

The *National Airspace and Procedures Plan* is built on a foundation of many years of experience in airspace and procedures design, development, and implementation. In the mid 1990s, as part of the reorganization of the Air Traffic Headquarters and Regional offices, a national airspace review effort was initiated. Upon completion of that activity, the National Airspace Redesign (NAR) was created in 1998. NAR was the Federal Aviation Administration (FAA) initiative to review, redesign, and restructure the nation's airspace. NAR included domestic and oceanic airspace, and addressed operational problems from small regional optimizations to large-scale high altitude redesign. In mid 2005, based on FAA organization changes and in response to a series of recommendations from the Department of Transportation's Inspector General, the FAA re-scoped and restructured NAR into the Airspace Management Program (AMP). Smaller and redefined, AMP has focused on completing the highest priority legacy NAR projects. Between 1998 and 2008, NAR and AMP completed approximately four dozen full or partial airspace projects, which have produced savings of over \$700M in direct operating costs to the aviation community.

The AMP legacy projects include projects started prior to the formation of the National Operational Airspace Council in August 2009. These projects are the New York/New Jersey/Philadelphia (NY/NJ/PHL) Metropolitan Area Airspace Redesign, the Chicago Airspace Project (CAP), the Houston Area Air Traffic System (HAATS) Airspace project, and the Western Corridor Southern Nevada Airspace project.

**NY/NJ/PHL Metropolitan Area Airspace Redesign:** This project was started in 1998 and encompasses a complete redesign of the airspace in the New York and Philadelphia metropolitan areas. The project capitalizes on Performance-Based Navigation (PBN), higher downwind segments for arrival aircraft, unrestricted departure climbs, fanned departure headings, and holding in terminal airspace. The purpose of the project is to increase efficiency and reliability of the airspace structure and Air Traffic Control (ATC) system to accommodate growth while enhancing safety, reducing delay and taking advantage of new technologies. There were four alternatives in the New York/New Jersey/Philadelphia Metropolitan Area Airspace Redesign: Future No Action, Modifications of Existing Airspace, Ocean Routing, and Integrated Airspace. The Integrated Airspace alternative was being examined with and without an associated facility. The alternatives addressed the baseline requirements of the National Environmental Policy Act (NEPA), the recommendations from the aviation community, and the input from the local communities gained during the environmental scoping process.

In September 2007, after an extensive environmental review process, the FAA signed a Record of Decision (ROD) selecting the Integrated Airspace alternative with the Integrated Control Complex with Noise Mitigation Strategy. The implementation phase of the project was started in December 2007 with initial fanned headings at Newark Liberty International Airport and Philadelphia International Airport. Implementation is segmented into four stages:

- Stage 1 includes procedural changes within the project's core facilities.
- Stage 2 concentrates on the Westgate departures. Stage 2 has two sub-stages, 2A focused on New York changes and 2B focused on Philadelphia changes.
- Stage 3 focuses on Northgate departures.
- Stage 4 completes the project with full integration of the airspace.

Each stage projected to overlap and take 12-18 months to complete. When implementation is completed, a 20% reduction in delay (compared to the No Action alternative) resulting in \$300M of direct operating cost savings is expected, as is a net reduction in noise levels for over 600,000 residents.

Upcoming milestones for the NY/NJ/PHL Metropolitan Area Airspace Redesign:

- Stage 2A and 2B implementation – Mid/Late 2011 (target)
- Stage 3 implementation – Late 2011 (proposal)
- Stage 4 implementation – Late 2012 (proposal)

**Chicago Airspace Project:** CAP was originally part of the Great Lakes Corridor project chartered in 1999. In its initial state, the project had several new departure routes planned (east, west and south) and proposed a doubling of the en route departure capacity. In 2001, when the O'Hare Modernization Project (OMP) was initiated, CAP expanded to include the need for new airspace to support the planned new runways and associated triple arrivals. CAP now includes three stages:

- Stage 1 East Enhancements: Two additional departure routes to the east (new total of four). Stage 1 was completed in March 2007.
- Stage 2 South Enhancements: Two additional departure routes to the south (new total of five), and High and Wide arrival procedures for ORD west flow (supporting the first OMP runway). Stage 2 was completed in November 2008.
- Stage 3 West Enhancements: Two additional departure routes to the west (new total of four), and High and Wide arrival procedures for ORD east flow (supporting the second OMP runway)

Benefits analysis indicates that the CAP airspace changes will provide a 10% reduction in delay in the east flow and a 20% reduction in the west flow (in terms of weighted arrival and departure delays). The addition of new runways under the OMP, in combination with the airspace changes, will enable triple simultaneous approaches capable of supporting balanced departure and arrival capacity during all weather conditions. The combination of the CAP airspace changes and the OMP airfield changes will produce a 66% decrease in average annual delays.

Upcoming milestone for CAP:

- Stage 3 implementation – Late 2012/Early 2013 (coincident with OMP Runway 10C/28C completion) (target)

**HAATS Airspace Project:** The project was originally chartered in 2000 as the Houston Gulf Coast Airspace Project and renamed to align with associated infrastructure efforts. The HAATS Airspace Project will revamp Houston terminal and surrounding en route airspace. The objectives of this project are to accommodate growth and airport expansion, increase efficiencies in managing the co-mingled DFW, DAL, IAH, and HOU flows, and to address the growth in traffic and leverage enhancements over the Gulf of Mexico. The project has three phases:

- Phase 1 incorporated changes that could be implemented prior to major infrastructure enhancement and was completed with the opening of IAH 15R in 2002.
- Phase 2 included changes required to service the new IAH Runway 08L/26R complex including triple approaches, and was completed in 2004.

- Phase 3 will be implemented over a three-year period and includes three sub-phases. Phase 3A (completed in June 2008) included an additional departure route to the northeast and associated airspace realignment and new sectors. Phase 3B (completed in March 2009) included an additional eastbound departure route and expanded airspace to the east by consolidating Beaumont TRACON (BPT) into Houston TRACON (I90). Phase 3C includes an additional westbound departure route and expands airspace to the west by establishing College Station approach control services at I90. Initial Phase 3C routing and procedural changes were implemented in July 2010. Airspace changes are planned for September 2010.

Customer benefits of \$4M-\$11M annually from additional arrival and departure airspace throughput are expected once the project is completed. There is an overall reduction in system delay in both years studied for the HAATS Enterprise Architecture. If no HAATS airspace improvements were implemented, delays would increase by roughly 50 percent between 2006 and 2015.

Upcoming milestone for the HAATS Airspace Project:

- Stage 3C completion – September 2010 (commitment)

**Las Vegas Optimization Project:** This airspace project is a result of airspace redesign work that was started in April 2008. In 2005 the Clark County Department of Aviation (CCDOA) announced plans for the Southern Nevada Supplemental Airport (SNSA) project to develop a new airport in the Ivanpah Valley to provide supplemental commercial service for Las Vegas and the surrounding area. In early 2008, Air Traffic began an airspace design process that would cover all feasible runway construction options, as determined by FAA's Airports Organization, and incorporated existing concepts/ideas to address the operational problems in the Las Vegas metropolitan area as an optimization alternative without any airfield construction. However, in June 2010 as a result of the national economic downturn, CCDOA announced a suspension of the Environmental Impact Statement (EIS) for SNSA and resulting delay to airfield effort. CCDOA and operational stakeholders stated that there was a strong need to provide interim operational enhancements for the Las Vegas aviation community, even with the suspension of the new airport. In verifying the need for interim airspace changes, FAA leadership sanctioned an independent airspace effort that will provide near-term modification of airspace and procedures supporting the Las Vegas Valley. This effort, named the Las Vegas Optimization project, is developing new departure and arrival routes and realigning airspace to increase efficiency at McCarran International Airport and surrounding satellite airports.

The proposed Las Vegas Optimization changes are expected to provide an overall positive impact. Initial modeling results indicate improvements in fuel efficiency and an overall decrease in flying miles

Upcoming milestones for the Las Vegas Optimization project:

- Las Vegas Optimization EA completion – Late 2011 (target)
- Henderson procedure optimization – June 2011 (target)
- Las Vegas Optimization implementation – 2013 (target)

**Initial Airspace Evaluations:** An initial airspace evaluation is the preliminary study that is carried out to characterize any operational issues or problems and result in an initial assessment of the airspace.<sup>1</sup> The initial evaluation is conducted to inform the second key decision point, to assess if an airspace study could assist in mitigating any identified problems and indicate whether a solution can be reached that is cost beneficial. The primary goals of an initial airspace review are to:

- Identify specific airspace issues that negatively impact operational performance
- Apply analysis tools and standardized metrics to the extent practical in order to validate and quantify identified issues
- Provide recommendations on whether further study is needed in order to develop and analyze mitigation alternatives

In 2009, airspace reviews were undertaken concerning the airspace serving Denver, Southern California, and North Texas (primarily the Dallas/Fort Worth metropolitan area). The review of Denver and Southern California were started in April 2009 and the report was delivered to the FAA in September 2009. The review of North Texas was started in September 2009 and the report was delivered to the FAA in May 2010. In summary, the reports cited:

- Southern California: Three primary problem areas were identified. Route inefficiencies included increased route lengths, flow interdependencies, and complex vertical interactions. Multi-function sectors caused added miles-in-trail, speed and altitude restrictions. Constrained airspace due to high proportions of special activity airspace limited flexibility and efficiency.
- Denver: Of the operational problem areas identified in the Denver metropolitan area, five showed direct relationship to airspace solution options. More efficient airspace is needed to deliver aircraft through the terminal airspace and to make more efficient use of Standard Terminal Arrivals (STARs) and altitudes.
- North Texas: Of the almost 20 operational problems identified in the North Texas area, 12 showed a direct relationship to airspace solution options. Routing efficiencies (shorter and more efficient profiles), limited flexibility, and corner-post capacity balancing issues could be addressed with better airspace and procedures.

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<sup>1</sup> Airspace Management Handbook, 2005 Edition.

## **Appendix B**

### **PBN Procedures and Routes**

In the late 1990s, in concert with the national focus on airspace design, efforts were directed on development of a national program office that would advance area navigation (RNAV) procedures. Aviation stakeholders invested in RNAV capabilities, a technology available since the 1970s, but until the formation of the RNAV Program Office, very few procedures were actually available for use. In the first decade of its existence, the national office, along with its sister offices in the FAA, made significant advances<sup>1</sup> in criteria, standards and tools supporting PBN capabilities, including RNAV Standard Instrument Departures (SIDs), RNAV STARs, RNAV Routes (e.g., Q-routes and T-routes) and Required Navigation Performance (RNP) Authorization Required (AR) procedures. In 2003, and again in 2006, the FAA published the Roadmap for Performance-Based Navigation, outlining the high-level plan for RNAV and RNP evolution in the NAS.<sup>2</sup> Hundreds of procedures and routes have been implemented as part of the Roadmap for Performance-Based Navigation and have provided significant safety and efficiency benefits. For example, RNAV departure procedures in Atlanta alone have produced an estimated \$105M savings in operator benefits. Furthermore, commitments outlined in the Roadmap for Performance-Based Navigation have been incorporated in the NextGen Implementation Plan.

RNAV and RNP commitments are captured in the proceedings of the National Airspace and Procedures Team (NAPT). In 2010, the annual procedure development goals are 50 RNAV SID/STAR procedures and 50 RNP AR approach procedures. In order to meet this production demand, a list of industry and FAA requests has been compiled. These requests are coordinated with Flight Standards and AeroNav Services and are reviewed to determine the relative importance of requests by applying a set of priority guidelines.<sup>3</sup> Priorities may be adjusted when justified to accommodate an urgent or safety related requirement or national initiative. The NAPT PBN production list<sup>4</sup> is included in Table B-1.

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<sup>1</sup> Appendix D contains a full list of orders, etc.

<sup>2</sup> The PBN Roadmap last published in 2006 has since been incorporated into the NAS Enterprise Architecture Airspace and Procedures Roadmap..

<sup>3</sup> Ten priority levels of priority used by core Regional Airspace and Procedures Team (RAPT) members.

<sup>4</sup> Based on July 2010 NAPT List and FY10 RNAV/RNP Work Plan.

**Table B-1. NAPT Production List**

| AIRPORT NAMES                    | STATE     | PROCEDURE NAME         | CHART DATE |
|----------------------------------|-----------|------------------------|------------|
| Albany (KALB)                    | NY        | RNAV (RNP) RWY 1, ORIG | 8/25/2011  |
| Albuquerque International (KABQ) | NM        | COLTR 1 (RNAV STAR)    | 8/25/2011  |
|                                  |           | ENCIA 1 (RNAV STAR)    | 8/25/2011  |
|                                  |           | KRKEE 1 (RNAV STAR)    | 8/25/2011  |
|                                  |           | LOWBO 1 (RNAV STAR)    | 8/25/2011  |
|                                  |           | SNDIA 1 (RNAV STAR)    | 8/25/2011  |
|                                  |           | ADYOS 1 (RNAV SID)     | 8/25/2011  |
|                                  |           | ATOMK 1 (RNAV SID)     | 8/25/2011  |
|                                  |           | BOSQE 1 (RNAV SID)     | 8/25/2011  |
|                                  |           | FYSTA 1 (RNAV SID)     | 8/25/2011  |
|                                  |           | GRIZZ 1 (RNAV SID)     | 8/25/2011  |
|                                  |           | MNZNO 1 (RNAV SID)     | 8/25/2011  |
| RDRNR 1 (RNAV SID)               | 8/25/2011 |                        |            |
| Anchorage (PANC)                 | AK        | MCKNZ 1 (RNAV SID)     | 7/29/2010  |
|                                  |           | SNDLK 1 (RNAV SID)     | 7/29/2010  |
|                                  |           | TERYT 1 (RNAV SID)     | 7/29/2010  |
|                                  |           | TLEFT 1 (RNAV SID)     | 7/29/2010  |
|                                  |           | WNFRM 1 (RNAV SID)     | 7/29/2010  |
|                                  |           | KROTO 1 (RNAV STAR)    | 7/29/2010  |
|                                  |           | OTTRR 1 (RNAV STAR)    | 7/29/2010  |
|                                  |           | PORTJ 1 (RNAV STAR)    | 7/29/2010  |
|                                  |           | TYOWN 1 (RNAV STAR)    | 7/29/2010  |
|                                  |           | NEELL 1 (RNAV STAR)    | 7/29/2010  |
|                                  |           | GASTO 3 (RNAV STAR)    | 6/30/2011  |
|                                  |           | KELYE 2 (RNAV STAR)    | 6/30/2011  |
|                                  |           | MUDIE 2 (RNAV STAR)    | 6/30/2011  |
| Aspen-Pitkin Co (KASE)           | CO        | PITKN 2 (RNAV SID)     | 11/18/2010 |
| Atka (PAAK)                      | AK        | INOTY 1 (RNAV SID)     | 7/29/2010  |
|                                  |           | HIMKI 1 (RNAV SID)     | 7/29/2010  |

| AIRPORT NAMES                           | STATE      | PROCEDURE NAME               | CHART DATE |
|---|------------|------------------------------|------------|
| Atlanta Hartsfield International (KATL) | GA         | JRAMS 1 (RNAV STAR)          | 7/29/2010  |
|   |            | UGAAA 3 (RNAV SID)           | 3/10/2011  |
|   |            | NUGGT 5 (RNAV SID)           | 3/10/2011  |
|   |            | RMBLN 6 (RNAV SID)           | 3/10/2011  |
|   |            | THRSR 6 (RNAV SID)           | 3/10/2011  |
|   |            | NOVSS 4 (RNAV SID)           | 3/10/2011  |
|   |            | MUNSN 5 (RNAV SID)           | 3/10/2011  |
|   |            | PNUTT 6 (RNAV SID)           | 3/10/2011  |
|   |            | JOGOR 4 (RNAV SID)           | 3/10/2011  |
|   |            | CADIT 6 (RNAV SID)           | 3/10/2011  |
|   |            | JCKTS 6 (RNAV SID)           | 3/10/2011  |
|   |            | COKEM 5 (RNAV SID)           | 3/10/2011  |
|   |            | GEETK 6 (RNAV SID)           | 3/10/2011  |
|   |            | SUMMT 5 (RNAV SID)           | 3/10/2011  |
|   |            | BRAVS 6 (RNAV SID)           | 3/10/2011  |
|   |            | DOOLY 5 (RNAV SID)           | 3/10/2011  |
|   |            | DAWGS 5 (RNAV SID)           | 3/10/2011  |
|   |            | DIRTY 1 (RNAV STAR)          | 12/31/2020 |
| NOTRE 1 (RNAV STAR)                     | 12/31/2020 |                              |            |
| Atlantic City International (KACY)      | NJ         | RNAV (RNP) Z RWY 13, ORIG    | 9/23/2010  |
|   |            | RNAV (RNP) Z RWY 31, ORIG    | 9/23/2010  |
| Aurora State (KUAO)                     | OR         | TBD 1 (RNAV SID)             | 3/10/2011  |
|   |            | TBD 1 (RNAV SID)             | 3/10/2011  |
|   |            | TBD 1 (RNAV SID)             | 3/10/2011  |
| Austin-Bergstrom International (KAUS)   | TX         | BEVOH 1 (RNAV SID)           | 9/23/2010  |
|   |            | WLEEE 1 (RNAV STAR)          | 9/23/2010  |
| Baltimore International (KBWI)          | MD         | TERPZ 2 (RNAV SID)           | 9/23/2010  |
|   |            | RNAV (RNP) Z RWY 10, AMDT 1  | 5/5/2011   |
|   |            | RNAV (RNP) Z RWY 15R, AMDT 1 | 5/5/2011   |
|   |            | RNAV (RNP) Z RWY 28, AMDT 1  | 5/5/2011   |
|   |            | RNAV (RNP) Z RWY 33L, AMDT 1 | 5/5/2011   |
|   |            | SWICH 1 (RNAV STAR)          | 5/5/2011   |
| SEVRN 1 (RNAV SID)                      | 12/31/2020 |                              |            |
| Bellingham (BLI)                        | WA         | MADEE 1 (RNAV STAR)          | 11/18/2010 |
| Birmingham International (KBHM)         | AL         | RNAV (RNP) Z RWY 24, ORIG    | 9/23/2010  |
|   |            | RNAV (RNP) Z RWY 6, ORIG     | 9/23/2010  |
|   |            | CRIMSON 1 (RNAV STAR)        | 12/15/2011 |
|   |            | CHOOK 1 (RNAV STAR)          | 12/15/2011 |
|   |            | WENDO 1 (RNAV STAR)          | 12/15/2011 |
|   |            | KYLEE 1 (RNAV STAR)          | 12/15/2011 |
|   |            | BOUNT 1 (RNAV SID)           | 12/15/2011 |
|   |            | FIBER 1 (RNAV SID)           | 12/15/2011 |
|   |            | GUMPY 1 (RNAV SID)           | 12/15/2011 |
|   |            | TALLEDEGA 1 (RNAV SID)       | 12/15/2011 |
| Bob Hope (KBUR)                         | CA         | RNAV (RNP) RWY 15, ORIG      | 3/10/2011  |
|   |            | RNAV (RNP) RWY 26, ORIG      | 3/10/2011  |
|   |            | RNAV (RNP) RWY 33, ORIG      | 3/10/2011  |
|   |            | RNAV (RNP) Z RWY 8, AMDT 1   | 3/10/2011  |
|   |            | JANNY 1 (RNAV STAR)          | 6/30/2011  |
|   |            | FLMOR 1 (RNAV STAR)          | 6/30/2011  |



| AIRPORT NAMES                                  | STATE | PROCEDURE NAME               | CHART DATE |
|--|-------|------------------------------|------------|
| Boca Raton (KBCT)                              | FL    | RNAV (RNP) RWY 5, ORIG       | 5/31/2012  |
|  |       | RNAV (RNP) RWY 23, ORIG      | 5/31/2012  |
| Boundary County (K65S)                         | ID    | KARPS 1 (RNAV SID)           | 7/29/2010  |
| Bradley International,<br>Windsor-Locks (KBDL) | CT    | RNAV (RNP) RWY 6, ORIG       | 8/25/2011  |
|  |       | RNAV (RNP) RWY 24, ORIG      | 8/25/2011  |
|  |       | RNAV (RNP) RWY 33, ORIG      | 8/25/2011  |
| Carlsbad - McClellan<br>(KCRQ)                 | CA    | RNAV (RNP) Z RWY 24, ORIG    | 3/10/2011  |
| Carson City (KCXP)                             | NV    | JIMPA 2 (RNAV SID)           | 9/23/2010  |
| Centennial (KAPA)                              | CO    | RNAV (RNP) RWY 17R, ORIG     | 12/31/2020 |
|  |       | RNAV (RNP) RWY 35L, ORIG     | 12/31/2020 |
|  |       | RNAV (RNP) RWY 17L, ORIG     | 12/31/2020 |
|  |       | RNAV (RNP) RWY 28, ORIG      | 12/31/2020 |
|  |       | RNAV (RNP) RWY 35R, ORIG     | 12/31/2020 |
| Charleston AFB/<br>International (KCHS)        | SC    | LGRHD 1 (RNAV SID)           | 10/20/2011 |
|  |       | MLTRE 1 (RNAV SID)           | 10/20/2011 |
|  |       | PLFMD 1 (RNAV SID)           | 10/20/2011 |
|  |       | PLMTO 1 (RNAV SID)           | 10/20/2011 |
|  |       | SWPFX 1 (RNAV SID)           | 10/20/2011 |
|  |       | AMYLU 1 (RNAV STAR)          | 10/20/2011 |
|  |       | BAGGY 1 (RNAV STAR)          | 10/20/2011 |
|  |       | MKNZI 1 (RNAV STAR)          | 10/20/2011 |
|  |       | OSPRI 1 (RNAV STAR)          | 10/20/2011 |
| Charleston Executive<br>(KJZI)                 | SC    | MILTRE 1 (RNAV SID)          | 10/20/2011 |
|  |       | SWPFX 1 (RNAV SID)           | 10/20/2011 |
| Charlotte/Douglas<br>International (KCLT)      | NC    | SUDSY 4 (RNAV STAR)          | 11/15/2012 |
| Chicago Executive Airport<br>(KPWK)            | IL    | RNAV (RNP) RWY 16, ORIG      | 8/25/2011  |
| Chicago Midway<br>International (KMDW)         | IL    | RNAV (RNP) Y RWY 22L, ORIG   | TBD        |
| Cincinnati (KCVG)                              | KY    | LOVEY 4 (RNAV SID)           | 9/23/2010  |
|  |       | BNGLE 3 (RNAV SID)           | 11/15/2012 |
|  |       | HAGOL 3 (RNAV SID)           | 11/15/2012 |
|  |       | KENLN 3 (RNAV SID)           | 11/15/2012 |
| City of Colorado Springs<br>Municipal (KCOS)   | CO    | RNAV (RNP) Z RWY 17L, ORIG   | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 17R, ORIG   | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 35L, ORIG   | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 35R, ORIG   | 9/23/2010  |
|  |       | OZZZY 1 (RNAV STAR)          | 2/9/2012   |
| Cleveland-Hopkins<br>International (KCLE)      | OH    | ALPHE 2 (RNAV SID)           | 11/18/2010 |
| Corpus Christi<br>International (KCRP)         | TX    | RNAV (RNP) Z RWY 13, ORIG    | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 31, ORIG    | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 35, ORIG    | 9/23/2010  |
| Dallas-Ft Worth<br>International (KDFW)        | TX    | RNAV (RNP) Z RWY 13R, AMDT 1 | 1/10/2013  |
|  |       | RNAV (RNP) Z RWY 31L, AMDT 1 | 1/10/2013  |
|  |       | RNAV (RNP) Z RWY 31R, AMDT 1 | 1/10/2013  |
| Dekalb-Peachtree (KPDK)                        | GA    | RNAV (RNP) RWY 02R           | TBD        |

| AIRPORT NAMES                            | STATE | PROCEDURE NAME             | CHART DATE |
|--|-------|----------------------------|------------|
| Denver International (KDEN)              | CO    | EEONS 1 (RNAV SID)         | 2/9/2012   |
|  |       | EMMYS 1 (RNAV SID)         | 2/9/2012   |
|  |       | EXTAN 1 (RNAV SID)         | 2/9/2012   |
|  |       | EPKEE 1 (RNAV SID)         | 2/9/2012   |
|  |       | GYPSM 1 (RNAV STAR)        | 2/9/2012   |
|  |       | TELLR 1 (RNAV STAR)        | 2/9/2012   |
| Detroit Metropolitan Wayne County (KDTW) | MI    | RNAV (RNP) RWY 03R, ORIG   | 5/5/2011   |
|  |       | RNAV (RNP) RWY 04L, ORIG   | 5/5/2011   |
|  |       | RNAV (RNP) RWY 04R, ORIG   | 5/5/2011   |
|  |       | RNAV (RNP) RWY 21L, ORIG   | 5/5/2011   |
|  |       | RNAV (RNP) RWY 22L, ORIG   | 5/5/2011   |
|  |       | RNAV (RNP) RWY 22R, ORIG   | 5/5/2011   |
|  |       | RNAV (RNP) RWY 27L, ORIG   | 5/5/2011   |
|  |       | RNAV (RNP) RWY 27R, ORIG   | 5/5/2011   |
| Driggs-Reed Mem (KDIJ)                   | ID    | LAMON 3 (RNAV SID)         | 5/5/2011   |
| Eagle County (KEGE)                      | CO    | RNAV (RNP) RWY 25, ORIG+   | 1/13/2011  |
| Eastern Sierra Regional (KBIH)           | CA    | RNAV (RNP) RWY 30, AMDT 1  | 8/25/2011  |
| El Paso International (KELP)             | TX    | BEARH 1 (RNAV STAR)        | 8/25/2011  |
|  |       | HSKNS 1 (RNAV STAR)        | 8/25/2011  |
|  |       | MOLLY 1 (RNAV STAR)        | 8/25/2011  |
|  |       | SAMMR 1 (RNAV STAR)        | 8/25/2011  |
|  |       | ATKIN 1 (RNAV SID)         | 8/25/2011  |
|  |       | JCOXX 1 (RNAV SID)         | 8/25/2011  |
|  |       | BUSEY 1 (RNAV SID)         | 8/25/2011  |
|  |       | LATVE 1 (RNAV SID)         | 8/25/2011  |
|  |       | NEVUE 1 (RNAV SID)         | 8/25/2011  |
| Eugene - Mahlon Sweet Field (KEUG)       | OR    | RNAV (RNP) Z RWY 16L, ORIG | 5/5/2011   |
|  |       | RNAV (RNP) Z RWY 16R, ORIG | 5/5/2011   |
|  |       | RNAV (RNP) Z RWY 34L, ORIG | 5/5/2011   |
|  |       | RNAV (RNP) Z RWY 34R, ORIG | 5/5/2011   |
| Fairbanks International (PAFA)           | AK    | CILAX 1 (RNAV STAR)        | 3/10/2011  |
|  |       | ELACA 1 (RNAV STAR)        | 3/10/2011  |
|  |       | BIMVE 1 (RNAV SID)         | 3/10/2011  |
|  |       | CACHE 1 (RNAV SID)         | 3/10/2011  |
|  |       | RNAV (RNP) Z RWY 2L, ORIG  | 8/25/2011  |
|  |       | RNAV (RNP) Z RWY 20R, ORIG | 8/25/2011  |
| Falcon Field (KFFZ)                      | AZ    | MESA 1 (RNAV SID)          | 7/29/2010  |
|  |       | SACAT 1 (RNAV SID)         | 7/29/2010  |
| Farmingdale/Republic Airport (KFRG)      | NY    | RNAV (RNP) RWY 14, ORIG    | 6/30/2011  |
|  |       | RNAV (RNP) RWY 32, ORIG    | 6/30/2011  |
| Forrest Shermard Field (KNPA)            | FL    | TBD 1 (RNAV SID)           | 4/5/2012   |
|  |       | TBD 1 (RNAV SID)           | 4/5/2012   |
|  |       | TBD 1 (RNAV STAR)          | 4/5/2012   |
|  |       | TBD 1 (RNAV STAR)          | 4/5/2012   |
| Gallatin Field (KBZN)                    | MT    | RNAV (RNP) Z RWY 12, ORIG  | 7/29/2010  |
|  |       | RNAV (RNP) RWY 30, ORIG    | 7/29/2010  |

| AIRPORT NAMES                       | STATE     | PROCEDURE NAME              | CHART DATE |
|-------------------------------------|-----------|-----------------------------|------------|
| Garfield County Regional (KRIL)     | CO        | EDUKY 3 (RNAV SID)          | 11/18/2010 |
|                                     |           | SQUAT 3 (RNAV SID)          | 11/18/2010 |
|                                     |           | UYRIG 2 (RNAV SID)          | 11/18/2010 |
|                                     |           | RNAV (RNP) Y RWY 26, AMDT 1 | 11/18/2010 |
|                                     |           | RNAV (RNP) Z RWY 26, AMDT 1 | 11/18/2010 |
|                                     |           | RNAV (RNP) Z RWY 8, AMDT 1  | 11/18/2010 |
| George Bush Intercontinental (KIAH) | TX        | WALIN 1 (RNAV SID)          | 7/29/2010  |
|                                     |           | GUSTI 2 (RNAV SID)          | 7/29/2010  |
|                                     |           | SABINE PASS 2 (RNAV SID)    | 7/29/2010  |
|                                     |           | AGGEE 2 (RNAV STAR)         | 7/29/2010  |
|                                     |           | DYNMO 1 (RNAV STAR)         | 7/29/2010  |
|                                     |           | HAMMU 1 (RNAV STAR)         | 7/29/2010  |
|                                     |           | KABOY 2 (RNAV STAR)         | 7/29/2010  |
|                                     |           | BAZBL 1 (RNAV STAR)         | 7/29/2010  |
|                                     |           | BOWFN 1 (RNAV SID)          | 9/23/2010  |
|                                     |           | ROKIT 2 (RNAV STAR)         | 11/18/2010 |
|                                     |           | TXMEX 2 (RNAV STAR)         | 11/18/2010 |
|                                     |           | RNAV (RNP) RWY 9            | TBD        |
|                                     |           | RNAV (RNP) RWY 33           | TBD        |
|                                     |           | RNAV (RNP) RWY 26L          | TBD        |
|                                     |           | RNAV (RNP) RWY 26R          | TBD        |
|                                     |           | RNAV (RNP) RWY 8R           | TBD        |
|                                     |           | RNAV (RNP) RWY 8L           | TBD        |
| RNAV (RNP) RWY 27                   | TBD       |                             |            |
| RNAV (RNP) RWY 15R                  | TBD       |                             |            |
| Grand Junction (KGJT)               | CO        | RNAV (RNP) RWY 11, ORIG     | 5/5/2011   |
| Great Falls International (GTF)     | MT        | RNAV (RNP) RWY 16, ORIG     | 5/5/2011   |
|                                     |           | RNAV (RNP) RWY 21, ORIG     | 5/5/2011   |
|                                     |           | RNAV (RNP) RWY 3, ORIG      | 5/5/2011   |
|                                     |           | RNAV (RNP) RWY 34, ORIG     | 5/5/2011   |
| Greenee County (KCFT)               | AZ        | SAN SIMON 1 (RNAV SID)      | 7/29/2010  |
| Greer (KGSP)                        | SC        | UNMAN 1 (RNAV STAR)         | 7/29/2010  |
|                                     |           | WHTTL 1 (RNAV STAR)         | 7/29/2010  |
| Gunnison/Butte Regional (KGUC)      | CO        | RNAV (RNP) RWY 24, ORIG     | 9/23/2010  |
| Hana (PHHN)                         | HI        | LINDBERG 2 (RNAV SID)       | 3/10/2011  |
| Heber City (K36U)                   | UT        | COOLI 2 (RNAV SID)          | 9/23/2010  |
|                                     |           | RNAV (RNP) Z RWY 3, ORIG    | 6/30/2011  |
| Henderson Executive (KHND)          | NV        | RNAV (RNP) RWY 17R, ORIG    | 1/13/2011  |
|                                     |           | RNAV (RNP) RWY 35L, ORIG    | 1/13/2011  |
|                                     |           | CHIPZ 1 (RNAV SID)          | 6/30/2011  |
|                                     |           | FLAMZ 1 (RNAV SID)          | 6/30/2011  |
|                                     |           | JAPRI 1 (RNAV SID)          | 6/30/2011  |
|                                     |           | LIDDL 1 (RNAV SID)          | 6/30/2011  |
|                                     |           | PALLY 1 (RNAV SID)          | 6/30/2011  |
|                                     |           | BOZER 1 (RNAV STAR)         | 6/30/2011  |
|                                     |           | DUBRE 1 (RNAV STAR)         | 6/30/2011  |
|                                     |           | HABEN 1 (RNAV STAR)         | 6/30/2011  |
| RHIKI 1 (RNAV STAR)                 | 6/30/2011 |                             |            |
| Hobby (KHOU)                        | TX        | STROS 1 (RNAV STAR)         | 7/29/2010  |
|                                     |           | COACH 1 (RNAV STAR)         | 7/29/2010  |

| AIRPORT NAMES                       | STATE | PROCEDURE NAME               | CHART DATE |
|-------------------------------------|-------|------------------------------|------------|
| Honolulu International (PHNL)       | HI    | HAABR 1 (RNAV STAR)          | 11/18/2010 |
|                                     |       | FRTZI 1 (RNAV STAR)          | 3/10/2011  |
|                                     |       | RNAV (RNP) RWY 26L, AMDT 1   | 3/10/2011  |
|                                     |       | RNAV (RNP) Z RWY 4R, AMDT 1  | 3/10/2011  |
|                                     |       | RNAV (RNP) Z RWY 8L, AMDT 1  | 3/10/2011  |
| Idaho Falls Regional (KIDA)         | ID    | RNAV (RNP) Z RWY 2, ORIG     | 9/23/2010  |
|                                     |       | RNAV (RNP) Z RWY 20, ORIG    | 9/23/2010  |
| Jackson Hole (KJAC)                 | WY    | RNAV (RNP) Y RWY 1, AMDT 1   | 10/20/2011 |
|                                     |       | RNAV (RNP) Z RWY 1, AMDT 1   | 10/20/2011 |
|                                     |       | RNAV (RNP) Z RWY 19, AMDT 1  | 10/20/2011 |
| Jackson-Evers International (KJAN)  | MS    | RNAV (RNP) RWY 16L, ORIG     | 8/25/2011  |
|                                     |       | RNAV (RNP) RWY 34L, ORIG     | 8/25/2011  |
|                                     |       | RNAV (RNP) RWY 34R, ORIG     | 8/25/2011  |
| Jacksonville International (KJAX)   | FL    | DUNTE 1 (RNAV STAR)          | 12/15/2011 |
|                                     |       | MULET 1 (RNAV STAR)          | 12/15/2011 |
|                                     |       | LUNNI 1 (RNAV STAR)          | 12/15/2011 |
|                                     |       | OHDEA 1 (RNAV STAR)          | 12/15/2011 |
|                                     |       | HOTAR 1 (RNAV STAR)          | 12/15/2011 |
|                                     |       | TEBOW 1 (RNAV STAR)          | 12/15/2011 |
|                                     |       | KRISO 1 (RNAV SID)           | 12/15/2011 |
|                                     |       | JETIN 1 (RNAV SID)           | 12/15/2011 |
|                                     |       | TRBRO 1 (RNAV SID)           | 12/15/2011 |
|                                     |       | WYTOK 1 (RNAV SID)           | 12/15/2011 |
|                                     |       | RNAV (RNP) Y RWY 25, ORIG    | 12/15/2011 |
|                                     |       | RNAV (RNP) Y RWY 13, ORIG    | 12/15/2011 |
|                                     |       | RNAV (RNP) Y RWY 7, ORIG     | 12/15/2011 |
| John F Kennedy International (KJFK) | NY    | RNAV (RNP) Z RWY 31L, AMDT 1 | 1/13/2011  |
|                                     |       | SCUBI 1 (RNAV STAR)          | 5/5/2011   |
|                                     |       | SKORR 3 (RNAV SID)           | 5/5/2011   |
|                                     |       | SCUBBY 1 (RNAV SID)          | 5/5/2011   |
|                                     |       | TBD 1 (RNAV SID)             | 5/5/2011   |
|                                     |       | TBD 1 (RNAV SID)             | 5/5/2011   |
|                                     |       | WRAPP 1 (RNAV SID)           | 5/5/2011   |
|                                     |       | SID RWY 31 (RNAV SID)        | 5/5/2011   |
| John Wayne-Orange County ((KSNA)    | CA    | RNAV (RNP) RWY 19R, ORIG     | 3/10/2011  |
| Juneau (PAJN)                       | AK    | ALSEK 3 (RNAV SID)           | 6/27/2013  |
|                                     |       | CINGA 4 (RNAV SID)           | 6/27/2013  |
|                                     |       | ROVZU 3 (RNAV SID)           | 6/27/2013  |
| Kahului (PHOG)                      | HI    | RNAV (RNP) RWY 2, ORIG       | 3/10/2011  |
|                                     |       | HAIKU 1 (RNAV STAR)          | 3/10/2011  |
| Klawock (PAKW)                      | AK    | TURTY 1 (RNAV SID)           | 9/23/2010  |
| Kona International (PHKO)           | HI    | KAIKO 1 (RNAV STAR)          | 3/10/2011  |
|                                     |       | RNAV (RNP) RWY 17, ORIG      | 3/10/2011  |
| La Guardia (KLGA)                   | NY    | NTHNS 2 (RNAV SID)           | 5/5/2011   |
|                                     |       | TREEO 2 (RNAV SID)           | 5/5/2011   |
|                                     |       | GLDMN 2 (RNAV SID)           | 5/5/2011   |
|                                     |       | TBD 1 (RNAV SID)             | 5/5/2011   |
|                                     |       | TBD 1 (RNAV SID)             | 5/5/2011   |
|                                     |       | TBD 1 (RNAV SID)             | 5/5/2011   |
|                                     |       | BASYE 1 (RNAV STAR)          | 12/31/2020 |

| AIRPORT NAMES                              | STATE     | PROCEDURE NAME                    | CHART DATE |
|--|-----------|-----------------------------------|------------|
| Logan International (KBOS)                 | MA        | LBSTA 2 (RNAV SID)                | 11/18/2010 |
|  |           | BRUWN 2 (RNAV SID)                | 11/18/2010 |
|  |           | CELTK 2 (RNAV SID)                | 11/18/2010 |
|  |           | HYLND 2 (RNAV SID)                | 11/18/2010 |
|  |           | SSOXS 2 (RNAV SID)                | 11/18/2010 |
|  |           | REVER 1 (RNAV STAR)               | 3/10/2011  |
|  |           | BRADY 1 (RNAV STAR)               | 3/10/2011  |
|  |           | TEDDY 1 (RNAV STAR)               | 3/10/2011  |
|  |           | DREEM 1 (RNAV STAR)               | 3/10/2011  |
|  |           | PATSS 2 (RNAV SID)                | 3/10/2011  |
|  |           | REVSS 1 (RNAV SID)                | 3/10/2011  |
|  |           | RNAV (RNP) Z RWY 4R, ORIG         | 10/20/2011 |
|  |           | Long Beach/Daugherty Field (KLGB) | CA         |
| RNAV (RNP) Y RWY 30, AMDT 1                | 1/13/2011 |                                   |            |
| Los Angeles International (KLAX)           | CA        | BUFIE 1 (RNAV STAR)               | 1/13/2011  |
|  |           | RNAV (RNP) Z RWY 25L, AMDT 1      | 5/5/2011   |
|  |           | RNAV (RNP) Z RWY 25R, AMDT 1      | 5/5/2011   |
| Louis Armstrong International (KMSY)       | LA        | RNAV (RNP) Z RWY 10, ORIG         | 9/23/2010  |
|  |           | RNAV (RNP) Z RWY 19, ORIG         | 9/23/2010  |
|  |           | RNAV (RNP) Z RWY 28, ORIG         | 9/23/2010  |
| Louisville International (KSDF)            | KY        | DAMEN 1 (RNAV STAR)               | 12/15/2011 |
|  |           | EMAUS 1 (RNAV STAR)               | 12/15/2011 |
|  |           | FRIZN 1 (RNAV STAR)               | 12/15/2011 |
|  |           | MAUDD 1 (RNAV STAR)               | 12/15/2011 |
|  |           | NERVE 1 (RNAV STAR)               | 12/15/2011 |
|  |           | SACKO 1 (RNAV STAR)               | 12/15/2011 |
|  |           | TUPAY 1 (RNAV STAR)               | 12/15/2011 |
|  |           | APALO 1 (RNAV SID)                | 12/15/2011 |
|  |           | FEDRA 1 (RNAV SID)                | 12/15/2011 |
|  |           | MYSTIC 1 (RNAV SID)               | 12/15/2011 |
| Lubbock Preston Smith International (KLBB) | TX        | RNAV (RNP) RWY 17R, ORIG          | 9/23/2010  |
|  |           | RNAV (RNP) RWY 35L, ORIG          | 9/23/2010  |
| Luis Munoz Marin International (TJSJ)      | PR        | CHAKA 2 (RNAV STAR)               | 9/23/2010  |
|  |           | TROCO 2 (RNAV STAR)               | 9/23/2010  |
|  |           | BEANO 2 (RNAV STAR)               | 9/23/2010  |
|  |           | JOSHE 2 (RNAV STAR)               | 9/23/2010  |
|  |           | SAALR 2 (RNAV STAR)               | 9/23/2010  |
| Marshall Don Hunter (PADM)                 | AK        | BIBNE 2 (RNAV SID)                | 7/29/2010  |
| McCarley Field (KU02)                      | ID        | IDAHO FALLS 2 (RNAV SID)          | 1/13/2011  |
|  |           | POCATELLO 2 (RNAV SID)            | 1/13/2011  |

| AIRPORT NAMES                    | STATE      | PROCEDURE NAME      | CHART DATE |
|----------------------------------|------------|---------------------|------------|
| McCarran International<br>(KLAS) | NV         | BOACH 3 (RNAV SID)  | 7/29/2010  |
|                                  |            | COWBY 3 (RNAV SID)  | 7/29/2010  |
|                                  |            | SHEAD 6 (RNAV SID)  | 7/29/2010  |
|                                  |            | TRALR 3 (RNAV SID)  | 7/29/2010  |
|                                  |            | BEERZ 1 (RNAV SID)  | 8/25/2011  |
|                                  |            | CHETR 1 (RNAV SID)  | 8/25/2011  |
|                                  |            | DARDN 1 (RNAV SID)  | 8/25/2011  |
|                                  |            | FEEEF 1 (RNAV SID)  | 8/25/2011  |
|                                  |            | FOLDD 1 (RNAV SID)  | 8/25/2011  |
|                                  |            | FRANO 1 (RNAV SID)  | 8/25/2011  |
|                                  |            | GUMPZ 1 (RNAV SID)  | 8/25/2011  |
|                                  |            | PAYUP 1 (RNAV SID)  | 8/25/2011  |
|                                  |            | REBAL 1 (RNAV SID)  | 8/25/2011  |
|                                  |            | TBD 1 (RNAV SID)    | 8/25/2011  |
|                                  |            | BEATY 1 (RNAV STAR) | 8/25/2011  |
|                                  |            | CEJAY 1 (RNAV STAR) | 8/25/2011  |
|                                  |            | DANBY 1 (RNAV STAR) | 8/25/2011  |
|                                  |            | DANKE 1 (RNAV STAR) | 8/25/2011  |
|                                  |            | DEUSE 1 (RNAV STAR) | 8/25/2011  |
|                                  |            | GLRNO 1 (RNAV STAR) | 8/25/2011  |
|                                  |            | GOFFS 1 (RNAV STAR) | 8/25/2011  |
|                                  |            | HOLDM 1 (RNAV STAR) | 8/25/2011  |
|                                  |            | HUGID 1 (RNAV STAR) | 8/25/2011  |
|                                  |            | PGS 1 (RNAV STAR)   | 8/25/2011  |
|                                  |            | RUGGS 1 (RNAV STAR) | 8/25/2011  |
| ZELMA 1 (RNAV STAR)              | 8/25/2011  |                     |            |
| TBD 1 (RNAV STAR)                | 8/25/2011  |                     |            |
| TBD 1 (RNAV STAR)                | 8/25/2011  |                     |            |
| Memphis International<br>(KMEM)  | TN         | LTOWN 5 (RNAV STAR) | 11/18/2010 |
|                                  |            | AUTMN 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | AZONE 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | BBKNG 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | BINKY 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | CASLN 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | CHLDR 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | DUCKZ 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | FREDX 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | GMBUD 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | GOETZ 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | GRRIZ 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | HOTRD 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | JERLE 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | JTEEE 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | OLEMS 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | PIPPE 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | SELPH 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | WDEEE 1 (RNAV SID)  | 5/5/2011   |
|                                  |            | BEERT 5 (RNAV STAR) | 12/15/2011 |
| LARUE 4 (RNAV STAR)              | 12/15/2011 |                     |            |
| LTOWN 6 (RNAV STAR)              | 12/15/2011 |                     |            |
| TAMMY 4 (RNAV STAR)              | 12/15/2011 |                     |            |

| AIRPORT NAMES                             | STATE | PROCEDURE NAME               | CHART DATE |
|---|-------|------------------------------|------------|
| Metropolitan Oakland International (KOAK) | CA    | RNAV (RNP) Z RWY 11, ORIG    | 9/23/2010  |
|   |       | RNAV (RNP) Z RWY 29, ORIG    | 9/23/2010  |
|   |       | RNAV (RNP) Z RWY 27L, ORIG   | 9/23/2010  |
|   |       | RNAV (RNP) Z RWY 27R, ORIG   | 9/23/2010  |
| Miami International (KMIA)                | FL    | BSTER 1 (RNAV SID)           | 10/20/2011 |
|   |       | DIAZZ 1 (RNAV SID)           | 10/20/2011 |
|   |       | JONZI 1 (RNAV SID)           | 10/20/2011 |
|   |       | KADAN 1 (RNAV SID)           | 10/20/2011 |
|   |       | HILEY 3 (RNAV STAR)          | 10/20/2011 |
|   |       | FLIPR 3 (RNAV STAR)          | 4/5/2012   |
| Morristown Municipal Airport (KMMU)       | NJ    | RNAV (RNP) RWY 23, ORIG      | 6/30/2011  |
|   |       | TBD 1 (RNAV SID)             | 12/31/2020 |
| Moses Lake-Grant Co International (KMWH)  | WA    | RNAV (RNP) RWY 4, ORIG       | 1/13/2011  |
|   |       | RNAV (RNP) RWY 14L, ORIG     | 1/13/2011  |
|   |       | RNAV (RNP) RWY 22, ORIG      | 1/13/2011  |
|   |       | RNAV (RNP) RWY 32R, ORIG     | 1/13/2011  |
| Napa County (KAPC)                        | CA    | OZIEE 1 (RNAV SID)           | 7/29/2010  |
| Newark Liberty International (KEWR)       | NJ    | RNAV (RNP) Y RWY 29, AMDT 1  | 1/13/2011  |
|   |       | PHLBO 3 (RNAV STAR)          | 5/5/2011   |
|   |       | TBD 1 (RNAV SID)             | 5/5/2011   |
|   |       | TBD 1 (RNAV SID)             | 5/5/2011   |
|   |       | PORTT SPLIT 1 (RNAV SID)     | 5/5/2011   |
|   |       | MEDDO SPLIT 1 (RNAV SID)     | 5/5/2011   |
|   |       | MEDDO 3 (RNAV SID)           | 5/5/2011   |
|   |       | PORTT 2 (RNAV SID)           | 5/5/2011   |
|   |       | TBD 1 (RNAV SID)             | 5/5/2011   |
|   |       | RNAV (RNP) Z RWY 29, AMDT 1  | 6/30/2011  |
| Norfolk International (KORF)              | VA    | RNAV (RNP) Y RWY 5, ORIG     | 6/30/2011  |
|   |       | RNAV (RNP) Y RWY 23, ORIG    | 6/30/2011  |
| Norman Y. Mineta (KSJC)                   | CA    | RNAV (RNP) Z RWY 12R, AMDT 1 | 9/23/2010  |
|   |       | RNAV (RNP) Z RWY 30L, AMDT 1 | 9/23/2010  |
|   |       | RNAV (RNP) RWY 12L, ORIG     | 9/23/2010  |
|   |       | RNAV (RNP) RWY 30R, ORIG     | 9/23/2010  |
| North Las Vegas (KVGT)                    | NV    | BERYL 1 (RNAV SID)           | 12/15/2011 |
|   |       | BIKKR 1 (RNAV SID)           | 12/15/2011 |
|   |       | GERYU 1 (RNAV SID)           | 12/15/2011 |
|   |       | HAKID 1 (RNAV SID)           | 12/15/2011 |
|   |       | NORRA 1 (RNAV STAR)          | 12/15/2011 |
|   |       | TRAGR 1 (RNAV STAR)          | 12/15/2011 |
|   |       | WABID 1 (RNAV STAR)          | 12/15/2011 |
| Omaha/Eppley Airfield (KOMA)              | NE    | RNAV (RNP) RWY 32L, ORIG     | 6/30/2011  |
|   |       | RNAV (RNP) RWY 32R, ORIG     | 6/30/2011  |
|   |       | RNAV (RNP) RWY 14L, ORIG     | 6/30/2011  |
|   |       | RNAV (RNP) RWY 14R, ORIG     | 6/30/2011  |
|   |       | RNAV (RNP) RWY 18, ORIG      | 6/30/2011  |
|   |       | RNAV (RNP) RWY 36, ORIG      | 6/30/2011  |
| Palm Beach International (KPBI)           | FL    | FRWAY 4 (RNAV STAR)          | 10/20/2011 |

| AIRPORT NAMES                           | STATE | PROCEDURE NAME               | CHART DATE |
|---|-------|------------------------------|------------|
| Palm Springs International (KPSP)       | CA    | RNAV (RNP) Z RWY 13R, AMDT 1 | 8/25/2011  |
|   |       | RNAV (RNP) Y RWY 13R, AMDT 2 | 8/25/2011  |
|   |       | RNAV (RNP) Y RWY 31L, AMDT 2 | 8/25/2011  |
| Pangborn Memorial (KEAT)                | WA    | RNAV (RNP) RWY 12, ORIG      | 7/29/2010  |
| Pasco - Tri-Cities (KPSC)               | WA    | RNAV (RNP) Z RWY 3L, ORIG    | 3/10/2011  |
|   |       | RNAV (RNP) Z RWY 12, ORIG    | 3/10/2011  |
|   |       | RNAV (RNP) Z RWY 21R, ORIG   | 3/10/2011  |
|   |       | RNAV (RNP) Z RWY 30, ORIG    | 3/10/2011  |
| Pensacola Gulf Coast Regional (KPNS)    | FL    | TBD 1 (RNAV SID)             | 4/5/2012   |
|   |       | TBD 1 (RNAV SID)             | 4/5/2012   |
|   |       | TBD 1 (RNAV STAR)            | 4/5/2012   |
|   |       | TBD 1 (RNAV STAR)            | 4/5/2012   |
| Petersburg James Johnson (PAPG)         | AK    | NAYTI 2 (RNAV SID)           | 6/30/2011  |
|   |       | NEERE 2 (RNAV SID)           | 6/30/2011  |
| Philadelphia International (KPHL)       | PA    | SPUDS 2 (RNAV STAR)          | 7/29/2010  |
|   |       | MIFLN 2 (RNAV SID)           | 3/10/2011  |
|   |       | STADM 2 (RNAV SID)           | 3/10/2011  |
|   |       | RNAV (RNP) Z RWY 27L, ORIG   | 12/31/2020 |
|   |       | RNAV (RNP) Z RWY 27R, ORIG   | 12/31/2020 |
| Phoenix Sky Harbor International (KPHX) | AZ    | KOOLY 3 (RNAV STAR)          | 1/13/2011  |
|   |       | MAIER 4 (RNAV STAR)          | 1/13/2011  |
|   |       | EAGUL 4 (RNAV STAR)          | 1/13/2011  |
|   |       | GEELA 4 (RNAV STAR)          | 1/13/2011  |
|   |       | BUKEE 1 (RNAV SID)           | 12/15/2011 |
|   |       | TBD 1 (RNAV SID)             | 12/15/2011 |
|   |       | TBD 1 (RNAV SID)             | 12/15/2011 |
|   |       | GBEND 1 (RNAV SID)           | 12/15/2011 |
|   |       | FORPE 1 (RNAV SID)           | 12/15/2011 |
|   |       | FANON 1 (RNAV SID)           | 12/15/2011 |
|   |       | CHOPR 1 (RNAV SID)           | 12/15/2011 |
| Phoenix-Mesa Gateway (KIWA)             | AZ    | HUUTY 1 (RNAV STAR)          | 3/10/2011  |
| Pittsburgh International (KPIT)         | PA    | RNAV (RNP) Z RWY 32, AMDT 1  | 11/18/2011 |
| Port Columbus International (KCMH)      | OH    | RNAV (RNP) Z RWY 10R, ORIG   | 9/23/2010  |
|   |       | RNAV (RNP) Z RWY 10L, ORIG   | 9/23/2010  |
|   |       | RNAV (RNP) Z RWY 28R, ORIG   | 9/23/2010  |
|   |       | RNAV (RNP) Z RWY 28L, ORIG   | 9/23/2010  |
| Portland International (KPWM)           | ME    | CWALL 1 (RNAV SID)           | 3/10/2011  |
|   |       | CEKAY 1 (RNAV STAR)          | 3/10/2011  |
| Portland-Hillsboro (KHIO)               | OR    | BERNI 1 (RNAV SID)           | 9/23/2010  |
|   |       | CHISM 1 (RNAV SID)           | 9/23/2010  |



| AIRPORT NAMES                            | STATE      | PROCEDURE NAME               | CHART DATE |
|--|------------|------------------------------|------------|
| Raleigh-Durham International (KRDU)      | NC         | FRAZI 1 (RNAV STAR)          | 9/23/2010  |
|  |            | MEYER 1 (RNAV STAR)          | 9/23/2010  |
|  |            | ZODAS 1 (RNAV STAR)          | 9/23/2010  |
|  |            | RASKL 1 (RNAV STAR)          | 9/23/2010  |
|  |            | RNAV (RNP) Z RWY 23L, AMDT 1 | 9/23/2010  |
|  |            | RNAV (RNP) Z RWY 23R, AMDT 1 | 9/23/2010  |
|  |            | RNAV (RNP) Z RWY 5L, AMDT 1  | 9/23/2010  |
|  |            | RNAV (RNP) Z RWY 5R, AMDT 1  | 9/23/2010  |
|  |            | BEXGO 1 (RNAV SID)           | 11/18/2010 |
|  |            | BULZZ 1 (RNAV SID)           | 11/18/2010 |
|  |            | HOOKZ 1 (RNAV SID)           | 11/18/2010 |
|  |            | LWOOD 1 (RNAV SID)           | 11/18/2010 |
|  |            | OXFRD 1 (RNAV SID)           | 11/18/2010 |
|  |            | WLFFF 1 (RNAV SID)           | 11/18/2010 |
| HURIC 1 (RNAV SID)                       | 11/18/2010 |                              |            |
| Reno/Tahoe International (KRNO)          | NV         | KENNO 1 (RNAV STAR)          | 7/29/2010  |
|  |            | PVINE 1 (RNAV SID)           | 1/13/2011  |
|  |            | SPLTM 1 (RNAV SID)           | 1/13/2011  |
|  |            | ZEFFR 4 (RNAV SID)           | 1/13/2011  |
|  |            | MYBAD 1 (RNAV STAR)          | 1/13/2011  |
|  |            | HARTT 1 (RNAV STAR)          | 1/13/2011  |
|  |            | EELZA 1 (RNAV STAR)          | 1/13/2011  |
|  |            | WADOL 1 (RNAV STAR)          | 1/13/2011  |
|  |            | RNAV (RNP) RWY 16L, ORIG     | 1/13/2011  |
|  |            | RNAV (RNP) RWY 16R, ORIG     | 1/13/2011  |
| Rick Husband Amarillo (KAMA)             | TX         | RNAV (RNP) RWY 13, ORIG      | 11/18/2010 |
|  |            | RNAV (RNP) RWY 22, ORIG      | 11/18/2010 |
|  |            | RNAV (RNP) RWY 31, ORIG      | 11/18/2010 |
|  |            | RNAV (RNP) RWY 4, ORIG       | 11/18/2010 |
| Rogue Valley International (KMFR)        | OR         | RNAV (RNP) RWY 14, ORIG      | 9/23/2010  |
|  |            | RNAV (RNP) RWY 32, ORIG      | 9/23/2010  |
| Ronald Reagan Washington National (KDCA) | DC         | HAMMI 1 (RNAV SID)           | 3/10/2011  |
|  |            | LAZIR 1 (RNAV SID)           | 3/10/2011  |
|  |            | CLIPER 2 (RNAV STAR)         | 5/5/2011   |
|  |            | RNAV (RNP) Y RWY 1, AMDT 1   | 8/25/2011  |
| Sacramento-Mather (KMHR)                 | CA         | TBD 1 (RNAV STAR)            | 5/5/2011   |
| Salt Lake City (KSLC)                    | UT         | RNAV (RNP) RWY 16L, ORIG     | 8/25/2011  |
|  |            | RNAV (RNP) RWY 16R, ORIG     | 8/25/2011  |
|  |            | RNAV (RNP) RWY 17, ORIG      | 8/25/2011  |
| San Antonio International (KSAT)         | TX         | HUBEE 1 (RNAV SID)           | 7/29/2010  |
|  |            | ALISS 1 (RNAV SID)           | 9/23/2010  |
|  |            | MILET 1 (RNAV SID)           | 9/23/2010  |
|  |            | RODIO 1 (RNAV STAR)          | 9/23/2010  |
|  |            | RNAV (RNP) RWY 12R, ORIG     | 1/13/2011  |
|  |            | RNAV (RNP) RWY 21, ORIG      | 1/13/2011  |
|  |            | RNAV (RNP) RWY 30L, ORIG     | 1/13/2011  |
| San Diego International (KSAN)           | CA         | RNAV (RNP) Z RWY 9, ORIG     | 9/20/2012  |

| AIRPORT NAMES                             | STATE | PROCEDURE NAME               | CHART DATE |
|---|-------|------------------------------|------------|
| San Francisco International (KSFO)        | CA    | RNAV (RNP) Y RWY 10R, AMDT 1 | 8/25/2011  |
|   |       | RNAV (RNP) Y 28R, AMDT 1     | 8/25/2011  |
| Santa Ana (KSNA)                          | CA    | STREL 1 (RNAV SID)           | 3/10/2011  |
|   |       | CANTA 1 (RNAV SID)           | 3/10/2011  |
|   |       | KEFFR 1 (RNAV STAR)          | 6/30/2011  |
|   |       | TBD 1 (RNAV STAR)            | 8/25/2011  |
|   |       | RAWLZ 1 (RNAV SID)           | 8/25/2011  |
| Santa Monica (KSMO)                       | CA    | TBD 1 (RNAV SID)             | 6/30/2011  |
| Sarasota International (KSRO)             | FL    | SRKUS 1 (RNAV SID)           | 1/13/2011  |
|   |       | TRAPR 1 (RNAV STAR)          | 1/13/2011  |
|   |       | TEEGN 1 (RNAV STAR)          | 1/13/2011  |
| Savannah/Hilton Head International (KSAV) | GA    | CANTR 1 (RNAV SID)           | 12/15/2011 |
|   |       | FLYNT 1 (RNAV SID)           | 12/15/2011 |
|   |       | RESLR 1 (RNAV SID)           | 12/15/2011 |
|   |       | TRASV 1 (RNAV SID)           | 12/15/2011 |
|   |       | DUNNK 1 (RNAV STAR)          | 12/15/2011 |
|   |       | PANDY 1 (RNAV STAR)          | 12/15/2011 |
| Scottsdale (KSDL)                         | AZ    | TBD 1 (RNAV SID)             | 8/25/2011  |
| Seattle-Tacoma International (KSEA)       | WA    | BANGR 7 (RNAV SID)           | 1/13/2011  |
|   |       | HAROB 4 (RNAV SID)           | 1/13/2011  |
|   |       | KMORE 3 (RNAV SID)           | 1/13/2011  |
|   |       | KTSAP 4 (RNAV SID)           | 1/13/2011  |
|   |       | RNAV (RNP) Z RWY 16L, ORIG   | 2/9/2012   |
| Socatean Bay (K13ME)                      | ME    | JAVUN 1 (RNAV SID)           | 9/23/2010  |
|   |       | SULOC 1 (RNAV SID)           | 9/23/2010  |
| Southwest Florida International (KRSW)    | FL    | RNAV (RNP) RWY 6, ORIG       | TBD        |
|   |       | RNAV (RNP) RWY 24, ORIG      | TBD        |
| Southwest Oregon Regional (KOTH)          | OR    | RNAV (RNP) Z RWY 4, ORIG     | 7/29/2010  |
| Spokane International (KGEG)              | WA    | RNAV (RNP) RWY 25, ORIG      | 11/18/2010 |
|   |       | RNAV (RNP) Z RWY 3, ORIG     | 11/18/2010 |
|   |       | RNAV (RNP) RWY 7, ORIG       | 11/18/2010 |
|   |       | RNAV (RNP) Z RWY 21, ORIG    | 11/18/2010 |
| St. Louis International (KSTL)            | MO    | BUSCH 1 (RNAV STAR)          | TBD        |
|   |       | MUSIAL 1 (RNAV STAR)         | TBD        |
|   |       | TATER 1 (RNAV STAR)          | TBD        |
|   |       | TWAIN 1 (RNAV STAR)          | TBD        |
|   |       | LEWIS 1 (RNAV SID)           | TBD        |
|   |       | CLARK 1 (RNAV SID)           | TBD        |
|   |       | BERRA 1 (RNAV SID)           | TBD        |
| JEFFERSON 1 (RNAV SID)                    | TBD   |                              |            |

| AIRPORT NAMES                                | STATE | PROCEDURE NAME               | CHART DATE |
|--|-------|------------------------------|------------|
| Tampa International (KTPA)                   | FL    | BAYPO 4 (RNAV SID)           | 1/13/2011  |
|  |       | CROWD 4 (RNAV SID)           | 1/13/2011  |
|  |       | ENDED 4 (RNAV SID)           | 1/13/2011  |
|  |       | GANDY 4 (RNAV SID)           | 1/13/2011  |
|  |       | SYKES 4 (RNAV SID)           | 1/13/2011  |
|  |       | BLOND 3 (RNAV STAR)          | 1/13/2011  |
|  |       | DADES 3 (RNAV STAR)          | 1/13/2011  |
|  |       | DEAKK 3 (RNAV STAR)          | 1/13/2011  |
|  |       | FOOXX 3 (RNAV STAR)          | 1/13/2011  |
| Teterboro (KTEB)                             | NJ    | JAIKE 3 (RNAV STAR)          | 5/5/2011   |
|  |       | RUUDY 3 (RNAV SID)           | 5/5/2011   |
|  |       | RNAV (RNP) RWY 1, ORIG       | 9/10/2020  |
|  |       | RNAV (RNP) RWY 24, ORIG      | 9/10/2020  |
| Trenton Mercer (KTTN)                        | NJ    | RNAV (RNP) RWY 6, ORIG       | 6/30/2011  |
|  |       | RNAV (RNP) RWY 16, ORIG      | 6/30/2011  |
|  |       | RNAV (RNP) RWY 24, ORIG      | 6/30/2011  |
| Tucson International (KTUS)                  | AZ    | RNAV (RNP) Y RWY 11L, AMDT 1 | 8/25/2011  |
|  |       | RNAV (RNP) Y RWY 29R, AMDT 1 | 8/25/2011  |
| Tulsa International (KTUL)                   | OK    | RNAV (RNP) Z RWY 18R, ORIG   | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 26, ORIG    | 9/23/2010  |
| Van Nuys (KVNY)                              | CA    | TBD 1 (RNAV SID)             | 6/30/2011  |
| Virginia Tech/<br>Montgomery Executive (BCB) | VA    | BEMAR 1 (RNAV SID)           | 3/10/2011  |
| Washington Dulles International (KIAD)       | DC    | HYPER 3 (RNAV STAR)          | 5/5/2011   |
| Waukegan Regional Airport (KUGN)             | IL    | RNAV (RNP) RWY 05, ORIG      | 3/10/2011  |
| Westchester County (KHPN)                    | NY    | RNAV (RNP) Z RWY 16, ORIG    | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 34, ORIG    | 9/23/2010  |
| Wichita Mid-Continent (KICT)                 | KS    | RNAV (RNP) Z RWY 1L, ORIG    | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 14, ORIG    | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 19R, ORIG   | 9/23/2010  |
|  |       | RNAV (RNP) Z RWY 19L, ORIG   | 9/23/2010  |
| Will Rogers World (KOKC)                     | OK    | RNAV (RNP) RWY 17R, ORIG     | 3/10/2011  |
|  |       | RNAV (RNP) RWY 35L, ORIG     | 3/10/2011  |
|  |       | RNAV (RNP) RWY 17L, AMDT 2   | 1/10/2013  |
|  |       | RNAV (RNP) RWY 35R, AMDT 1   | 1/10/2013  |
| Yakima Air Terminal (KYKM)                   | WA    | RNAV (RNP) RWY 9, ORIG       | 5/5/2011   |
|  |       | RNAV (RNP) Z RWY 27, ORIG    | 5/5/2011   |
| Yeager (KCRW)                                | WV    | RNAV (RNP) RWY 5, ORIG       | 4/5/2012   |
|  |       | RNAV (RNP) RWY 23, ORIG      | 4/5/2012   |

## Appendix C

### High Altitude Airspace Performance-Based Routing and National Special Activity Airspace Program

**High Altitude Airspace Performance-based Routing:** This effort reinitiates a national, top-down effort to redesign high altitude airspace and procedures, providing overarching connectivity between regional airspace and procedures efforts. The work is generated from a dissection of airspace concepts implemented under the High Altitude Redesign (HAR) project from 2003-2005. High Altitude Airspace Performance-based Routing covers two constructs: continued development and implementation of Q-routes as the national routing backbones and instantiation of the Navigational Reference System (NRS) as a key transitional element in NextGen evolution.

Q-routes are high altitude performance-based routes that offer an efficient way to traverse en route airspace by removing manufactured choke-points that are created by the ground-based navigation system. Q-routes provide efficient connectivity between key metropolitan areas and can add capacity in the en route domain. They may be part of other airspace efforts or may be stand-alone routes. The implementation plan capitalizes on near-term implementation opportunities, leveraging and revalidating plans and designs started but not completed under HAR. The implementation of Q-routes will also provide a dimension of metroplex connectivity as part of the Metroplex Optimization of Airspace and Procedures efforts. Implementation of Q-routes will cover one or all of the following corridors: Northeast-Midwest, Northeast-Southeast, Midwest-Southeast, Southwest-Northeast, and West.

A second type of high altitude performance-based routings is high altitude RNAV-point-to-point routes. One key application of these point-to-point routings is transitioning conventional National Playbooks to RNAV-based routings to increase options while decreasing the total number of playbooks. Conventional playbook routing was designed based on ground-based navigation aids that do not allow flexibility to make adjustments according to winds, resulting in additional fuel burn for airspace users. The conversion of conventional playbooks is being aided by increased use of the existing NRS. The NRS is a national grid of RNAV waypoints, initially published as a grid of approximately 1,600 RNAV waypoints. Expanding and increasing usage of NRS supports flexibility in routing. There is a multi-year plan for transition of the National Playbooks to RNAV, with the focus on transcontinental routings and on the most-used playbooks.

High Altitude Performance-based Routing efforts increase airspace efficiency and capacity and relieve congestion in high density areas. Q-routes enable benefits in the form of reduced flight distances and flight times. Estimates indicate annual savings of \$4.2M for two Seattle-based Q-routes. The HAR-implemented Q-routes have delivered about \$13M in customer cost savings annually and NRS-based routing options can save an average of 30-80 nautical miles.

Upcoming milestones for High Altitude Airspace Performance-based Routing:

- Oakland Eastbound Q-routes; Denver to Bay Area Q-routes – 2011 (target).
- Seattle Center eastbound Q-routes – 2012 (proposal).
- Additional Playbook transition design and modeling complete – 2012 (proposal).
- NRS Usage and Human Factors studies (phase 2) complete – 2012 (target).

**Special Activity Airspace:** One of the key national airspace efforts is the development of the National Special Activity Airspace Project (NSAAP). Special Activity Airspace (SAA) is defined as any airspace with defined dimensions within the NAS wherein limitations may be imposed upon aircraft operations. SAA may be restricted areas, prohibited areas, military operations areas, ATC assigned airspace, and any other designated airspace areas. The NSAAP is committed to developing increased cooperation and operational partnerships between the identified SAA Community of Interest (COI), which includes FAA and NAS

customers, both civilian and Department of Defense (DoD). NSAAP has a diverse set of stakeholders and intersects with many NextGen efforts, including the Joint Planning and Development Office (JPDO). The general tasks associated with this effort include:

- Integrating the many organizations, operators, “types” of airspace, policies/orders, and technologies that are associated with the management and use of SAA.
- Developing cohesive policies and agreements that will set the cooperative atmosphere for this effort.
- Creating a consistent information flow that will support predictive management and use of SAA.
- Building a measurement system that can be used in all stages of decision making concerning development, management and use of SAA, which will support accessibility and transparency of data.
- Advancing the various programs and procedures governing use and management of SAA, including NextGen and other relevant FAA and DoD technology efforts.

Upcoming milestones for NSAAP include:

- Concept of Operations, initial requirements documentation, and preliminary impact and benefits assessment of the proposed concept – Late 2010 (commitment).

## Appendix D Process Descriptions

### Process Overview

The design of airspace and procedures is a complex process that includes many steps. There are separate defined processes for the various types of airspace and procedures that may be included in a design project. Each of these processes must also consider relevant design standards and criteria, along with specific regulations, such as environmental and safety. Finally, there are processes for the implementation, approval, and operational use of the airspace and procedures.

This appendix provides a list of references for the design process, standards and criteria, regulations, implementation and operational approval.

The process for the design of airspace and for procedures has historically been a separate endeavor. There is an effort to bring these processes together into a single integrated airspace and procedure process. This appendix also includes a description of how this integrated process is being developed.

### List of Processes and Applicable References

The following is a list of relevant references, along with a brief description of the purpose of the document.

- |               |   |
|---------------|---|
| FAA           | <u><a href="#">Airspace Management Handbook –Version 2.2</a></u><br>The handbook describes a step-by-step procedure for airspace design management where each step contains specific data requirements and defined products. The handbook distills the experience and best practices of many airspace design projects.  |
| FAA           | <u><a href="#">SMS Manual – Version 2.1 May 2008</a></u><br>The Safety Management System (SMS) provides a systematic and integrated method for managing safety of air traffic control (ATC) and navigation services in the National Airspace System (NAS). This manual documents the SMS, building on existing Federal Aviation Administration (FAA) safety management capabilities.  |
| FAA           | <u><a href="#">Environmental Desk Reference for Airport Actions – October 2007</a></u><br>As a compendium, the Desk Reference summarizes applicable special purpose laws in one location for convenience and quick reference. Its function is to help FAA integrate the compliance of NEPA and applicable special purpose laws to the fullest extent possible. This integration should ensure that all environmental review procedures applicable to an airport action run concurrently rather than consecutively.                                      |
| Order 1050.1E | <u><a href="#">Policies and Procedures for Considering Environmental Impacts</a></u><br>This order provides FAA policy and procedures to ensure agency compliance with the requirements set forth in the Council on Environmental Quality (CEQ) regulations for implementing the provisions of the National Environmental Policy Act of 1969 (NEPA), 40 Code of Federal Regulations (CFR) parts 1500-1508; Department of Transportation Order DOT 5610.1C, Procedures for Considering Environmental Impacts; and other related statutes and directives. |

- Order 1100.161 Air Traffic Safety Oversight  
This order specifies the manner by which safety oversight will be conducted by the Air Traffic Safety Oversight Service (AOV), within the Office of the Associate Administrator for Aviation Safety (AVS), on the Air Traffic Organization (ATO), and other organizations within the FAA regarding safety management of the air traffic system.
- Order 5050.4B Airport Environmental Handbook  
FAA's Office of Airports (ARP) has prepared this Order to ensure ARP personnel and others interested or involved in ARP actions are able to prepare accurate, timely, and high quality environmental documents that comply with NEPA.
- Order 7100.9D Standard Terminal Program and Procedures – Appendix 5 Guidelines for Implementing Terminal RNAV Procedures  
The order provides a standardized, systematic process for the development of terminal area navigation (RNAV) arrival and departures procedures (DP). The process is also known as the "18-STEP" RNAV process.
- Order 7210.3W Facility Operation and Administration  
This order provides direction and guidance for the day to day operations of facilities and offices under administration of the FAA's Air Traffic Organization.
- Order 7400.2G Procedures for Handling Airspace Matters  
The order specifies procedures for use by all personnel in the joint administration of the airspace program. It contains six parts; general procedures for airspace management, objects affecting navigable airspace, airport airspace analysis, terminal and Enroute airspace, special use airspace, miscellaneous procedures.
- Order 8260.3B U.S. Standard for Terminal Instrument Procedures (TERPS)  
This Order prescribes standardized methods for use in design instrument flight procedures.

## **Appendix E**

### **National Operational Airspace Council**

The mission of the National Operational Airspace Council (NOAC) is to ensure the national operational coordination and communication of airspace and procedures efforts and align decision-making with responsibilities. The NOAC will provide an integrated, system-level National Airspace strategy, through the National Airspace and Procedures Plan.

National Operational Airspace Council is comprised of:

- Director of Airspace
- Operations Director of System Operations
- Planning Director of En route
- Planning Director of Terminal
- Safety and Operations Director of En route
- Safety and Operations Director of Technical Operations
- Safety and Operations Director of Terminal
- Director from Eastern Service Area
- Director from Central Service Area
- Director from Western Service Area



## Appendix F Acronyms

|          |   |          |  |
|----------|---|----------|--|
| <b>A</b> |   | NGIP     | NextGen Implementation Plan                |
| AMP      | Airspace Management Program                               | NJ       | New Jersey                                 |
| AOV      | Air Traffic Safety Oversight Service                      | NOAC     | National Operational Airspace Council      |
| AR       | Authorization Required                                    | NRS      | Navigational Reference System              |
| ARP      | FAA's Office of Airports                                  | NSAAP    | National Special Activity Airspace Project |
| ASPIRE   | Asia and South Pacific Initiative to Reduce Emissions     | NY       | New York                                   |
| ATC      | Air Traffic Control                                       | <b>O</b> |  |
| ATO      | Air Traffic Organization                                  | OEP      | Operational Evolution Partnership          |
| AVS      | Office of the Associate Administrator for Aviation Safety | OMP      | O'Hare Modernization Project               |
|          |   | OPD      | Optimized Profile Descents                 |
|          |   | ORD      | Chicago O'Hare International Airport       |
| <b>B</b> |   | <b>P</b> |  |
| BPT      | Southeast Texas Regional Airport                          | PBN      | Performance-Based Navigation               |
| <b>C</b> |   | PHL      | Philadelphia                               |
| CAP      | Chicago Airspace Project                                  | <b>R</b> |  |
| CCDOA    | Clark County Department of Aviation                       | RAPT     | Regional Airspace and Procedures Team      |
| CEQ      | Council on Environmental Quality                          | RNAV     | Area Navigation                            |
| CFR      | Code of Federal Regulations                               | RNP      | Required Navigation Performance            |
| COI      | Community of Interest                                     | ROD      | Record of Decision                         |
| CY       | Calendar Year   | <b>S</b> |  |
| <b>D</b> |   | SAA      | Special Activity Airspace                  |
| DAC      | Dynamic Airspace Configuration                            | SID      | Standard Instrument Departure              |
| DAL      | Dallas Love Field Airport                                 | SNSA     | Southern Nevada Supplemental Airport       |
| DFW      | Dallas/Fort Worth International Airport                   | STAR     | Standard Terminal Arrival                  |
| DoD      | Department of Defense                                     | <b>T</b> |  |
| <b>E</b> |   | TERPS    | Terminal Instrument Procedures             |
| EA       | Environmental Assessment                                  | TF5      | Task Force 5                               |
| EIS      | Environmental Impact Statement                            | TRACON   | Terminal Radar Approach Control            |
| <b>F</b> |   |          |  |
| FAA      | Federal Aviation Administration                           |          |  |
| FACT     | Future Airport Capacity Task Force                        |          |  |
| FY       | Fiscal Year   |          |  |
| <b>H</b> |   |          |  |
| HAATS    | Houston Area Air Traffic System                           |          |  |
| HAR      | High Altitude Redesign                                    |          |  |
| HOU      | Houston William P. Hobby Airport                          |          |  |
| <b>I</b> |   |          |  |
| IAH      | George Bush Intercontinental Airport                      |          |  |
| <b>J</b> |   |          |  |
| JPDO     | Joint Planning and Development Office                     |          |  |
| <b>N</b> |   |          |  |
| NAPP     | National Airspace and Procedures Plan                     |          |  |
| NAPT     | National Airspace and Procedures Team                     |          |  |
| NAR      | National Airspace Redesign                                |          |  |
| NAS      | National Airspace System                                  |          |  |
| NAS EA   | National Airspace System Enterprise Architecture          |          |  |
| NEPA     | National Environmental Policy Act                         |          |  |
| NextGen  | Next Generation Air Transportation System                 |          |  |



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