Draft Environmental Assessment for Washington, D.C. Optimization of Airspace and Procedures in the Metroplex

June 2013

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1 Introduction

The National Environmental Policy Act of 1969 (NEPA)(42 United States Code [U.S.C.] § 4321 *et seq*.), requires federal agencies to disclose to decision makers and the interested public a clear, accurate description of potential environmental impacts arising from proposed federal actions and reasonable alternatives to those actions. Through NEPA, Congress has directed federal agencies to include environmental factors in their planning and decision making processes and to encourage public involvement in decisions that affect the quality of the human environment. Furthermore, as part of the NEPA process, federal agencies are required to consider the environmental effects of a proposed action, reasonable alternatives to the proposed action, and a no action alternative (analyzing the potential environmental effects of not undertaking the proposed action). The Federal Aviation Administration (FAA) has established a process to ensure compliance with the provisions of NEPA through FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1E).

This Environmental Assessment (EA), prepared in accordance with FAA Order 1050.1E, documents the potential effects to the environment that may result from the optimization of Air Traffic Control (ATC) procedures that would standardize aircraft routing to and from airports. The Proposed Action, the subject of this EA, is referred to as the Optimization of Airspace and Procedures in the Washington D.C. Metroplex or "DC OAPM." The procedures designed as part of the DC OAPM would support arriving and departing aircraft operating under Instrument Flight Rules (IFR) at the study area airports ("the Study Airports"), using currently available technology.

This EA consists of the following chapters and appendices:

- **Chapter 1: Introduction.** Chapter 1 provides basic background information on the air traffic system, the Next Generation Air Transportation System program, performance based navigation including area navigation technology, the FAA's OAPM initiative, and information on the Washington D.C. Metroplex and Study Airports.
- **Chapter 2: Purpose and Need.** Chapter 2 discusses the need (problem) and purpose (goal) for airspace and procedure optimization in the DC Metroplex area and identifies the Proposed Action that is the subject of this EA.
- **Chapter 3: Alternatives.** Chapter 3 discusses the Proposed Action and the No Action Alternatives analyzed as part of the environmental review process.
- **Chapter 4: Affected Environment.** Chapter 4 discusses existing conditions within the DC Metroplex area.
- **Chapter 5: Environmental Consequences.** Chapter 5 discusses the potential environmental impacts associated with the Proposed Action and No Action Alternatives.
- **Appendix A: Agency and Public Coordination.** Appendix A documents agency and public coordination associated with the EA process and includes any comments received during the public review period and responses to these comments.

- **Appendix B: List of Preparers and List of Receiving Parties.** Appendix B lists the preparers of the EA and the local agencies and parties that received a copy of the Draft and Final EA documents.
- **Appendix C: References.** Appendix C lists the references used in the preparation of the EA document.
- **Appendix D: List of Acronyms and Glossary.** Appendix D lists acronyms and provides a glossary of terms used in the EA.
- **Appendix E: Noise.** Appendix E presents information on aircraft noise as well as the general methodology used to analyze noise associated with aviation projects.
- **Appendix F: Section 4(f) Resources.** Appendix F lists all the Section 4(f) resources identified in the General Study Area.
- **Appendix G: Historic and Cultural Resources.** Appendix G lists the historic and cultural resources identified in the General Study Area.
- **Appendix H: Reportable Noise Increases.** Appendix H provides the reportable noise increases associated with the Proposed Action.

1.1 Project Background

On January 16, 2009, the FAA asked the RTCA to create a joint government-industry task force to make recommendations for implementation of Next Generation Air Transportation System (NextGen) operational improvements for the nation's air transportation system.[1] In response, RTCA assembled the NextGen Mid-Term Implementation Task Force (Task Force 5), which included more than 300 members representing commercial airline, general aviation, military, manufacturer, and airport stakeholders.[2] The NextGen Program is discussed in more detail in Section 1.2.4.[3]

On September 9, 2009, RTCA issued the NextGen Mid-Term Implementation Task Force Report, which provided the Task Force 5 recommendations. One of these recommendations suggested that the FAA should undertake planning for the implementation of Performance-Based Navigation (PBN)[4] procedures such as Area Navigation (RNAV) and Required Navigation Performance (RNP) procedures on a Metroplex basis.[5] (RNAV and RNP procedures are further discussed in Section 1.2.4.) Based on this recommendation, the FAA created the OAPM initiative.

[1] RTCA, Inc. Executive Summary of the *NextGen Mid-Term Implementation Task Force Report*, September 9, 2009.

[2] RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance and air traffic management system issues. RTCA functions as a federal advisory committee and includes roughly 400 government, industry and academic organizations from the United States and around the world. Members represent all facets of the aviation community, including government organizations, airlines, airspace users, airport associations, labor unions, and aviation service and equipment suppliers. More information is available at http://www.rtca.org.

[3] RTCA Inc., Executive Summary of the *NextGen Mid-Term Implementation Task Force Report*. September 9, 2009.

[4] Additional information on Performance-Based Navigation is provided on the U.S. Department of Transportation, Federal Aviation Administration's Fact Sheet, "NextGen Goal: Performance-Based Navigation," April 24, 2009 http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=8768 (Accessed April 11, 2012)].

[5] A Metroplex is a geographic area covering several airports, serving major metropolitan areas and a diversity of aviation stakeholders.

The purpose of the OAPM initiative is to optimize air traffic procedures and airspace on a regional scale. This would be accomplished by employing technological advances in navigation such as RNAV while ensuring that aircraft that are not equipped to use RNAV have access to terminal airspace.[6] This approach addresses congestion and other factors that reduce efficiency in busy Metroplex areas and accounts for key operating airports and airspace in the Metroplex. Study Area airports are further discussed in Section 1.4. It also addresses connectivity with other Metroplex areas. The intent is to use the limited airspace as efficiently as possible for congested Metroplex areas.[7]

1.2 Air Traffic Control and the National Airspace System

The following sections are intended to provide the reader with basic background knowledge of air traffic control and the National Airspace System (NAS). A description of the NAS, the role of Air Traffic Control (ATC), the methods used by air traffic controllers to manage the Air Traffic Control system, and the different phases of aircraft flight within the system. Following this discussion, information is provided on the FAA's NextGen program and the OAPM initiative.

1.2.1 National Airspace System

Under the Federal Aviation Act of 1958 (49 USC § 40101 *et seq.*), the FAA is charged with the responsibility for controlling the use of the nation's navigable airspace and regulating civil and military aircraft operations in the interest of maintaining safety and efficiency. To help fulfill this mandate, the FAA established the NAS. Within the NAS, the FAA manages aircraft takeoffs and landings and the flow of aircraft between airports through a system of infrastructure (e.g., air traffic control facilities), people (e.g., air traffic controllers, maintenance, and support personnel), and technology (e.g., radar, communications equipment, ground-based navigational aids (NAVAIDs),[8] etc.) The NAS is governed by various FAA rules and regulations.

The NAS comprises one of the most complex aviation networks in the world. Accordingly, to fulfill its mission, the FAA is continuously reviewing the design of all NAS resources to ensure they are effectively and efficiently managed. When changes are proposed to the NAS, the FAA works to ensure that the changes maintain or enhance system safety and improve efficiency. One way to accomplish this mission is to employ emerging technologies to increase system flexibility and predictability.[9] The FAA Air Traffic Organization (ATO) is the primary organization within the FAA responsible for optimizing airspace and flight procedures used in the NAS. In working to improve the NAS, the FAA must comply with NEPA and other applicable laws and regulations.

[6] Terminal Airspace: an area of airspace defined by boundaries and altitudes assigned to a radar control facility associated with an airport or group of airports. The facility that manages this airspace is referred to as the Terminal Radar Approach Control (TRACON). The boundaries and altitudes are based on factors such as traffic flows, neighboring airports and terrain. The primary traffic flows are arrivals and departures to the airport(s) located within the terminal airspace.

[7] Department of Transportation, Federal Aviation Administration, *FAA Response to Recommendations of the RTCA NextGen Mid-Term Implementation Task Force*. January 2010. Pg. 14.

[8] NAVAIDs are facilities that transmit signals that define key points or routes.

[9] U.S. Department of Transportation, Federal Aviation Administration, Order JO 7400.2G, Change 3, *Procedures for Handling Airspace Matters*, Section 32-3-5(b) "National Airspace Redesign," April 10, 2008

1.2.2 Air Traffic Control within the National Airspace System

The combination of infrastructure, people, and technology used to monitor and guide or direct aircraft within the NAS is referred to collectively as ATC. ATC is responsible for separating aircraft (keeping minimum distances between aircraft) to maintain safety and expedite the flow of traffic operating in the NAS. Air traffic controllers are responsible for providing these air traffic services to aircraft operating in the airspace. This is accomplished through communications with pilots and by using various technologies such as radar.

Aircraft operate under two distinct categories of flight rules: Visual Flight Rules (VFR) and Instrument Flight Rules (IFR).[10] These flight rules generally correspond with two categories of weather conditions: Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC).[11] VMC generally exist during fair to good weather with good visibility. IMC occur during periods when visibility falls to less than three statute miles or the ceiling (the distance from the ground to the bottom layer of clouds when the clouds cover more than 50 percent of the sky) drops to lower than 1,000 feet. Under VFR, pilots are able to fly whatever route they chose and are responsible to "see and avoid" other aircraft and obstacles such as terrain to maintain safe separation. Under IFR ATC is responsible for providing separation from other aircraft and terrain and pilots use cockpit instruments and radar to fly routes specified by ATC and to comply with ATC instructions. Pilots must follow IFR during IMC; however, due to various factors such as the general requirement for aircraft to operate under IFR in Class A airspace (i.e., enroute airspace between 18,000 feet MSL and 60,000 feet MSL)[12], the majority of commercial air traffic operate under IFR regardless of weather conditions.

Based on factors such as aircraft type and weather, air traffic controllers apply criteria to maintain defined minimum distances (referred to as separation) between aircraft.[13] These types of separations include:

- **Vertical or "Altitude" Separation:** separation between aircraft operating at different altitudes;
- **Longitudinal or "In-Trail" Separation:** the separation between two aircraft operating along the same flight route referring to the distance between a lead and a following aircraft; and,
- **Lateral or "Side-to-Side" Separation:** separation between aircraft (left or right side) operating along two separate but nearby flight routes.

Exhibit 1-1 depicts the three dimensions around an aircraft used to determine separation.

For aircraft operating under IFR, air traffic controllers maintain separation by monitoring and, as needed, directing pilots following standard instrument procedures. Standard instrument procedures define the routes along which aircraft operate. These procedures are intended to provide predictable, efficient routes to move aircraft through the airspace in an orderly manner. They also minimize the need for communication between the controller

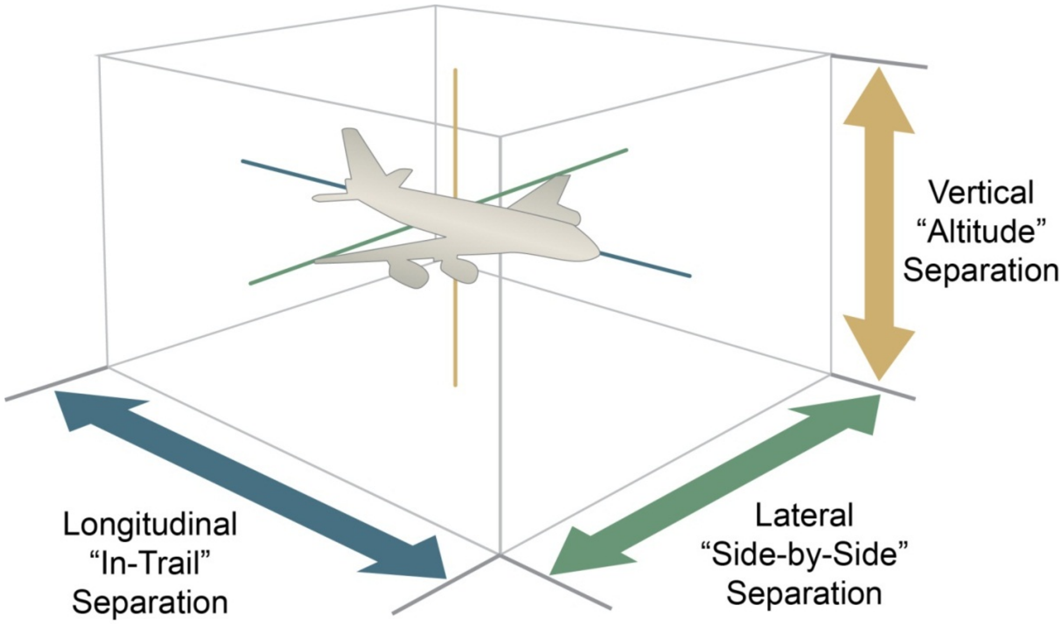
[10] 14 Code of Federal Regulations (C.F.R.) Part 91.

[11] 14 C.F.R. §§ 91.151 through 91.193, "Visual Flight Rules" and "Instrument Flight Rules."

[12] 14 C.F.R. § 91.135.

[13] Defined in FAA Order 7110.65U, *Air Traffic Control*.

Exhibit 1-1 Three Dimensions Around an Aircraft



Source: ATAC Corporation, December 2012.
Prepared by: ATAC Corporation, December 2012.

and pilot as the aircraft operates in the terminal airspace and transitions to and from the enroute airspace. Standard instrument procedures are considered "conventional" if they are based on ground-based NAVAIDs, which provide instrument guidance to a pilot as the aircraft flies over each NAVAID, or if they are based on vectoring, or verbal instructions from an air traffic controller.

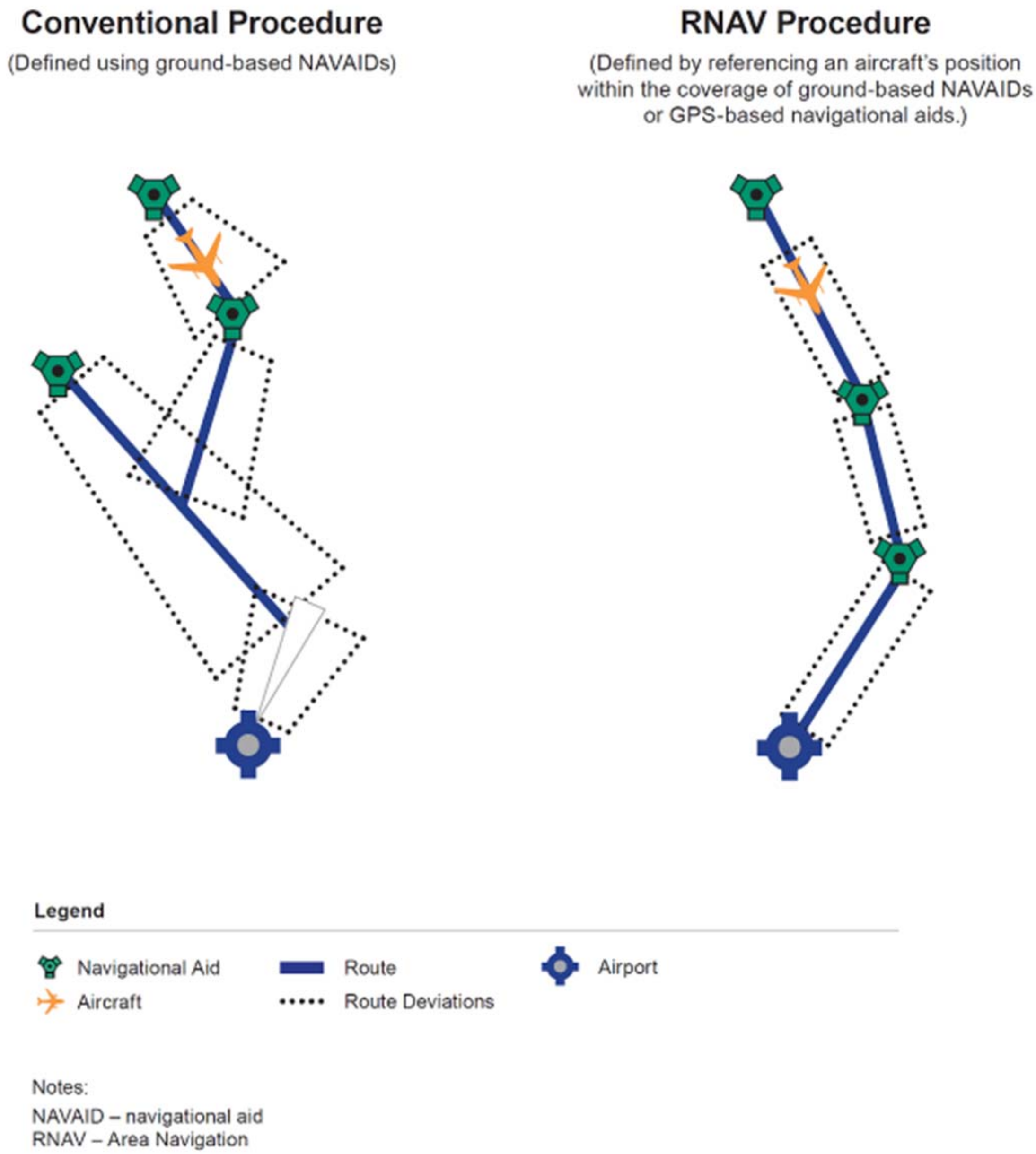
In its effort to modernize the NAS, the FAA is developing standard instrument procedures using new and alternate technologies. A primary technology being applied in this effort is RNAV. RNAV technology allows an RNAV-trained pilot operating an RNAV-equipped aircraft to fly a more direct route based on instrument guidance that references an aircraft's position within the coverage of ground-based NAVAIDs[14] or space-based navigational aids using Global Positioning System (GPS) technology. **Exhibit 1-2** compares an RNAV procedure to a conventional procedure.

If standard instrument procedures in the terminal airspace do not exist or are unable to accommodate demand due to air traffic congestion, ATC must maintain safety within the airspace it controls by using one or a combination of several management tools and coordination techniques. The more frequently this is done, the more complex pilot and controller workload becomes. The management tools and coordination techniques include:

- **Vectoring:** Controllers issue a series of headings to a pilot to route an aircraft. This can increase aircraft flight distance and flight time resulting in increased fuel burn, decreased flight route predictability, and increased air traffic controller/pilot communication requirements and workload.

[14] Ground-based distance measuring equipment (DME) can be used to establish an aircraft's position.

Exhibit 1-2 Comparison of Routes Following Conventional versus RNAV Procedures



Source: U.S. Department of Transportation, Federal Aviation Administration, "Performance-Based Navigation (PBN)" brochure, 2009.
Prepared by: ATAC Corporation, December 2012.

- **Speed Control:** Controllers direct aircraft to reduce or increase aircraft speed. A reduction in speed can increase aircraft flight time resulting in increased fuel burn, decrease flight route predictability, and increase air traffic controller/pilot communication requirements and workload.
- **Hold Pattern/Ground Hold:** Controllers assign aircraft to a holding pattern in the air or hold aircraft on the ground before departure. Holding an aircraft on the ground can result in delays and increased flight time. Assigning an aircraft to a holding

pattern in the air increases flight time resulting in greater fuel burn and air traffic controller/pilot communication requirements and workload.

- **Level-off:** Controllers direct an aircraft to level off during ascent or descent. This can increase flight time and distance, resulting in increased fuel burn, by disrupting a continuous ascent or descent and increasing air traffic controller/pilot communication requirements and workload.
- **Reroute:** Controllers reroute aircraft to terminal airspace entry or exit gates other than the preferred or most direct gate. This can increase flight time, distance, and fuel burn; decrease flight route predictability; and increase air traffic controller/pilot communication requirements, complexity, and workload.
- **Point-out:** Controllers point out, or notify a controller managing an adjacent sector of the proximity of an aircraft to the adjacent sector's boundary (close to one and a half miles from the shared boundary). Point outs can be done verbally or electronically and can result in added complexity to air traffic controller communications and increased workload.

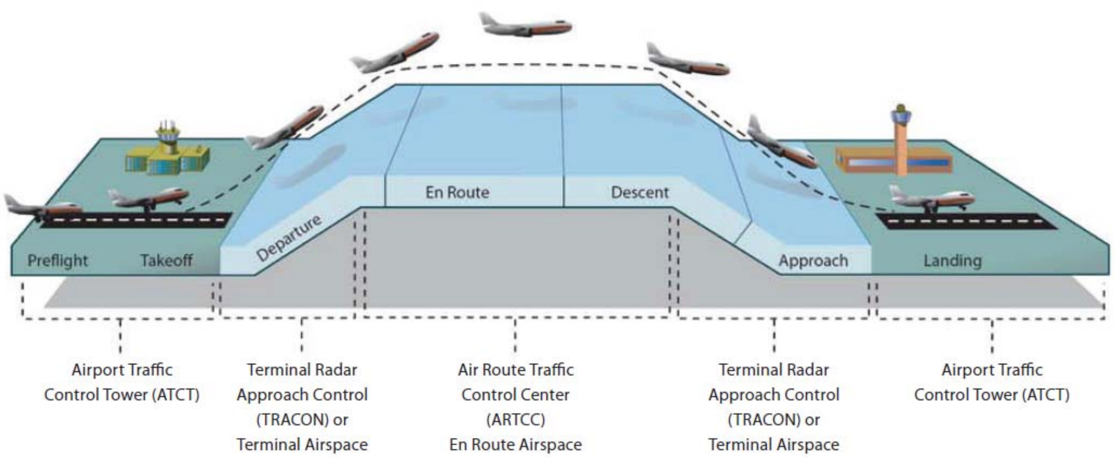
As an aircraft moves from origin to destination, ATC personnel function as a team and transfer control of the aircraft from one controller to the next and from one ATC facility to the next. Overall, managing the flow of departing aircraft (departure flow) tends to be less complicated. For example, if traffic conflicts or weather related issues are anticipated aircraft can be held on the ground to ensure safe management of the airspace. Managing the arrival flow tends to be more complicated because arriving aircraft are already airborne and thus require increased management to maintain a safe airspace environment.

1.2.3 Aircraft Flow within the National Airspace System

An aircraft traveling from airport to airport typically operates through six phases of flight (plus a "preflight" phase.) **Exhibit 1-3** depicts the typical phases of flight for a commercial aircraft. These phases include:

- **Preflight (Flight Planning):** The preflight route planning and checks in preparation for takeoff.
- **Push Back/Taxi/Takeoff:** The transition of an aircraft from push back at the gate to taxiing to an assigned runway and lift off from the runway.
- **Departure:** The in-flight transition of an aircraft from take-off to the enroute phase of flight, during which the aircraft climbs to its assigned cruising altitude following a standard instrument procedure (predefined set of guidance instructions that define a route for a pilot to follow) or a series of verbally issued instructions from an air traffic controller.
- **Enroute:** The generally level segment of flight ("cruising altitude") between the departure and destination airports.
- **Descent:** The in-flight transition of an aircraft from the assigned cruising altitude to the point at which the pilot initiates the approach to a runway at the destination airport.

Exhibit 1-3 Typical Phases of a Commercial Aircraft Flight



Source: United States Department of Transportation, Federal Aviation Administration, Houston Area Air Traffic System, Airspace Redesign, Final Environmental Assessment, Figure 1.1.1-1, March 2008.
Prepared by: ATAC Corporation, December 2012.

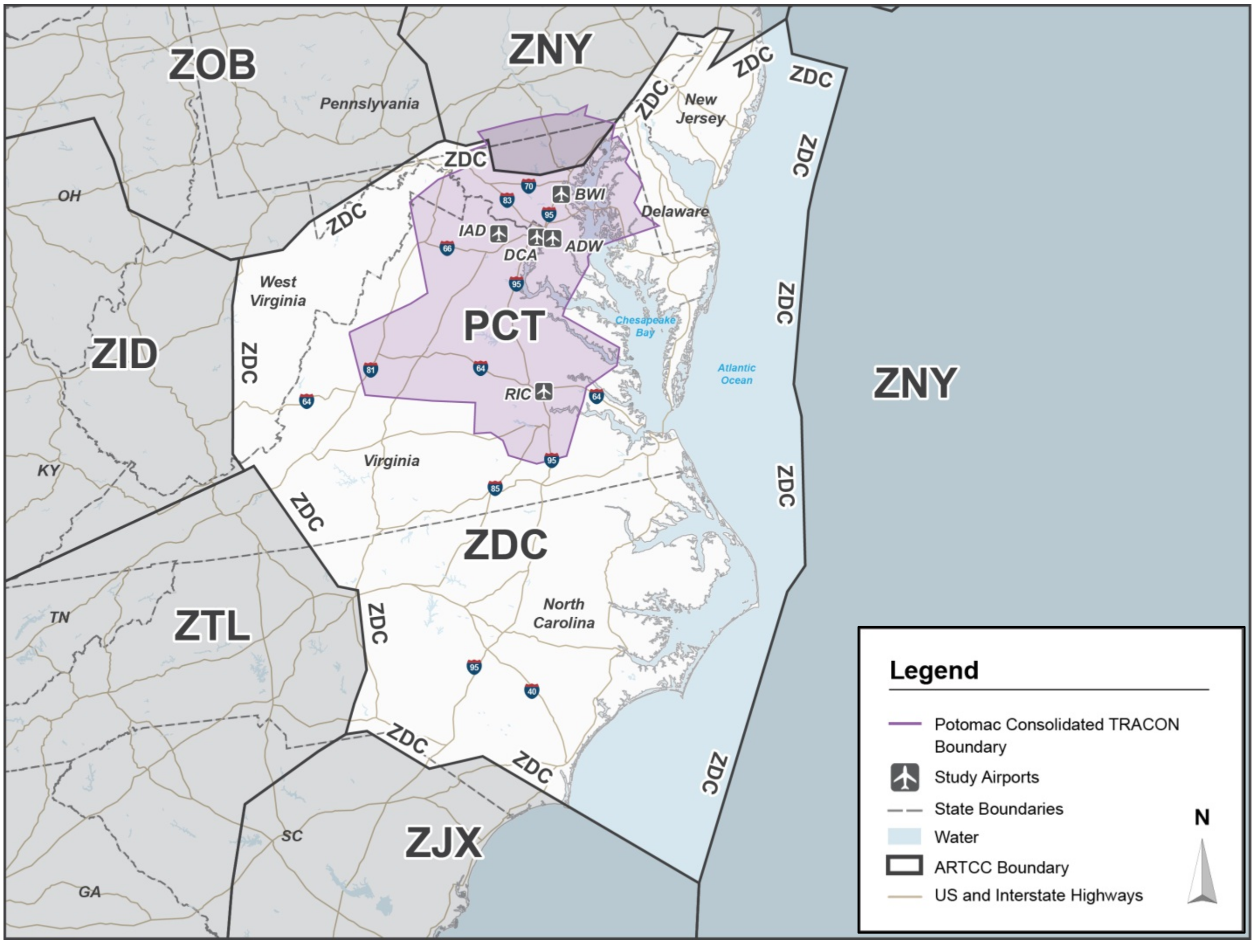
- **Approach:** The segment of flight during which a pilot follows a standard procedure or series of verbal instructions from an air traffic controller to guide the aircraft to the landing runway.
- **Landing:** Touch-down of the aircraft at the destination airport's runway and taxiing from the runway end to the gate or parking position.

1.2.4 Air Traffic Control Facilities

The NAS is organized into three-dimensional areas of navigable airspace (defined by a floor, a ceiling, and a lateral boundary), which are managed by different ATC facilities. These airspace areas are divided into specialized areas, which are further broken down into sectors. Air traffic controllers are assigned to specialized areas within the control of their ATC facility and assigned specific sectors within which they manage the aircraft operating under IFR. The three types of ATC facilities include:

- **Air Traffic Control Tower:** Controllers at an Air Traffic Control Tower (ATCT) located at an airport manage phases of flight associated with an aircraft taking off from and landing at an airport. ATCT typically controls airspace extending from the airport out to a distance of several miles.
- **Terminal Radar Approach Control:** Controllers at a Terminal Radar Approach Control (TRACON) facility manage aircraft as they transition between an airport and the enroute phase of flight. This includes the departure, climb, descent, and approach phases of flights. TRACON controllers are responsible for separating aircraft operating within the terminal airspace sectors. As an aircraft moves from sector to sector, responsibility for management of that aircraft is transferred from controller to controller. The terminal airspace in the DC Metroplex area is referred to as "the Potomac Consolidated TRACON" or "PCT" and is shown on **Exhibit 1-4**.

Exhibit 1-4 Airspace in the DC Metroplex Area



Notes:

PCT – Potomac Consolidated TRACON
ZID – Indianapolis ARTCC
ZTL – Atlanta ARTCC
ZDC – Washington ARTCC
ZNY – New York ARTCC
ZJX – Jacksonville ARTCC
ZOB – Cleveland ARTCC

Sources: National Flight Data Center National Airspace System Resources database, accessed September 16, 2012 (airspace boundaries); National Atlas of the United States of America: U.S. County and State Boundaries; Water Bodies; Bureau of Transportation Statistics: National Transportation Atlas Database; FAA: NFDC Airport and Runway databases; ATAC Corporation: Study Area Boundary

Prepared by: ATAC Corporation, 2012.

- **Air Route Traffic Control Centers:** Controllers at Air Route Traffic Control Centers (ARTCCs or "Centers") manage the flow of traffic to, from, and within the enroute airspace. Enroute airspace includes low-altitude routes called "victor airways", high altitude jet routes called "jet routes" (both defined by a series of ground-based NAVAIDS); low altitude RNAV routes called "T-routes" and high altitude RNAV routes called "Q-routes." The RNAV routes provide a more direct path to a destination airport. **Exhibit 1-4** shows how enroute airspace is delegated to different ARTCCs in the DC Metroplex area. Similar to terminal airspace, enroute airspace is divided into sectors.

The following sections discuss how air traffic controllers at these ATC facilities control the phases of flight for aircraft operating under IFR.

1.2.4.1 Departure Flow

As an aircraft operating under IFR departs a runway and follows its assigned heading, it moves from the ATCT airspace, through the terminal airspace, and into enroute airspace where it proceeds on a specific route or "jet route." Once on a jet route, an aircraft flies along the route until it nears its destination airport.

Within the terminal airspace, TRACON controllers are responsible for controlling aircraft departing from the ATCT airspace to an exit gate. An exit gate represents an area along the boundary between terminal airspace and enroute airspace. Exit gates are generally established near jet routes to better facilitate transfer of aircraft between terminal and enroute airspace. When aircraft pass through the exit gate, control is passed from TRACON to ARTCC controllers as aircraft join a jet route.

To maintain safe distances between aircraft within the terminal airspace, TRACON controllers must maintain separation for departing aircraft (as well as between arriving and departing aircraft). Separation is further discussed in Section 1.2.3.3.

Standard Instrument Departures

Departing aircraft operating under IFR use an instrument procedure called a Standard Instrument Departure (SID). A SID provides pilots with defined lateral and vertical guidance to facilitate safe and predictable navigation from an airport through the terminal airspace to a jet route in the enroute airspace. A SID may be based on vectoring, following a route defined by ground-based NAVAIDs, or a combination of both. This is called a "conventional" SID. Because of the increased precision inherent in RNAV technology, an RNAV SID, which provides GPS-based navigation, defines a more predictable route through the airspace than does a conventional SID.

The portion of a SID that provides a path serving a particular runway at an airport is referred to as a "runway transition." A SID may have several runway transitions serving one or more runways at one or more airports. From the common segment of the route, guidance may then be provided in the SID to one or more jet routes in the enroute airspace. This is referred to as an "enroute transition."

1.2.4.2 Arrival Flow

A pilot will initiate the descent phase of flight within the enroute airspace. During descent, the aircraft will enter the terminal airspace for the destination airport at an entry gate. The entry gate represents a point along the boundary between terminal airspace and enroute airspace. When aircraft pass through the entry gate control of the aircraft is passed from ARTCC to TRACON controllers. To maintain safe distances between aircraft within the terminal airspace, TRACON controllers must maintain the same separation for arriving aircraft as those defined for departing aircraft. Separation is further discussed in Section 1.2.3.3.

Standard Terminal Arrival Routes

Aircraft arriving within the terminal airspace follow an instrument procedure called a Standard Terminal Arrival Route (STAR.) A STAR proceeds from a route in the enroute airspace to the final approach to a runway. The final approach is the segment of flight when an aircraft is aligned with the landing runway and operates along a straight route at a constant rate of descent to the runway (an approximately three or slightly less degree angle).

A STAR can provide full guidance from enroute airspace through a terminal airspace entry gate, to a commonly used segment of the STAR in the terminal airspace, and then to the final approach to one or more runways at one or more airports. Guidance from the enroute airspace to the terminal airspace is called an "enroute transition" and from the common segment of the STAR in the terminal airspace to the final approach to a runway end is called a "runway transition." A STAR can also provide only partial guidance through the terminal airspace and may not include runway transitions.

1.2.4.3 Aircraft Separation

As TRACON controllers manage the flow of aircraft into, out of, and within the terminal airspace, they maintain the following separations between aircraft:

- **Altitude separation (vertical):** when operating below 29,000 feet above mean sea level (MSL),[15] two aircraft on separate routes that cross or converge, must be at least 1,000 feet above/below each other at the point the two routes intersect. When operating above 29,000 feet MSL and below 41,000 feet MSL, the two aircraft must be at least 1,000 feet from each other under reduced vertical separation minima (RVSM).
- **In-Trail separation (longitudinal):** Within a TRACON radar controlled area and within 40 miles of the radar site being used to track the aircraft, the minimum distance between two aircraft on the same route (or in-trail) is three miles. When aircraft are beyond 40 miles from the radar site, the minimum longitudinal separation of aircraft increases to five miles due to radar coverage capabilities.[16] As aircraft proceed further from the radar, ATC must increase departure aircraft separation from three miles to five miles as the aircraft nears the exit gate. To ensure that the minimum five mile separation is maintained, ATC may separate aircraft by as much as seven miles.
- **Side-to-Side separation (lateral):** Similar to in-trail separation, the minimum side-to-side (left or right side of an aircraft) between aircraft in the terminal airspace must be at least three miles within 40 miles of the primary radar site, and at least five miles beyond 40 miles from the primary radar site.

1.2.5 Special Use Airspace

Special Use Airspace (SUA) is airspace with defined boundaries in which certain activities such as military flight training and air-to-ground military exercises must be confined. These areas either restrict other aircraft from entering or restrict the type of aircraft activity allowable within the airspace. There are six types of special use airspace:

- **Prohibited Area:** Prohibited areas contain airspace of defined dimensions within which aircraft are prohibited unless given prior authorization. Such areas are established for security or other reasons associated with the national welfare.
- **Restricted Area:** Restricted areas contain airspace identified by an area within which aircraft, while not wholly prohibited, are subject to restrictions when the area is being used. The area denotes the existence of unusual, often invisible hazards to

[15] Mean Sea Level: elevation (on the ground) or altitude (in the air) of any object, relative to the average sea level measured in 1991 (called the North American Vertical Datum of 1988).

[16] Department of Transportation, Federal Aviation Administration, Order JO 7110.65U, Ch. 5, Sec. 5-5-1. February 9, 2012.

aircraft such as artillery firing, aerial gunnery, or guided missiles. Entering a restricted area without authorization may be extremely hazardous to the aircraft and its occupants. When the area is not being used, control of the airspace is released to the FAA and ATC can use the area for normal operations.

- **Warning Area:** Warning areas are airspace of defined dimensions, extending from three nautical miles (nmi) outward from the coast of the U.S. in which activity may occur that is hazardous to non-participating aircraft. The purpose of warning areas is to warn pilots of potential danger. A warning area may be located over domestic and/or international waters.
- **Military Operating Area:** Military Operating Areas (MOAs) consist of airspace with defined vertical and lateral limits established for the purpose of separating certain military training activities (e.g., air combat tactics, air intercepts, aerobatics, formation training, and low-altitude tactics) from IFR traffic. Whenever a MOA is being used, nonparticipating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic.
- **Alert Areas:** Alert areas are depicted on an aeronautical chart to inform pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity.
- **Controlled Firing Area:** Controlled Firing Areas (CFAs) contain activities which, if not conducted in a controlled environment, could be hazardous to an aircraft not participating in the activity. The distinguishing feature of a CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. This area does not impact or change an aircraft flight path; therefore, it is not depicted on aeronautical charts.

In addition to the six types of SUA described above, the DC Metroplex is subject to the Washington D.C. Metropolitan Area Special Flight Rule Area (DC SFRA) and a Flight Restricted Zone (DC FRZ). The DC SFRA and DC FRZ are areas of airspace where the ready identification, location, and control of aircraft are required in the interest of national security.[17]

1.2.6 Next Generation Air Transportation System

The NextGen program is the FAA's long-term plan to modernize the NAS through evolution from a ground-based system of air traffic control to a GPS-based system of air traffic management.[18] The OAPM initiative's objective is to accomplish this step in the overall process of transitioning to the NextGen system by 2018. A key step in achieving the NextGen ATC system is implementation of PBN procedures, such as RNAV and RNP procedures, which use GPS-based technology and aircraft "auto pilot" and Flight Management System (FMS) capabilities. RNAV and RNP capabilities are now readily available and, PBN can serve as the primary means aircraft use to navigate along a route.

[17] 14 CFR § 93.335.

[18] U.S. Department of Transportation, Federal Aviation Administration's Fact Sheet, "NextGen Goal: Performance-Based Navigation," April 24, 2009. [http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=8768 (Accessed April 11, 2012)].

As of 2011, 92 percent of U.S. scheduled air carriers were equipped for some level of RNAV.[19] The following sections describe PBN procedures in greater detail.

1.2.6.1 RNAV

Exhibit 1-5 shows a comparison of conventional and RNAV procedures. RNAV enables aircraft traveling through terminal and enroute airspace to follow more accurate and better defined, direct flight routes in areas covered by GPS-based navigational aids. This results in predictable routes with fixed locations and altitudes that can be planned ahead of time by the pilot and air traffic control. In addition, fixed routes help maintain segregation between aircraft by providing the ability to separate traffic both vertically and horizontally. As a result, some routes can be shortened and the need for level-offs can be eliminated.

Ground-based NAVAID routing is often limited by issues such as line-of-sight and signal reception accuracy. NAVAIDs such as, VHF Omnidirectional Range (VOR) are affected by terrain and other obstructions that can limit their signal accuracy. Consequently, routes using ground-based NAVAIDS require at least six nmi of clearance on either side of the route's main path to account for potential obstructions. This clearance requirement increases the farther an aircraft is from the VOR. In comparison, RNAV signal accuracy requires only two nmi of clearance on either side of the procedure's main path (called RNAV-1). RNAV procedures can mirror conventional procedures or provide routes within the airspace using satellite technology that were not previously possible with ground-based NAVAIDs. RNAV also provides routes that enable transition routes to multiple runways. These runway transition route options provide more flexibility in managing arrival traffic.

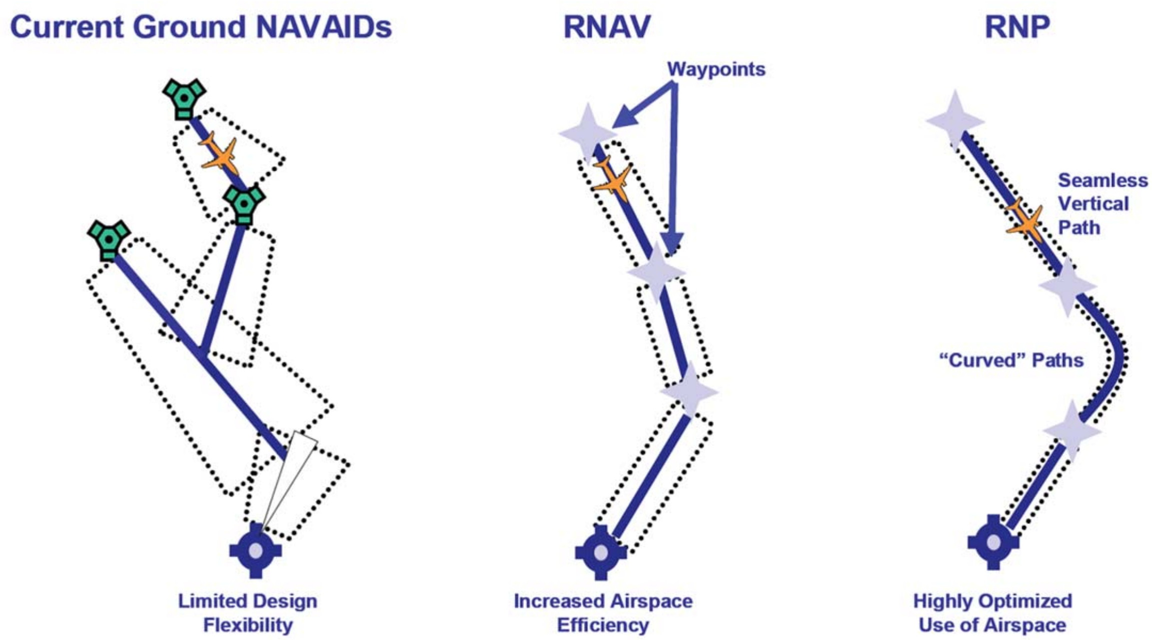
RNAV-based procedures facilitate more efficient design and use of airspace that collectively results in improved access, predictability, and operational efficiency while maintaining or enhancing safety and increasing opportunities to reduce fuel consumption. The predictability of routes following RNAV procedures can reduce the need for controllers to employ management tools, such as vectoring and holding, and therefore, reduce controller and pilot workload and airspace complexity.

1.2.6.2 RNP

RNP is an RNAV procedure that is flown with the addition of an onboard performance monitoring and alerting system. A defining characteristic of an RNP operation is the ability for an RNP capable aircraft navigation system to monitor the accuracy of its navigation (based on the number of GPS satellite signals available to pinpoint the aircraft location) and inform the crew if the required data becomes unavailable. **Exhibit 1-5** compares conventional, RNAV, and RNP procedures and shows how an RNP capable aircraft navigational system provides a more accurate location (down to less than a mile from the intended path) and will follow an exact path, including turns. The enhanced accuracy and predictability makes it possible to implement procedures within a controlled airspace that were not possible under the current air traffic system.

[19] U.S. Department of Transportation, Federal Aviation Administration, *NextGen Implementation Plan-2011*, March 2011, page 12.

Exhibit 1-5 Performance-Based Navigation – Conventional/RNAV/RNP



Source: U.S. Department of Transportation, Federal Aviation Administration. "Performance-Based (PBN) Brochure" October 2009.
Prepared by: ATAC Corporation, 2012.

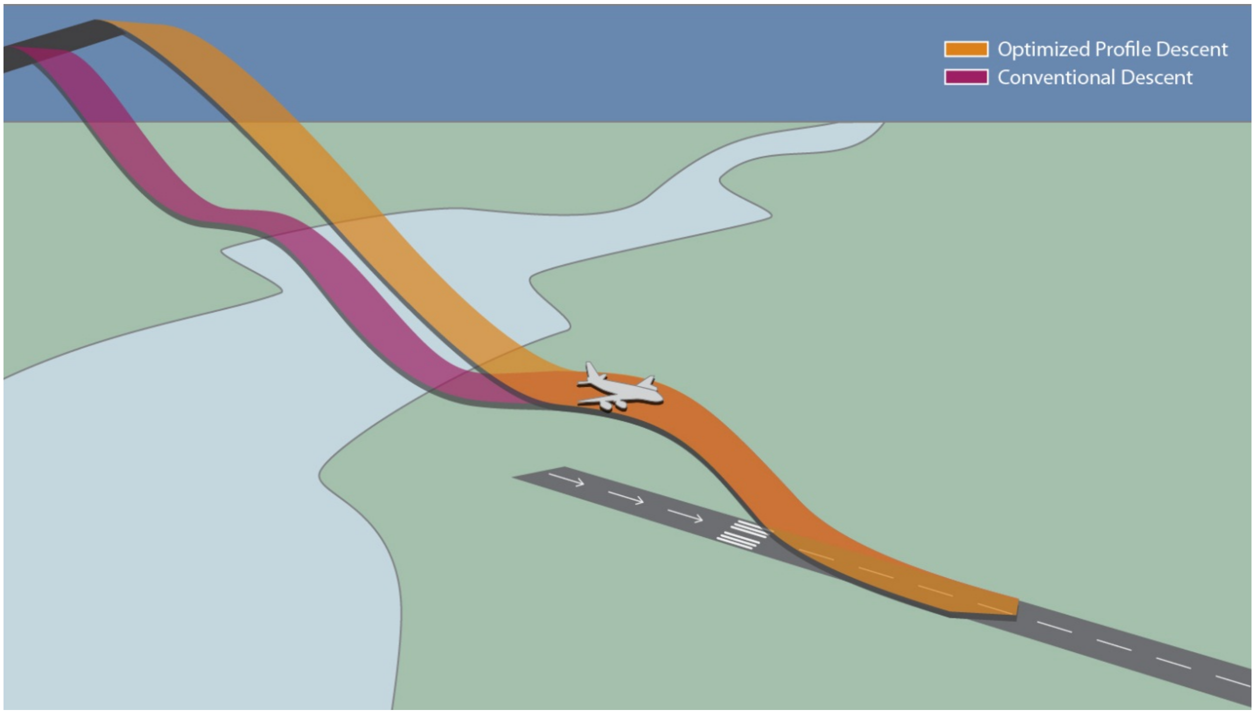
1.2.6.3 Optimized Profile Descent

An Optimized Profile Descent (OPD) is a flight procedure that uses the aircraft FMS to fly continuously from the top of descent to landing without intervening level-off segments. **Exhibit 1-6** illustrates an OPD procedure compared to a conventional descent. Aircraft that fly OPD can maintain higher altitudes and lower thrust for longer periods. This results in lower fuel burn and corresponding reductions in emissions and noise. As level-off segments are eliminated, OPD also reduces the need for communications between controllers and pilots.

1.2.7 The OAPM Initiative

The FAA intends to design and implement RNAV procedures that will take advantage of the readily available technology in the majority of aircraft as part of the OAPM initiative. The OAPM initiative specifically addresses congestion, airports in close geographical proximity, and other limiting factors that reduce efficiency in busy Metroplex airspace. Efficiency is improved by expanding the implementation of RNAV-based standard instrument procedures and connecting the routes defined by the standard instrument procedures to high and low altitude RNAV routes. Efficiency would also be increased taking advantage of RNAV to maximize the use of the limited airspace in congested Metroplex environments.

Exhibit 1-6 Optimized Profile Descent Compared to a Conventional Descent



Source: ATAC Corporation, December 2012.
Prepared by: ATAC Corporation, December 2012.

1.3 The DC Metroplex

The following sections describe the airspace structure and existing standard instrument procedures of the DC Metroplex that would be affected by the DC OAPM project.

1.3.1 DC Metroplex Airspace

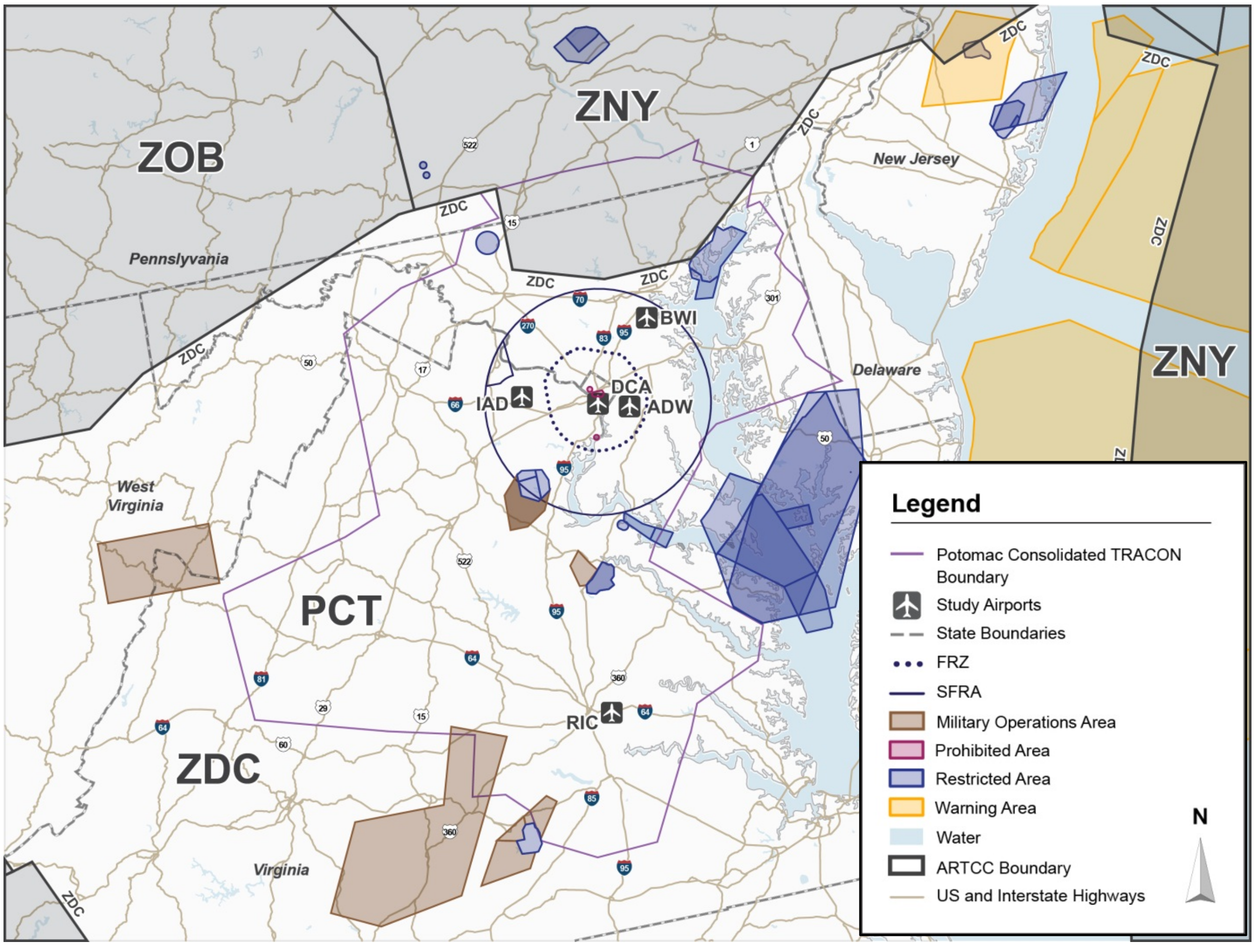
Exhibit 1-4 depicts part of the airspace structure in the DC Metroplex. Air traffic controllers in the PCT TRACON facility control a portion of airspace designated as PCT that is located within the Washington ARTCC (ZDC) and New York ARTCC (ZNY) airspace. Surrounding ARTCC airspace includes Boston (ZBW), Atlanta (ZTL), Indianapolis (ZID), and Jacksonville (ZJX). While PCT airspace is located entirely within the DC Metroplex airspace, the DC Metroplex airspace also includes portions of ZDC enroute airspace.

The lateral boundary of the PCT airspace is irregularly shaped, extending from Ronald Reagan Washington National Airport (KDCA or DCA) to between approximately 28 to 68 nmi to the north, 63 to 113 nmi to the east, 83 to 116 nmi to the south, and 63 to 113 nmi to the west. Excluding airspace delegated to the ATCTs at controlled airports within PCT, PCT controllers currently manage the airspace within these boundaries from the surface to as high as 25,000 feet MSL over the DC Metroplex area and up to 9,000 feet MSL on the outer edges. ZDC controllers manage the airspace above and adjacent to the PCT airspace, and portions of the northeast PCT area adjacent to and above the PCT airspace are managed by ZNY controllers.

1.3.1.1 DC Metroplex SUA

The physical configuration of the PCT airspace is constrained by the close proximity of major airports and the existence of SUA. Four of the six types of SUA are found within the D.C. Metroplex area, primarily reflecting airspace areas and controlled airspace used by the military as delegated by FAA (e.g., Military Operations Area and Restricted Areas). In addition, the DC Metroplex is subject to the DC SFRA and FRZ. **Exhibit 1-7** depicts the boundaries of SUA in proximity to PCT.

Exhibit 1-7 Special Use Airspace



Notes:

PCT – Potomac Consolidated TRACON
ZOB – Cleveland ARTCC
DCA – Ronald Reagan Washington National Airport
ZDC – Washington ARTCC
ADW – Joint Base Andrews
IAD – Washington Dulles International Airport
ZNY – New York ARTCC
BWI – Baltimore/Washington International Thurgood Marshall Airport
RIC – Richmond International Airport

Sources: National Flight Data Center National Airspace System Resources database, accessed September 16, 2012 (airspace boundaries); National Atlas of the United States of America: U.S. County and State Boundaries; Water Bodies; Bureau of Transportation Statistics: National Transportation Atlas Database; FAA: NFDC Airport and Runway databases.

Prepared by: ATAC Corporation, March 2013.

1.3.2 Current STARs and SIDs

As of December 2011, 32 published STARs and SIDs served the airports within the DC Metroplex airspace. Of these, 19 are conventional procedures and 13 are RNAV procedures. Eight of the 13 RNAV procedures provide RNAV guidance from the enroute airspace to a runway final approach. Many of the RNAV STARs currently in place were developed over time as the availability of RNAV-technology in aircraft cockpits increased and RNAV design criteria was improved. Several of these procedures are overlays of conventional procedures designed as part of the Potomac Consolidated TRACON Redesign project.[20] The purpose of that project was to increase efficiency and enhance safety by taking advantage of the benefits of combining the TRACON facilities in the Baltimore-Washington metropolitan area. However, the alternative selected did not include RNAV procedures.

1.4 DC Metroplex Airports

The focus of the proposed DC OAPM project is on the Study Airports which are connected to standard procedures subject to change. **Table 1-1** lists the Study Area airports, their locations, and their runways. **Exhibit 1-8** shows where the airports are located geographically.

Table 1-1 DC Metroplex EA Study Airports (1 of 2)

Airport Name	Code	Location	Runways[1/]
Major Airports			
Dulles International Airport	IAD	Washington D.C.	01L,01C,01R,19L,19C,19R, 12, 30
Ronald Reagan Washington National Airport	DCA	Washington D.C.	01, 04, 15, 19, 22, 33
Baltimore/Washington International/Thurgood Marshall Airport	BWI	Baltimore, MD	04, 10, 15L, 15R, 22, 28, 33L, 33R
Joint Base Andrews	ADW	Camp Springs, MD	01L, 01R, 19L, 19R
Richmond International Airport	RIC	Richmond, VA	02, 07, 16, 20, 25, 34

[20] U.S. Department of Transportation, Federal Aviation Administration, *Record of Decision for the Consolidated Potomac TRACON Airspace Redesign Environmental Impact Study*, June 2001.

Table 1-1 DC Metroplex EA Study Airports (2 of 2)

Airport Name	Code	Location	Runways[1/]
Satellite Airports			
Easton/Newnam Field Airport	ESN	Easton, MD	04, 15, 22, 33
Frederick Municipal Airport	FDK	Frederick, MD	05, 12, 23, 30
Leesburg Executive Airport	JYO	Leesburg, VA	17, 35
Montgomery County Airpark	GAI	Gaithersburg, MD	14, 32
Manassas Regional Airport/Harry P. Davis Field	HEF	Washington D.C.	16L, 16R, 34L, 34R
Eastern West Virginia Regional Airport/Shepherd Field	MRB	Martinsburg, WV	08, 26
Winchester Regional Airport	OKV	Winchester, VA	14, 32
Stafford Regional Airport	RMN	Stafford, VA	15, 33
Martin State Airport	MTN	Baltimore, MD	15, 33

Notes:
1/ A runway can be used in both directions, but is named in each direction separately. Runway number is based on the magnetic direction of the runway (e.g., Runway 09 points to the east direction). The two numbers on either side always differ by 180 degrees. If there is more than one runway pointing in the same direction, each runway number includes an 'L', 'C' or 'R' at the end. This is based on which side a runway is next to another one in the same direction.

Source: Department of Transportation, Federal Aviation Administration. digital-Airport/Facility Directory. September 20, 2012 (http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_afd; accessed October 5, 2012).
Prepared by: ATAC Corporation, October 2012.

1.4.1 Major Study Airports

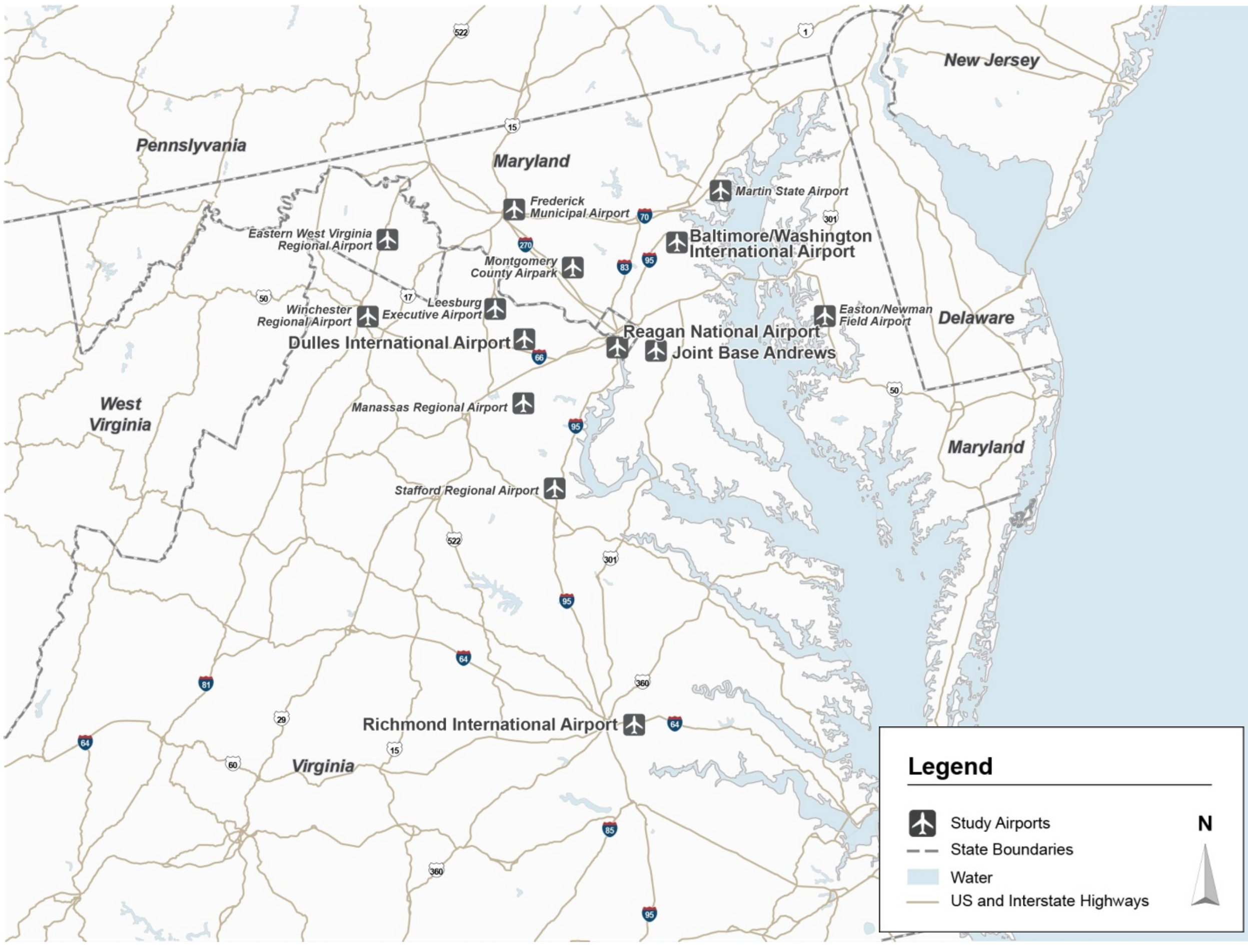
The DC Metroplex airports are divided into major Study Airports and satellite airports. The major Study Airports include the following:

Washington Dulles International Airport (KIAD or IAD) classified as a large-hub primary airport[21] in the National Plan of Integrated Airport Systems (NPIAS), IAD is the primary commercial airport serving the DC Metroplex area.[22] Accordingly, IAD receives scheduled commercial service and accommodates at least one percent of total U.S. enplaned passengers. IAD supports a mix of domestic and international passenger airlines, air cargo carriers, corporate aviation, and general aviation activity. The airport has four runways, described in **Table 1-1**. As of the end of 2011, an aircraft arriving at IAD may be assigned

[21] "Primary airport" means a commercial service airport the Secretary determines to have more than 10,000 passenger boardings each year. (49 U.S.C. § 47102(16).) "Large hub airport" means a commercial service airport that has at least 1.0 percent of the passenger boardings. (49 U.S.C. § 47102(11).)

[22] U.S. Department of Transportation, Federal Aviation Administration, *Terminal Area Forecast Summary 2012-2040*. [http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY2012.pdf; accessed May 24, 2013.]

Exhibit 1-8 Study Airport Locations



Sources: National Atlas of the United States of America: U.S. County and State Boundaries; Water Bodies; Bureau of Transportation Statistics: National Transportation Atlas Database; FAA: NFDC Airport and Runway databases; ATAC Corporation: Study Area Boundary

Prepared by: ATAC Corporation, March 2013.

one of four RNAV STARs or one of four conventional STARs. A departing aircraft may be assigned one RNAV SID or one conventional SID.[23]

Ronald Reagan Washington National Airport (KDCA or DCA) is located approximately 21 nmi southeast of IAD and accommodates a mix of commercial, corporate and general aviation activity. DCA is classified as a primary, large-hub airport in the NPIAS.[24] The airport has three runways, described in **Table 1-1**. As of the end of December 2011, DCA IFR arrivals may be assigned one of five RNAV STARs or one conventional STAR

[23] Department of Transportation, Federal Aviation Administration. *digital-Terminal Procedures*. April 5, 2012 [http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_tpp; accessed June 7, 2012.]

[24] U.S. Department of Transportation, Federal Aviation Administration, *Terminal Area Forecast Summary 2012-2040*. [http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY2012.pdf; accessed May 24, 2013.]

depending upon where they enter the terminal airspace. Departing aircraft may be assigned one RNAV SID or one conventional SID.[25]

Baltimore/Washington International Thurgood Marshall Airport (KBWI or BWI) is located approximately 40 nmi northeast of IAD and 26 nmi northeast of DCA. Similar to IAD and DCA, BWI is classified as a primary, large-hub airport under the NPIAS.[26] BWI has four runways, described in **Table 1-1**. As of the end of 2011, BWI arrivals may be assigned one RNAV STAR or one of two conventional STARs. Departing aircraft may be assigned one RNAV SID, or one of two conventional SIDs.[27]

Joint Base Andrews (KADW or ADW) is located approximately 29 nmi southeast of IAD and primarily serves military activity. The airport has two runways, described in **Table 1-1**. As of the end of 2011, arriving IFR aircraft may be assigned to one conventional STAR, depending on where they enter the terminal airspace. Departing aircraft may be assigned one of the three conventional SIDs.[28]

Richmond International Airport (KRIC or RIC) is located approximately 94 nmi south of IAD. RIC is classified as a small-hub[29] airport under the NPIAS.[30] RIC has three runways, described in **Table 1-1**. As of the end of 2011, RIC did not have associated STAR procedures. Departing aircraft may be assigned one of two conventional SIDs.[31]

Approximately 88 percent of all IFR traffic within the DC Metroplex area operates at the major Study Airports. As shown in **Table 1-2**, in 2011, the combined major and satellite Study Airports accommodated 95 percent of all IFR traffic that departed or landed under FAA control in or out of the DC Metroplex area (specifically within the PCT TRACON and ZDC controlled airspace).

1.4.2 Major Study Airport Runway Operating Configurations

The major Study Airports often operate under several different runway operating configurations depending on conditions such as weather, prevailing wind, and air traffic conditions. As a result, it is possible for the runway ends used for arrivals and departures to change several times throughout a day. ATCT controllers at these airports generally use two different runway operating configurations, and each runway operating configuration may designate primary and secondary arrival and departure runway ends for that configuration.

[25] Department of Transportation, Federal Aviation Administration. *digital-Terminal Procedures*. April 5, 2012 (http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_tpp; accessed June 7, 2012).

[26] U.S. Department of Transportation, Federal Aviation Administration, *Terminal Area Forecast Summary 2012-2040*. [http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY2012.pdf; accessed May 24, 2013.]

[27] Department of Transportation, Federal Aviation Administration. *digital-Terminal Procedures*. April 5, 2012 (http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_tpp; accessed June 7, 2012).

[28] Id.

[29] "small hub airport" means a commercial service airport that has at least 0.05 percent but less than 0.25 percent of the passenger boardings. (49 U.S.C. § 47102(25).)

[30] U.S. Department of Transportation, Federal Aviation Administration, *Terminal Area Forecast Summary 2012-2040*. [http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY2012.pdf; accessed May 24, 2013.]

[31] Department of Transportation, Federal Aviation Administration. *digital-Terminal Procedures*. April 5, 2012 (http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_tpp; accessed June 7, 2012).

Table 1-2 Distribution of 2011 IFR Traffic Among Study Airports in PCT

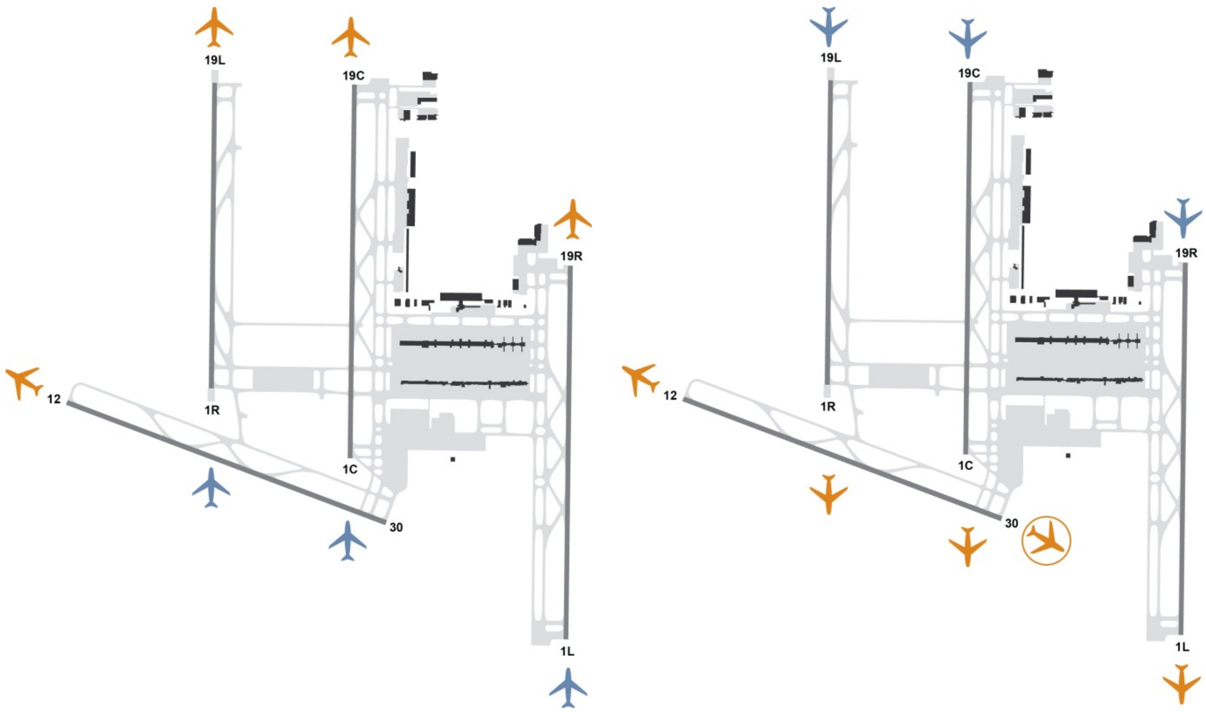
Airport	IFR Operations	Percent of Total Operations
Dulles International Airport (IAD)	359,608	31.1%
Ronald Reagan Washington National Airport (DCA)	282,618	24.4%
Baltimore/Washington International/Thurgood Marshall Airport (BWI)	272,908	23.6%
Richmond International Airport (RIC)	86,435	7.5%
Joint Base Andrews (ADW)	25,641	2.2%
Manassas Regional Airport/Harry P. Davis Field (HEF)	20,072	1.7%
Leesburg Executive Airport (JYO)	11,605	1.0%
Martin State Airport (MTN)	11,366	1.0%
Montgomery County Airpark (GAI)	9,758	0.8%
Frederick Municipal Airport (FDK)	6,570	0.6%
Easton/Newnam Field Airport (ESN)	5,217	0.5%
Eastern West Virginia Regional Airport/Shepherd Field (MRB)	3,616	0.3%
Winchester Regional Airport (OKV)	3,153	0.3%
Stafford Regional Airport (RMN)	2,893	0.2%
Total IFR Operations	1,101,460	95.1%
Total PCT IFR Operations	1,157,617	100.0%

Notes:
(Sorted from Highest IFR Operations to Lowest)

Source: Department of Transportation, Federal Aviation Administration. Operations Network: Tower Counts for KIAD, KDCA, KADW, KRIC, KHEF, and KESN https://aspm.faa.gov/opsnet/sys/Tower.asp (accessed October 5, 2012); Traffic Flow Management System Counts for KFDK, KGAI, KJYO, KMRB, KOKV, and KRMN https://aspm.faa.gov/tfms/sys/Airport.asp (accessed October 5, 2012).
Prepared by: ATAC Corporation, October 2012.

Exhibits 1-9 through **1-13** illustrate the primary runway operating configurations at IAD, DCA, BWI, ADW, and RIC, respectively.

Exhibit 1-9 KIAD Runway Operating Configurations



KIAD: North Runway
Operating Configuration – 48%

KIAD: South Runway
Operating Configuration – 52%

Primary Arrival

Secondary Arrival

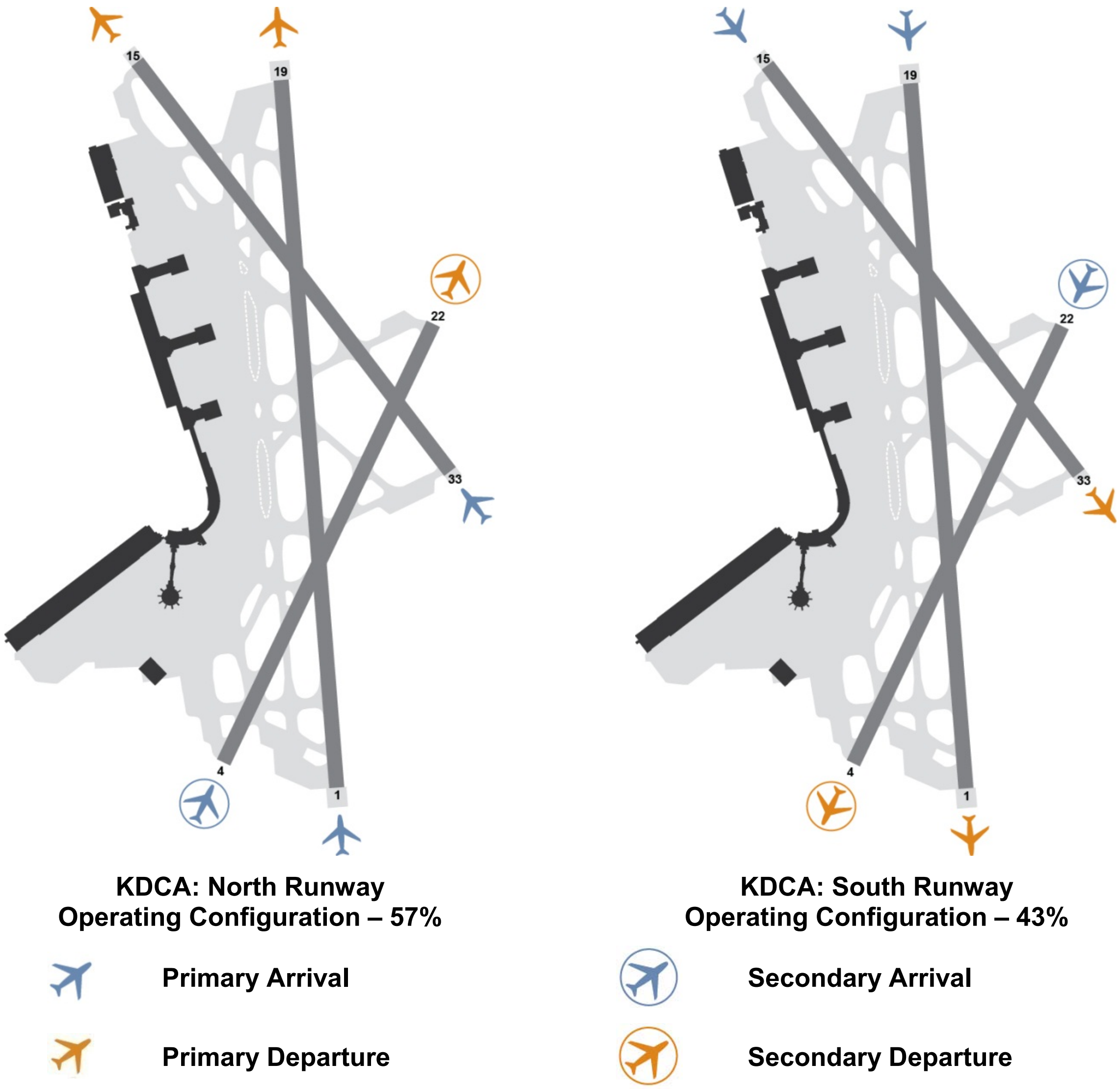
Primary Departure

Secondary Departure

Source: U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.

Prepared By: ATAC Corporation, December 2012.

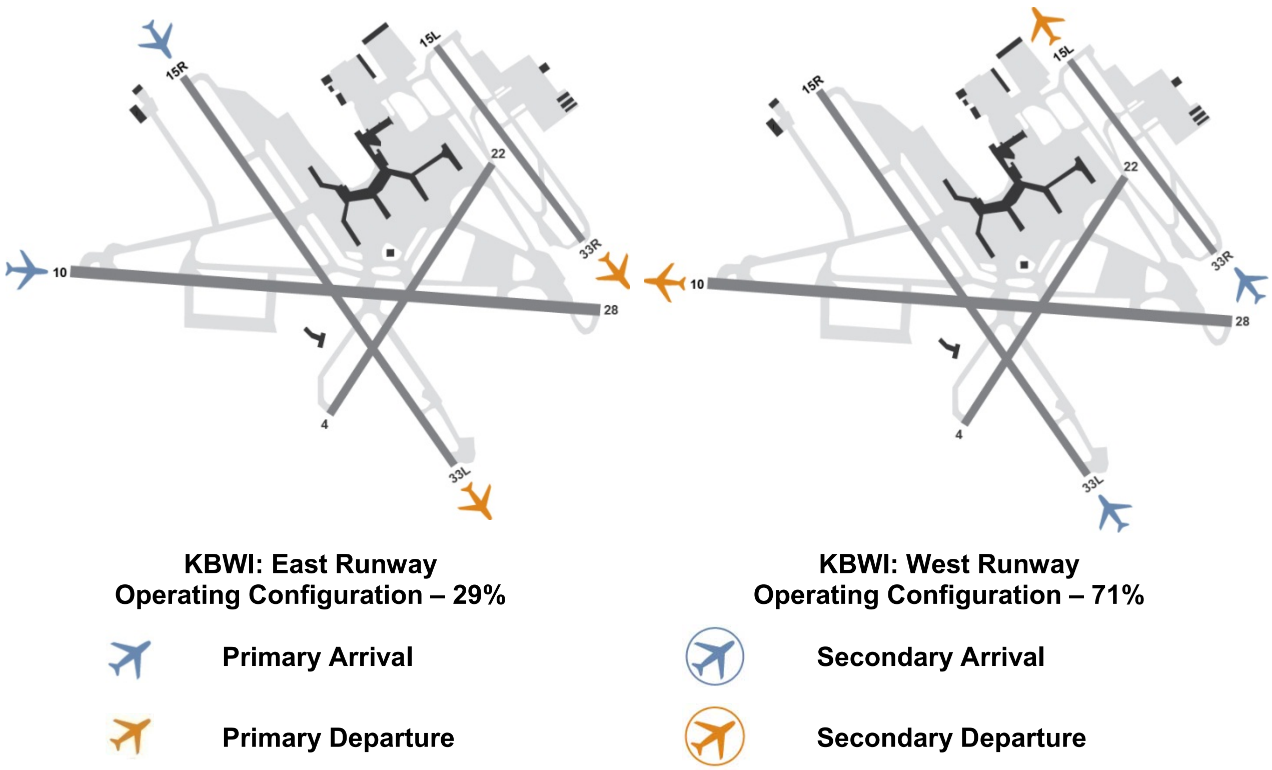
Exhibit 1-10 KDCA Runway Operating Configurations



Source: U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.

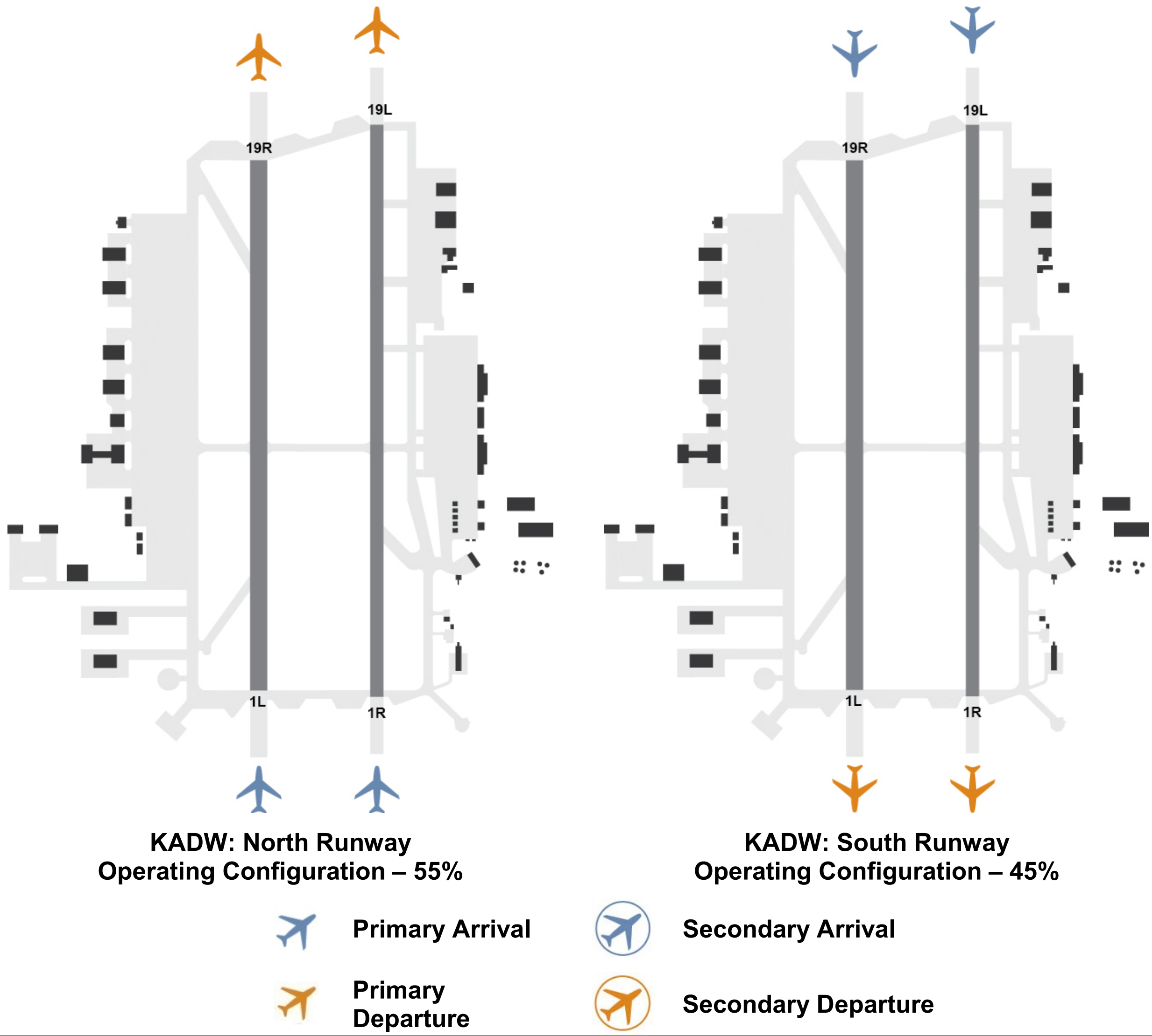
Prepared By: ATAC Corporation, December 2012.

Exhibit 1-11 KBWI Runway Operating Configurations



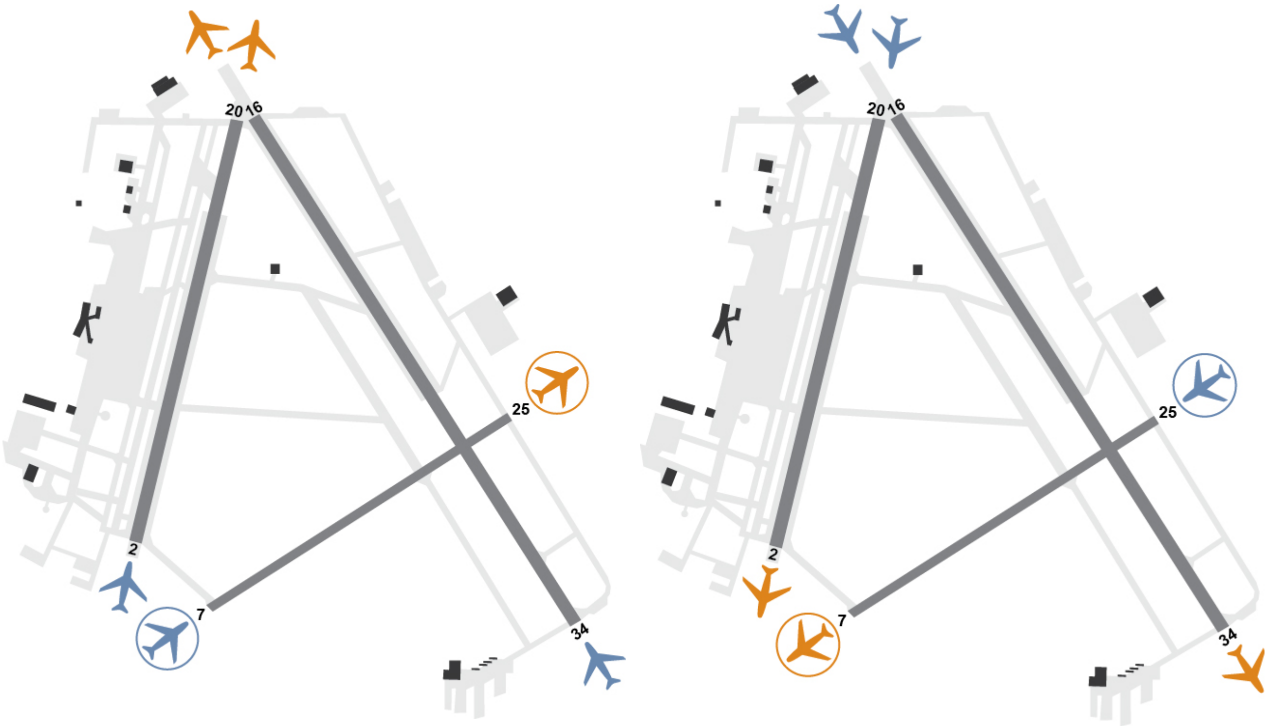
Source:	U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.
Prepared By:	ATAC Corporation, December 2012.

Exhibit 1-12 KADW Runway Operating Configurations



Source:	U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.
Prepared By:	ATAC Corporation, December 2012.

Exhibit I-13 KRIC Runway Operating Configurations



KRIC: North Runway Operating Configuration – 49%

KRIC: South Runway Operating Configuration – 51%

Primary Arrival

Secondary Arrival

Primary Departure

Secondary Departure

Source: U.S. Department of Transportation, Federal Aviation Administration, FAA Airport Diagrams [http://www.faa.gov/airports/runway_safety/diagrams/], Accessed December 2012.
Prepared By: ATAC Corporation, December 2012.