3 Alternatives

The alternative analysis was conducted pursuant to Council on Environmental Quality (CEQ) regulations and Federal Aviation Administration (FAA) guidance provided in FAA Order 1050.1E, Chg. 1, *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1E). This chapter discusses the following topics:

- Alternative Development Process
- Alternatives Overview
- Comparison of Alternatives
- Listing of Federal Laws and Regulations

The technical terms and concepts discussed in this chapter are explained in Chapter 1, *Background*.

3.1 Alternative Development Process

The development of an alternative for the Washington D.C. Optimization of Airspace and Procedures in the Metroplex (DC OAPM) project was a multi-step process that began with the formation of the DC OAPM Study Team (Study Team). The Study Team was charged with defining operational issues in the DC Metroplex and recommending conceptual designs for procedures that would address these issues.[38] The recommended procedures were then provided to the DC OAPM Design and Implementation (D&I) Team. The D&I Team was responsible for designing individual procedures based on the Study Team's recommended conceptual procedures. Each procedure designed by the D&I Team was required to meet several design criteria and the project Purpose and Need. As defined in Chapter 2, the need for the Proposed Action is to address existing DC Metroplex Standard Instrument Departure (SID) and Standard Terminal Arrival Route (STAR) procedures that are not achieving the higher levels of efficiency found in procedures designed to use Area Navigation (RNAV) technology. The FAA rejected individual procedures if, on their own merit, they did not meet the Purpose and Need.

For purposes of the DC OAPM project, the Proposed Action alternative evaluated in this Environmental Assessment (EA) is a package including many individual procedures combined into one alternative. This group of procedures were considered and evaluated in combination with one another to determine whether the alternative may meet the project's Purpose and Need. The FAA considered multiple versions of each air traffic procedure; however, several versions were not carried forward because they failed to meet the objectives established to meet the Purpose of the project.

The following sections describe the alternative development process the FAA used to create a series of procedures that when employed together would add efficiency to the DC Metroplex.

3.1.1 DC OAPM Study Team

In September 2010, the DC OAPM Study Team began work to define operational problems in the DC Metroplex and to identify potential solutions. The Study Team included experts

[38] DC OAPM Metroplex Study Team Final Report, March 2011.

on the Air Traffic Control (ATC) system for the DC Metroplex. The work completed was intended to provide a guide for later design efforts by the D&I Team. The Study Team obtained input from local facilities (e.g., air traffic control [ATC]), airspace users (e.g., pilots), and aviation industry representatives to learn more about the challenges of operating in the DC Metroplex. These meetings helped identify operational challenges related to individual procedures and potential solutions that would increase efficiency. Initially, the Study Team identified 56 issues related to existing procedures in the DC Metroplex. As the Study Team identified additional issues, they were grouped together in generalized categories based on similarity.

The Study Team identified several potential modifications to the arrival/departure procedures to accommodate procedure changes that addressed the issues identified. The modifications proposed were conceptual in nature, and did not include a detailed technical assessment, which was reserved for the D&I Team to conduct.[39]

3.1.2 DC OAPM Design and Implementation Team

Following completion of the Study Team's Final Report in March 2011, the D&I Team began work on the procedure designs. First, the Study Team proposals were prioritized based on complexity, interdependencies with other procedures, and degree of potential benefit to the Metroplex. Second, the D&I Team divided into workgroups to further develop and refine the Study Team proposals into preliminary designs. Finally, the preliminary designs were brought to the whole D&I Team for review and modification, if necessary. In developing the proposed procedures, the D&I Team was responsible for following regulatory and technical guidance as well as meeting criteria and standards in three general categories:

1. **RNAV Design Criteria and Air Traffic Control Regulatory Requirements** - Flight procedure design is subject to requirements found in several FAA Orders, including FAA Order 7100.9D, *Standard Terminal Arrival Program and Procedures*, FAA Order 8260.43A, *Flight Procedures Management Program*, and FAA Order JO 7110.65U, *Air Traffic Control*. The *Guidelines for Implementing Terminal RNAV Procedures*, to be followed in conjunction with the requirements of FAA Order 8260.43A, includes an "18-Step Process" for developing, reviewing, and implementing RNAV procedures. In addition, FAA Order JO 7110.65U includes requirements governing air traffic control procedures, air traffic management, and appropriate technical terminology.

2. **Operational Criteria** – Operational criteria were consistent with the Purpose and Need for the project. This includes increasing efficiency and flexibility, and decreasing complexity in air traffic management. These criteria were measured for all procedures using either a full motion simulator, a stationary simulator, and/or flight training devices. These criteria were also measured for many procedures using real time Human-In-The-Loop Simulations (HITLs). These simulations further validated that operations in the DC Metroplex would not be limited by the proposed procedures. The D&I Team also evaluated each of the procedure designs with full motion aircraft simulators. The simulations helped ensure that aircraft could fly the procedure as designed and that efficiency (e.g., pilot workload) would not be limited by the proposed procedures.

[39] Id.

3. **Safety Factors** – Procedures were subject to evaluation using the FAA's Air Traffic Organization's (ATOs) Safety Management System (SMS). The SMS is the ATO's system for managing the safety of ATC and navigation services in the National Airspace System (NAS). In compliance with SMS requirements, the procedures were evaluated by a Safety Risk Management Panel (SRMP) following a five step process: 1) describe the system; 2) identify the hazards in the system; 3) analyze the risks; 4) assess the risk; and, 5) treat the risk. If a procedure introduced a new hazard or increased the severity and/or likelihood of an existing hazard that is being mitigated, the design was adjusted to reduce the hazard to acceptable levels.

To ensure that procedures included in the Proposed Action were viable, the D&I team undertook validation exercises that further refined the procedures. Over a multi-month period, the D&I Team worked to meet Proposed Final Design milestones at the 25, 50, 75, 90, and 100 percent design levels. To reach each of these milestones, the D&I Team relied on stakeholder input, design solution tools (e.g., design and testing software), and the criteria described above. The combined final procedure designs have been brought forward in this EA as the Proposed Action alternative. The following sections describe the process that was used for two procedures that were carried forward as part of the Proposed Action.

3.1.2.1 Proposed ANTHM STAR

There were four versions of the proposed ANTHM STAR evaluated during the alternative development process. The first version was the Study Team's recommendation. The second version was the initial procedure designed by the D&I Team based on the Study Team recommendation. A third version of the D&I Team's design was prepared that refined the procedure to better meet the criteria described in Section 3.1.2. The final version simplified the procedure by making changes to altitudes at various waypoints along the procedure and simplified the procedure to reduce pilot workload.

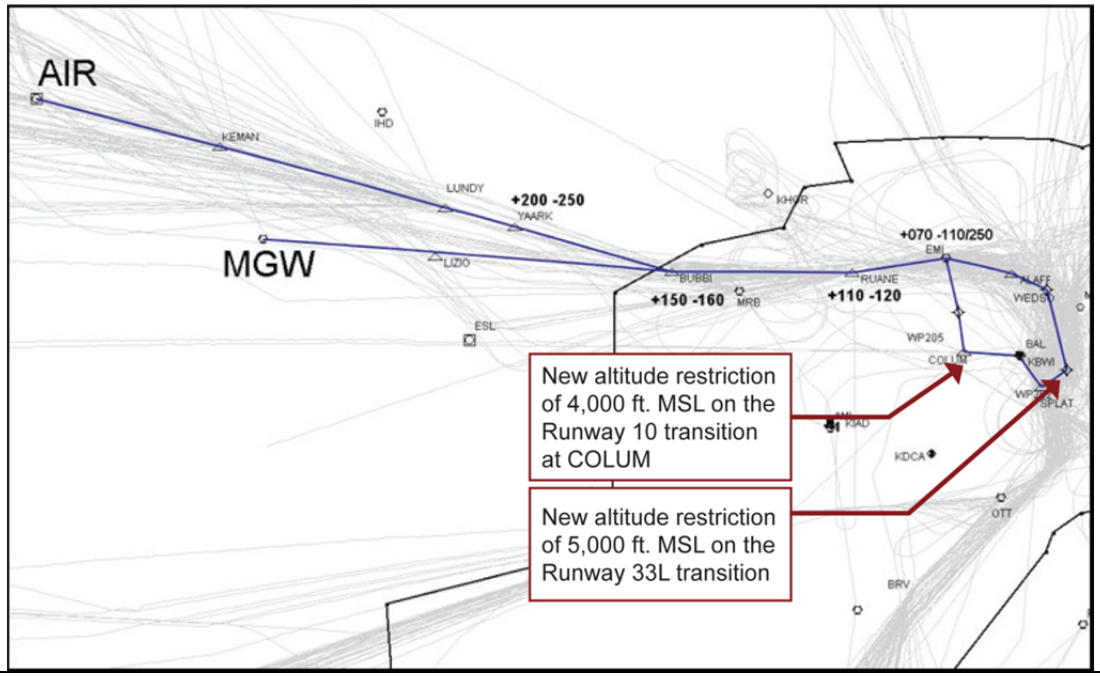
First, the Study Team identified issues with the conventional Westminster (EMI) STAR serving Baltimore-Washington International Airport (BWI). The Study Team determined that the EMI STAR would be more efficient with runway transitions that delivered arriving aircraft closer to the runway along a more predictable flight path. In addition, jet aircraft arriving on the existing procedure level off at the BUBBI Fix at 15,000 feet above mean sea level (MSL) and at the RUANE waypoint at 11,000 feet MSL. These level-offs result in a less efficient trajectory for aircraft flying on this procedure.

The Study Team proposed four recommendations to address the issues identified with the EMI STAR. These recommendations included:

1. Developing a new RNAV STAR based on the existing EMI STAR with modifications to bring arrivals closer to the runway;
2. Add a new altitude restriction of 5,000 feet MSL on the Runway 33L transition west of BWI;
3. Add a new altitude constraint of 4,000 feet MSL on the Runway 10 transition at the COLUM waypoint; and,
4. Incorporate an Optimal Profile Descent (OPD) into BWI for this arrival procedure.

Exhibit 3-1 illustrates the Study Team's recommendations for the EMI STAR.

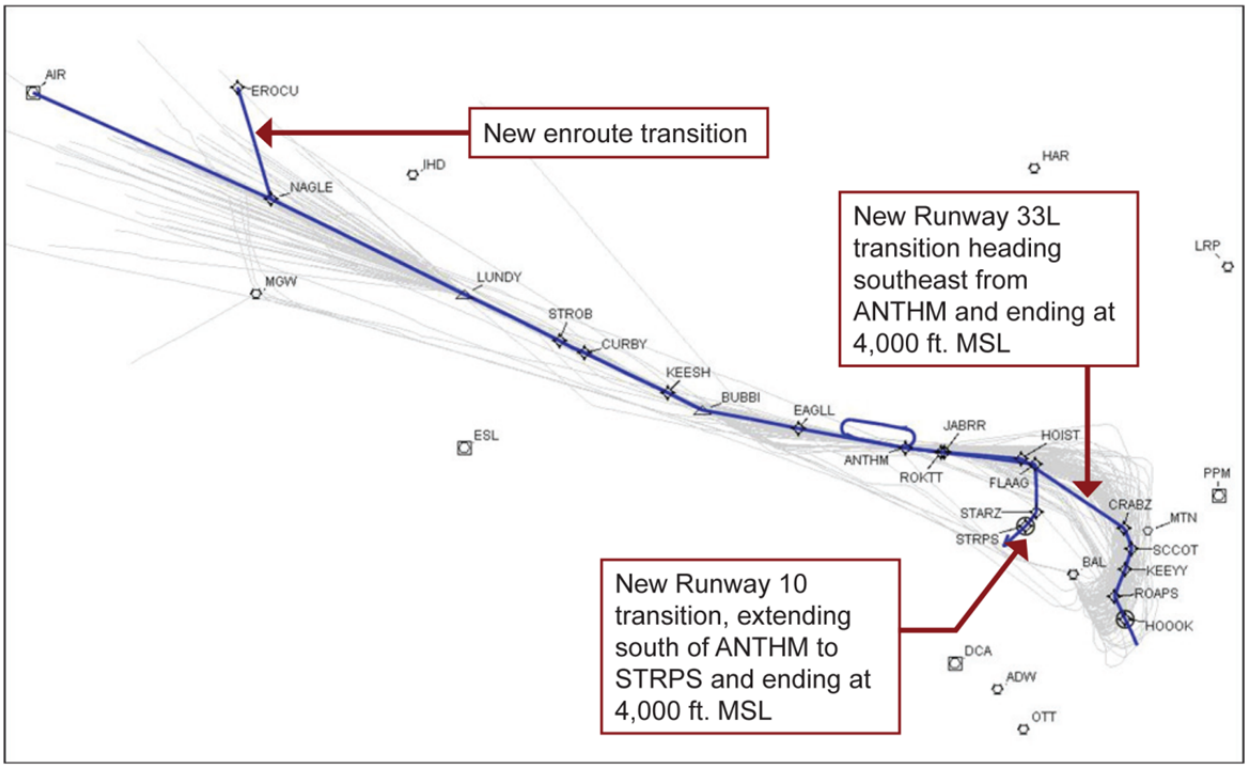
Exhibit 3-1 Study Team Recommended Procedure – EMI STAR



Source: DC OAPM Metroplex Study Team, March 2011.
Prepared by: ATAC Corporation, March 2013.

Based on the Study Team recommendations, the D&I Team proposed the development of a new RNAV STAR called ANTHM that would replace but generally follow the current route of the EMI STAR. **Exhibit 3-2** depicts the first version of the proposed ANTHM STAR. While the ANTHM STAR addresses the Study Team recommendations, the procedure design varies from the design recommended by the Study Team to better meet operational criteria. The Runway 33L transition would be closer to the runway and end at 4,000 feet MSL, instead of 5,000 feet MSL as recommended by the Study Team. In addition, the proposed transition for Runway 33L would proceed to the ANTHM waypoint then turn southeast to allow controllers the flexibility to bring an aircraft into the airport for landing or to sequence them into other arrival flows when necessary. The transition for Runway 33L was changed to avoid potential traffic conflicts with arrivals to Runway 33L on the proposed RAVNN and MIIDY RNAV STARs. The transition was also changed to prevent traffic conflicts with departures from Runway 33R. Similarly, the proposed new transition to Runway 10 is different from the design recommended by the Study Team. Because of potential traffic conflicts with aircraft operating in a neighboring ATC sector, the Runway 10 transition would extend south from the ANTHM waypoint to the STRPS waypoint. This would also give controllers added flexibility in sequencing arrival traffic flows. In addition to the runway transitions, the ANTHM STAR added an enroute transition from the EROCU waypoint to streamline departures from Pittsburgh International Airport.

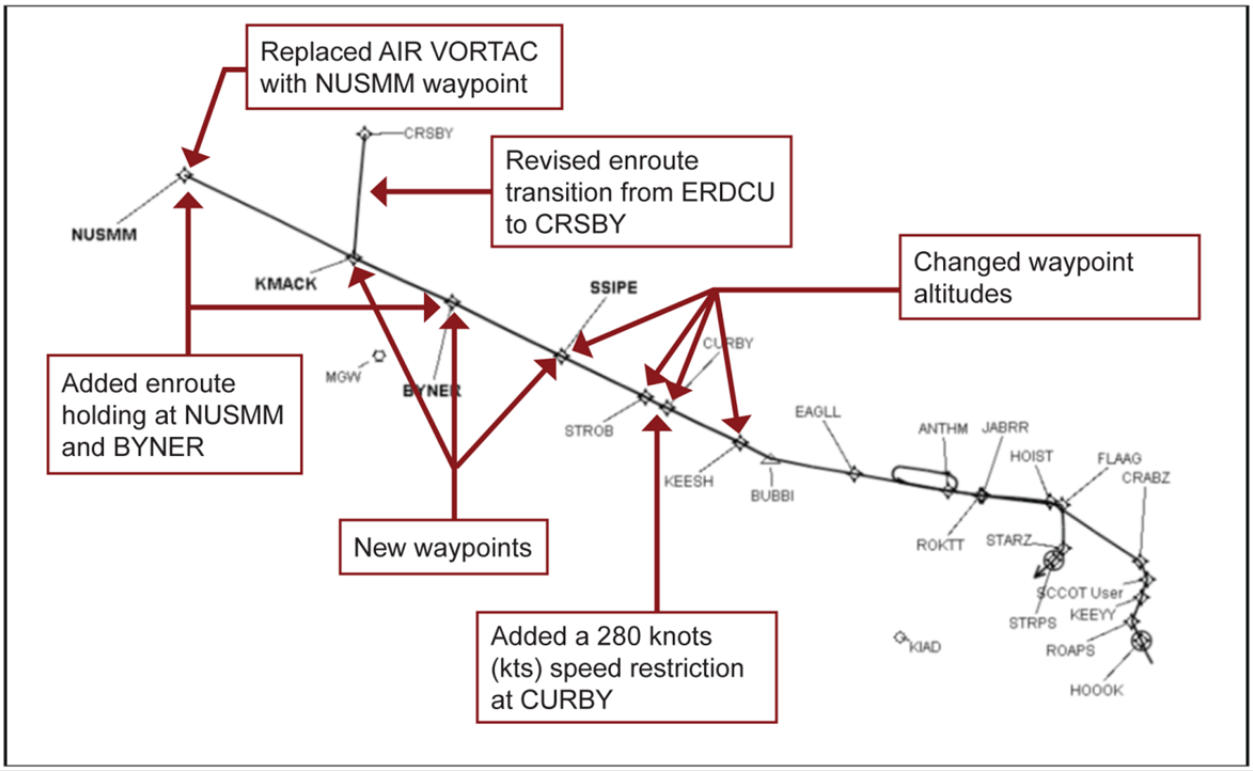
Exhibit 3-2 Proposed Design, First Version – ANTHM RNAV STAR



Source: DC OAPM D&I Team ANTHM RNAV STAR Proposed Final Design Sheet, September 2012.
Prepared by: ATAC Corporation, March 2013.

After completing the first version of this procedure, more changes were made following further evaluation using the criteria described in Section 3.1.2 (e.g., RNAV Design Criteria: design adjustments to meet updated criteria; and Operational Factors: enhanced procedure connectivity between ATC facilities.) **Exhibit 3-3** depicts the second version of the ANTHM STAR. The second version made several changes including adding more waypoints, changing some waypoint altitudes, and replaced the ERDCU enroute transition with the CRSBY enroute transition to improve connectivity with air traffic routes in ZOB airspace. The second version of the procedure is the Proposed Final Design included as part of the Proposed Action Alternative.

Exhibit 3-3 Proposed Design, Second Version – ANTHM RNAV STAR

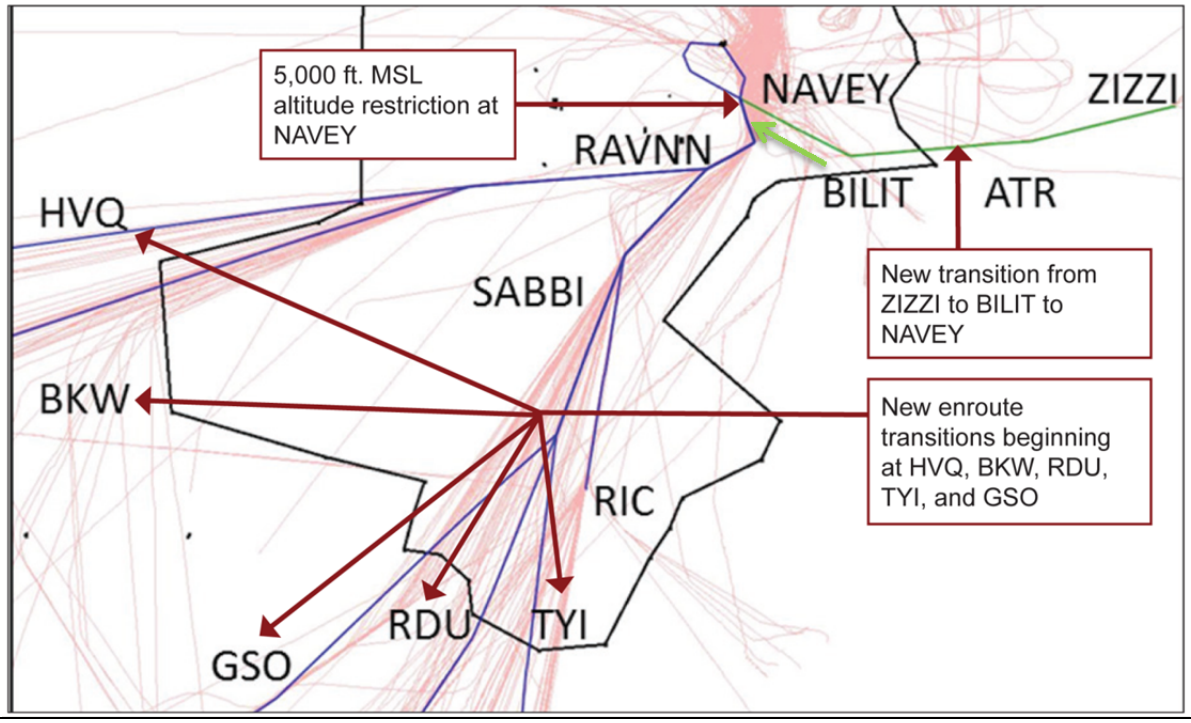


Source: DC OAPM D&I Team ANTHM RNAV STAR Change Control Sheet, October 2012.
Prepared by: ATAC Corporation, March 2013.

3.1.2.2 Proposed MIIDY STAR

The new MIIDY STAR was proposed by the D&I Team to address issues with the existing RAVNN STAR raised by the Study Team. The Study Team found that the RAVNN STAR lacks established transitions for arrivals between the BILIT and NAVEY waypoints. This results in increased complexity for controllers due to the need for increased communications between ATC and pilots. To address this issue, the Study Team recommended that a new transition be added to the RAVNN STAR. The new transition would begin at the ZIZZI waypoint and proceed to the BILIT waypoint and then to the NAVEY waypoint. An altitude restriction of 5,000 feet MSL would be added at the NAVEY waypoint. The Study Team also recommended that enroute transitions be added to the RAVNN STAR with starting points at the HVQ, BKW, GSO, RDU, and TYI ground-based navigational aids (NAVAIDs). **Exhibit 3-4** illustrates the Study Team's recommendations.

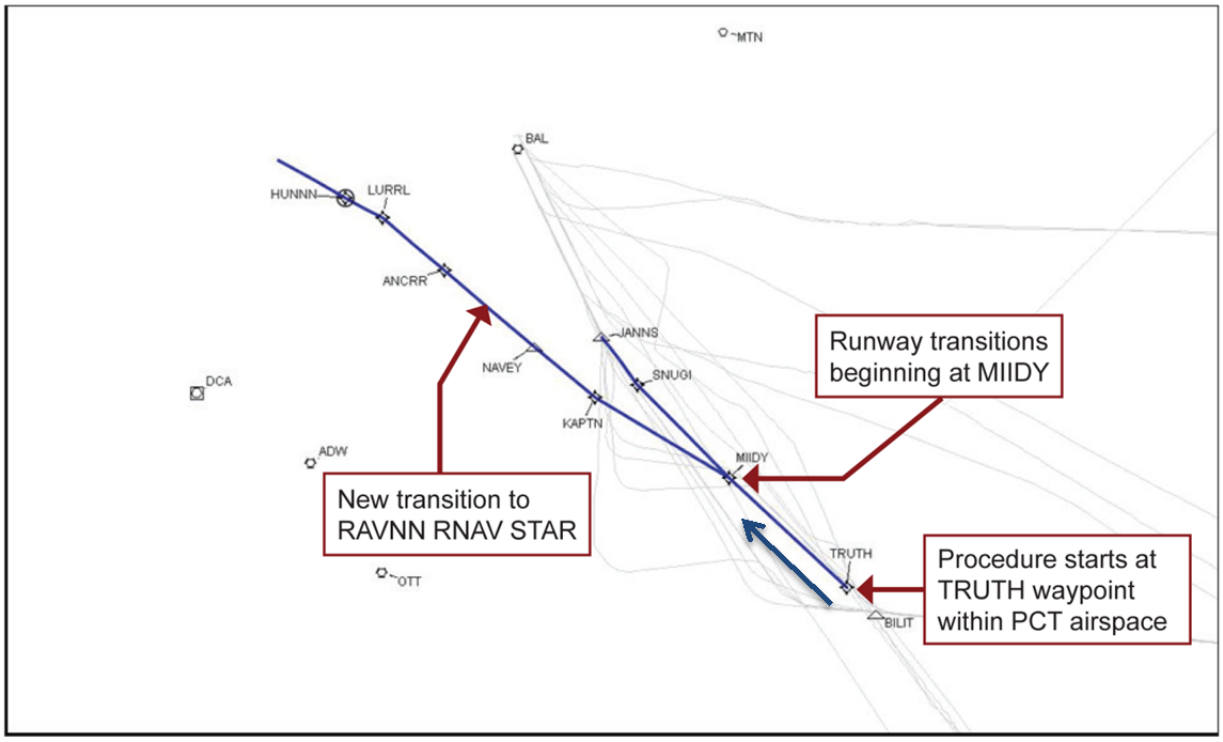
Exhibit 3-4 Study Team Recommended Changes – RAVNN STAR



Source: DC OAPM Metroplex Study Team, 2010
Prepared by: ATAC Corporation, March 2013.

Exhibit 3-5 depicts the first version of the MIIDY STAR developed by the D&I Team based on the Study Team recommendation. The design addresses the first Study Team recommendation by adding a new transition to the RAVNN RNAV STAR. However, this procedure differs from the Study Team recommendation by starting the procedure at the TRUTH waypoint within PCT airspace. Complexity is reduced by keeping the procedure within PCT airspace instead of starting it further east outside of PCT airspace. The D&I Team also added runway transitions that would begin at the MIIDY waypoint. The Runway 15L runway transition would avoid conflict with Runway 15R departure traffic from BWI and traffic arriving on the RAVNN RNAV STAR from the south and west. The Runways 33L and 33R runway transition would give aircraft a more predictable route to join the final approach procedures to the runways.

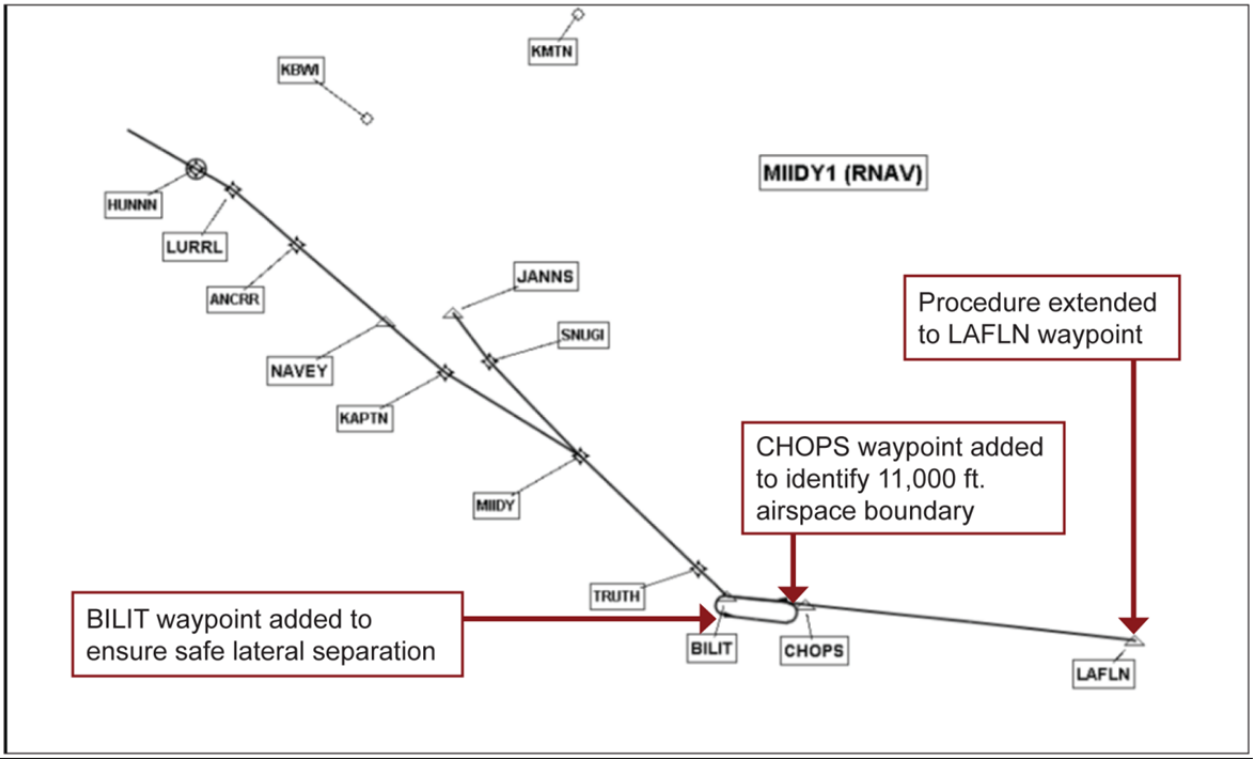
Exhibit 3-5 Proposed Design, First Version – MIIDY STAR



Source: DC OAPM D&I Team MIIDY RNAV STAR Proposed Final Design Sheet, September 2012.
Prepared by: ATAC Corporation, March 2013.

After completing the first version of this procedure, more changes were made following further evaluation using the criteria described in Section 3.1.2 (e.g. Air Traffic Regulations and Requirements: air traffic facility transfers and separation requirements). **Exhibit 3-6** depicts the second version of the MIIDY STAR. The second version extended the procedure to the east to begin at the LAFLN waypoint. This would allow for better automation into PTC airspace from ZDC airspace. In addition, the CHOPS waypoint was added to the procedure to identify an 11,000 foot airspace boundary. Finally, the BILIT waypoint was added to the procedure to ensure safe lateral separation from aircraft operating on adjacent procedures. The second version of the procedure is the Proposed Final Design included as part of the Proposed Action Alternative.

Exhibit 3-6 Proposed Design, Second Version – MIIDY STAR



Source: DC OAPM D&I Team MIIDY RNAV STAR Change Control Sheet, October 2012.
Prepared by: ATAC Corporation, March 2013.

3.2 Alternatives Overview

The following sections discuss the Proposed Action and the No Action Alternative, the alternatives carried forward for analysis in the EA.

3.2.1 No Action Alternative

Under the No Action Alternative, the FAA would keep existing arrival and departure procedures. The air traffic routes in use in the DC Metroplex as of 2011 (representing existing conditions) would generally remain the same. However, the No Action Alternative would include some procedure changes independent of those included in the Proposed Action. This include the implementation of seven new procedures, four serving IAD (GIBBZ ONE, DOCCS ONE, BUNZZ ONE, and RNLDI ONE) and three serving DCA (FRDMM ONE, TRUPS ONE, and NUMMY ONE) that were previously developed and determined to be of independent utility. Four existing procedures (ROYIL, SHNON, ELDEE FIVE, and WZZRD) would be replaced by five of the seven new procedures (GIBBZ ONE, DOCCS ONE, FRDMM ONE, TRUPS ONE, and NUMMY ONE). These changes would be made prior to the Proposed Action to deal with issues not related to this project, and would continue without the Proposed Action procedures.

The factors limiting FAA's ability to increase efficiency are identified in Section 2.1.2. In summary, the factors are:

- Lack of flexibility for the efficient transfer of traffic between the enroute and terminal area airspace;

- Complex converging interactions between arrival and departure flight paths; and
- Lack of predictable standard procedures to/from and in enroute airspace.

3.2.1.1 No Action Alternative Standard Procedures

Table 3-1 lists the names of the No Action Alternative procedures, the procedure type (i.e., SID or STAR), the basis of design (indicated by the type of navigational aid the procedures are based on: NAVAID (shown as VHF Omnidirectional Range [VOR]), RNAV, or radar vectors), and the airports served. In addition, the table includes the number of runway and enroute transitions for each procedure and, where applicable, by airport, and the entry/exit gates served by the procedure. The No Action Alternative includes current procedures, as well as procedures expected to be put into effect prior to implementation of the DC OAPM.

Table 3-1 No Action Alternative SIDs and STARS (1 of 2)

No Action Alternative Procedure	Procedure Type	Basis of Design	Primary Airport Served	Other Study Airports Served	Transitions (enroute/ runway)	Entry/Exit Gate Served
ANDREWS ONE	SID	Radar Vectors	ADW	None	0/1	North
ARSENAL TWO	SID	VOR	HEF	None	6/2	North, West
BARIN ONE	STAR	RNAV	IAD	None	2/1	South
BILIT ONE	STAR	RNAV	DCA	None	2/1	North
BUNZZ ONE[2]	SID	RNAV	IAD	None	1/7	West
CAMP SPRINGS ONE	SID	Radar Vectors	ADW	None	0/2	West, South
CAPITAL EIGHT	SID	Radar Vectors	IAD	None	0/0	North, South, West
CLIPR ONE	STAR	RNAV	DCA	None	1/2	North
COATT FOUR	STAR	VOR	IAD	HEF,JYO	2/0	South
COLIN FIVE	SID	VOR	RIC	None	1/0	West
DELRO TWO	STAR	VOR	IAD	None	2/0	West
DOCCS ONE[2]	STAR	VOR	IAD	JYO	1/2, (1/0)[1]	West
FRDMM ONE[2]	STAR	RNAV	DCA	ADW	1/2, (1/0)[1]	West
GIBBZ ONE[2]	STAR	RNAV	IAD	HEF, JYO	3/2, (3/0)[1]	West
HYPER FOUR	STAR	RNAV	IAD	MRB,OKV, JYO,HEF, RMN	4/1, (4/0)[1]	North
IRONS FOUR	STAR	VOR	ADW	DCA	1/0	South
LAZIR THREE	SID	RNAV to Radar Vectors	DCA	None	1/2	North, South, West
LEGGO TWO	STAR	RNAV	IAD	None	1/0	North
MORNINGSIDE ONE	SID	Radar Vectors	ADW	None	0/2	North, South
NATIONAL TWO	SID	VOR/DME to Radar Vectors	DCA	None	0/0	North
NOTTINGHAM SIX	STAR	VOR	BWI	MTN	3/0	North
NUMMY ONE[2]	STAR	VOR	DCA	ADW	1/2, (1/0)[1]	North
OJAAY ONE	STAR	RNAV	DCA	None	1/1	South
PALEO THREE	SID	VOR	BWI	None	2/0	North
PHILIPSBURG TWO	STAR	VOR	IAD	None	1/0	North
PRTZL THREE	STAR	RNAV	IAD	None	1/0	North

Table 3-1 No Action Alternative SIDs and STARS (2 of 2)

No Action Alternative Procedure	Procedure Type	Basis of Design	Primary Airport Served	Other Study Airports Served	Transitions (enroute/ runway)	Entry/Exit Gate Served
RAVNN THREE	STAR	RNAV	BWI	MTN	2/1, (2/0)1	North
RNLDI ONE[2]	SID	RNAV	IAD	None	1/7	North
SELINSGROVE THREE	STAR	VOR	IAD	None	1/0	North
SKILS TWO	STAR	RNAV	DCA	None	2/2	West, South
STOIC TWO	SID	RNAV	IAD	None	4/0	West
SWANN THREE	SID	VOR	BWI	None	2/0	North
TERPZ TWO	SID	RNAV	BWI	None	6/0	North, South
TRIXY FOUR	SID	VOR	MRB	None	3/2	North, South
TRUPS ONE[2]	STAR	RNAV	DCA	ADW	2/2, (2/0)[1]	West
WESTMINSTER FIVE	STAR	VOR	BWI	MTN	2/0	West, South
YEAST ONE	SID	VOR	RIC	None	3/0	North

Notes:

[1] Indicates enroute and runway transitions for other airports served.
[2] Denotes a procedure previously developed and determined to be of independent utility.

ADW – Joint Base Andrews
BWI – Baltimore/Washington International Thurgood Marshall Airport
DCA – Ronald Reagan Washington National Airport
IAD – Washington Dulles International Airport
HEF – Manassas Regional Airport/Harry P. Davis Field
MTN – Martin State Airport
JYO – Leesburg Executive Airport
GAI – Montgomery County Airpark
MRB – Eastern WV Regional Airport/Shepherd Field
OKV – Winchester Regional Airport
ESN – Easton/Newnam Field Airport
RMN – Stafford Regional Airport
SID – Standard Instrument Departures
n/a – Not Applicable
STAR – Standard Terminal Arrival Route
RNAV – Area Navigation
VOR – VHF Omnidirectional Range

Source: National Flight Data Center National Airspace System Resources database, accessed September 16, 2012.
Prepared by: ATAC Corporation, April 2013.

Under the No Action Alternative, the final approach flows to and initial departure flows from the runways at all the Study Airports are similar to Existing Conditions (2011). However, in some cases the NAVAID used as the basis for the procedure design would differ. For a few airports, the location of landing thresholds on the runways will change as a result of independent projects improving Runway Safety Areas (RSAs).[40] These changes are taken into account in the analysis of impacts associated with the No Action Alternative (See Chapter 5, *Environmental Consequences*.)

3.2.1.2 Airspace Control Structure under the No Action Alternative

When aircraft depart or arrive on an assigned route in the DC Metroplex, control over the aircraft is transferred between the Washington Air Route Traffic Control Center (ARTCC) (ZDC) or New York ARTCC (ZNY) Centers and the Potomac Consolidated Terminal Radar Approach Control (TRACON) (PCT). The entry and exit gates between the DC Metroplex airspace and the neighboring ZDC and ZNY Centers would remain the same as under Existing Conditions (2011). **Exhibits 2-1** and **2-3** in Chapter 2 depict the locations of the entry and exit gates for the DC Metroplex airspace, respectively. The entry and exit gates associated with each procedure are shown in **Table 3-1**.

[40] FAA Order 5200.8, *Runway Safety Area Program*, requires all federally obligated airports and airports certificated under 14 CFR Part 139 to improve their RSAs, to the extent practicable, to comply with the design standards included in AC 150/5300-13, Airport Design.

Exhibits 3-7 and **3-8** show all arrival and departure flows to the major Study Airports associated with the No Action Alternative during South Flow and North Flow conditions, respectively. Corridors are grouped by procedure type (conventional or RNAV), operation (arrival or departure), and airport. Arrival and departure corridors to/from the satellite Study Airports are shown on **Exhibit 3-9.** Different corridors can be turned on and off on **Exhibits 3-7** through **3-9** by clicking on the boxes that contain the "eye" icon on the left hand side of the exhibit.

Exhibit 3-10 and **Exhibit 3-11** depict the arrival and departure corridors to/from the major Study Airports under South Flow conditions, respectively. Similarly, **Exhibit 3-12** and **Exhibit 3-13** depict the arrival and departure corridors to/from the major Study Airports under North Flow conditions, respectively. **Exhibit 3-14** and **Exhibit 3-15** depict arrivals and departures to the satellite Study Airports, respectively.

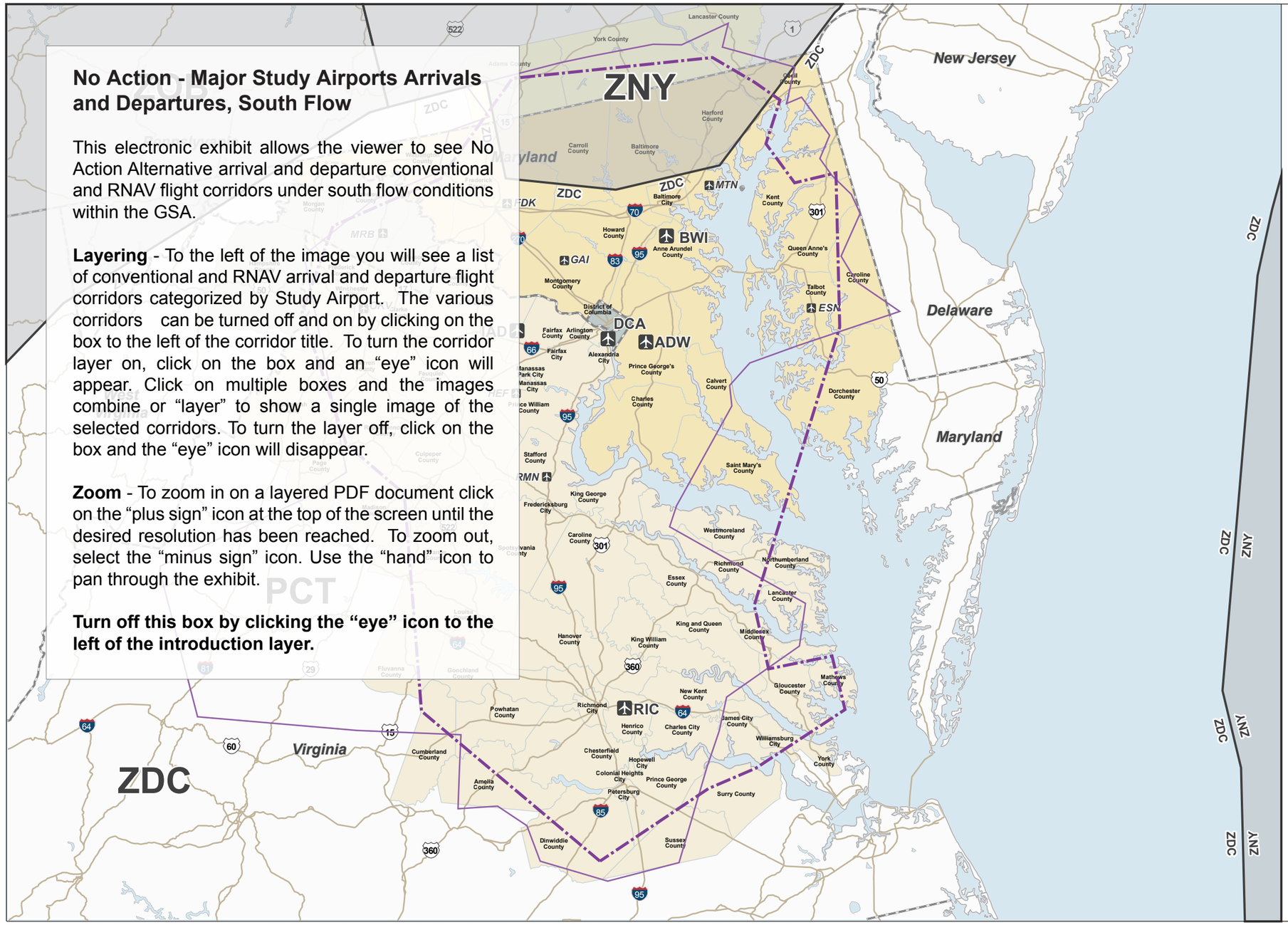
No Action - Major Study Airports Arrivals and Departures, South Flow

This electronic exhibit allows the viewer to see No Action Alternative arrival and departure conventional and RNAV flight corridors under south flow conditions within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

Zoom - To zoom in on a layered PDF document click on the "plus sign" icon at the top of the screen until the desired resolution has been reached. To zoom out, select the "minus sign" icon. Use the "hand" icon to pan through the exhibit.

Turn off this box by clicking the "eye" icon to the left of the introduction layer.



LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Arrival
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

N

0 40 nm

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.

Prepared By: ATAC Corporation, February 2013.

Exhibit 3-7

No Action Alternative - Major Study Airports Arrivals and Departures, South Flow

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No Action - Major Study Airports Arrivals and Departures, North Flow

This electronic exhibit allows the viewer to see No Action Alternative arrival and departure conventional and RNAV flight corridors under north flow conditions within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

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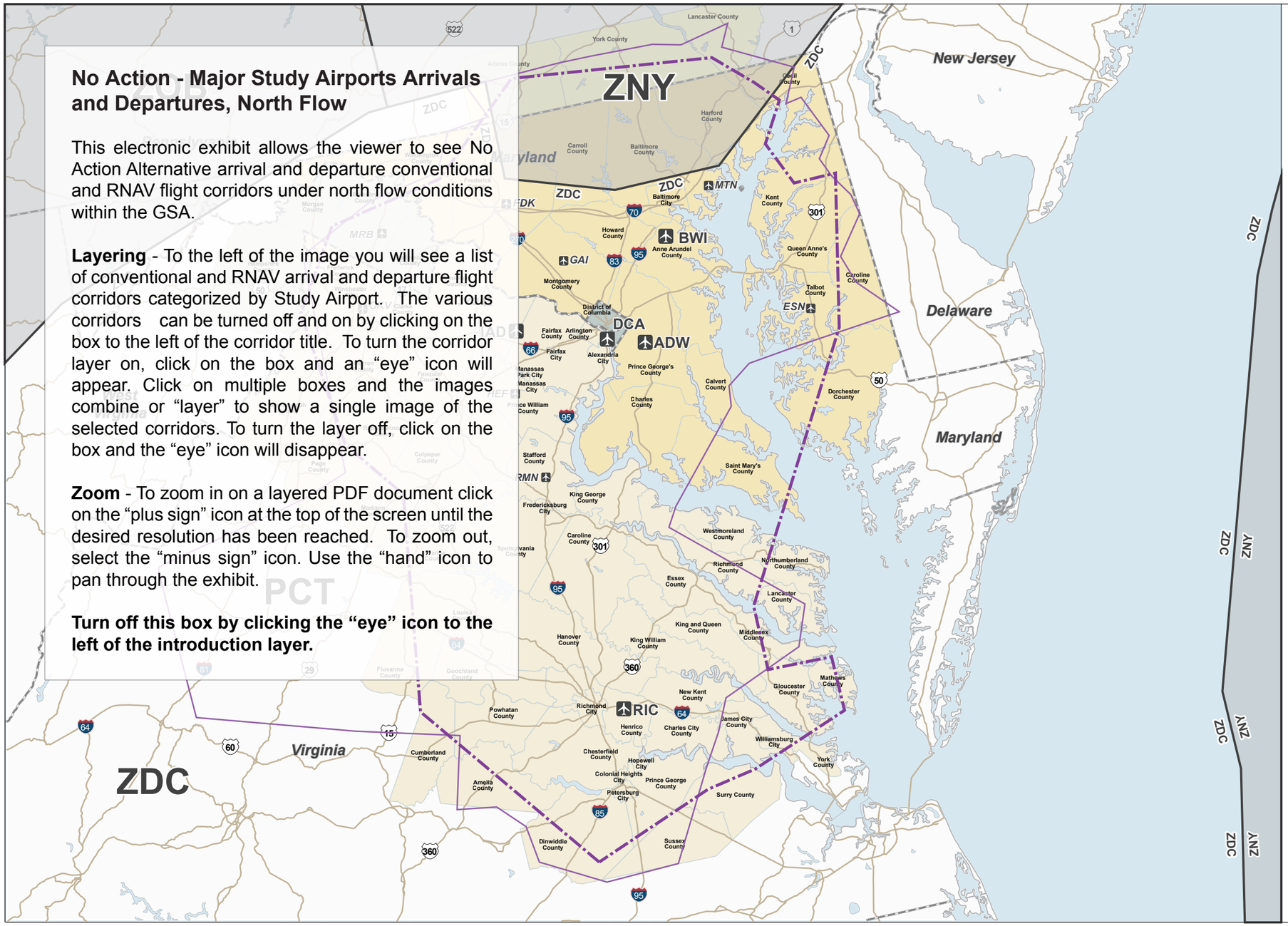
Turn off this box by clicking the "eye" icon to the left of the introduction layer.



LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Arrival
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

N

0 40 nm

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-8

No Action Alternative - Major Study Airports Arrivals and Departures, North Flow

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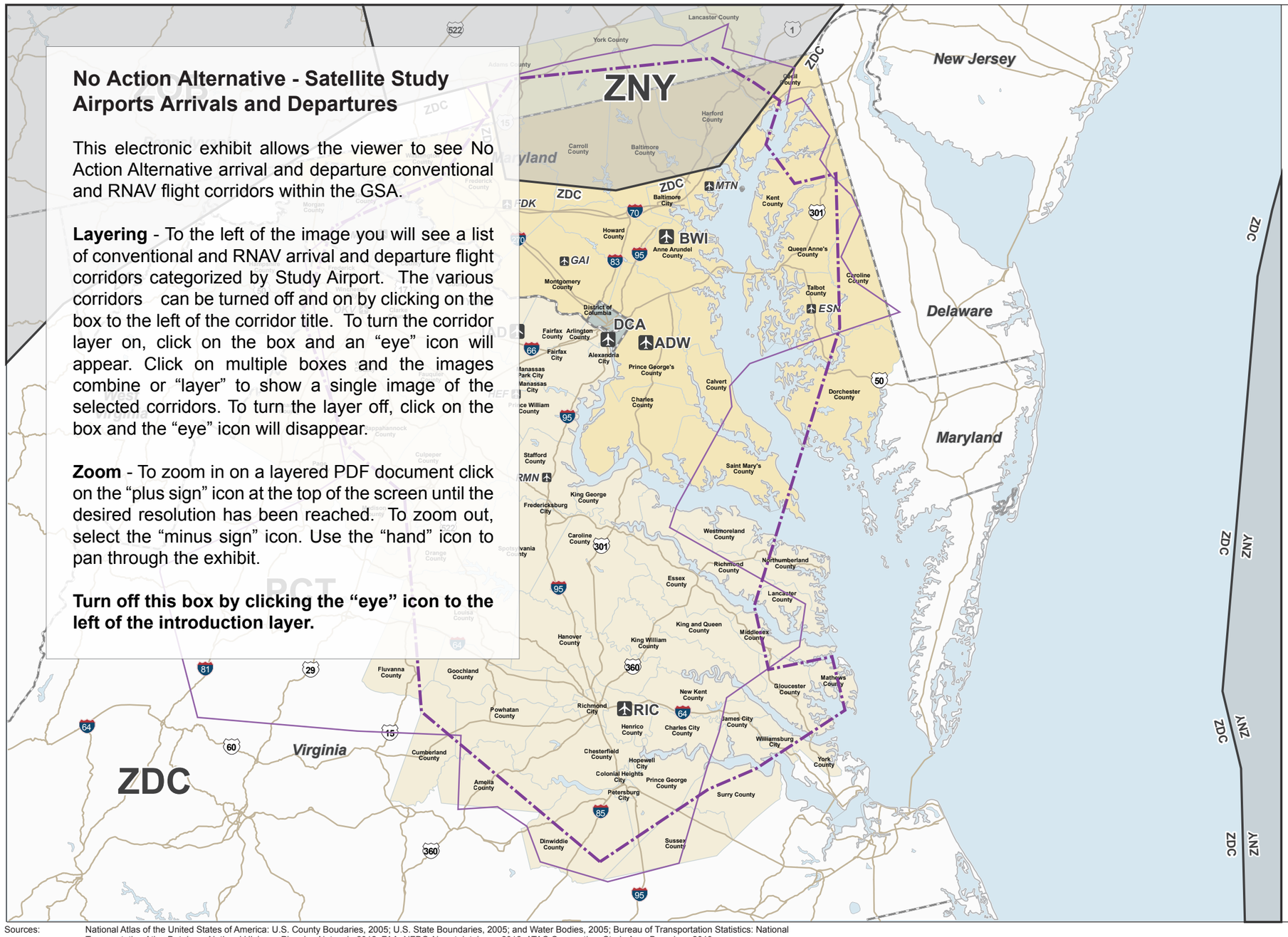
No Action Alternative - Satellite Study Airports Arrivals and Departures

This electronic exhibit allows the viewer to see No Action Alternative arrival and departure conventional and RNAV flight corridors within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

Zoom - To zoom in on a layered PDF document click on the "plus sign" icon at the top of the screen until the desired resolution has been reached. To zoom out, select the "minus sign" icon. Use the "hand" icon to pan through the exhibit.

Turn off this box by clicking the "eye" icon to the left of the introduction layer.



LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Arrival
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

N

0 40 nm

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-9

No Action Alternative Satellite Study Airports Arrivals and Departures

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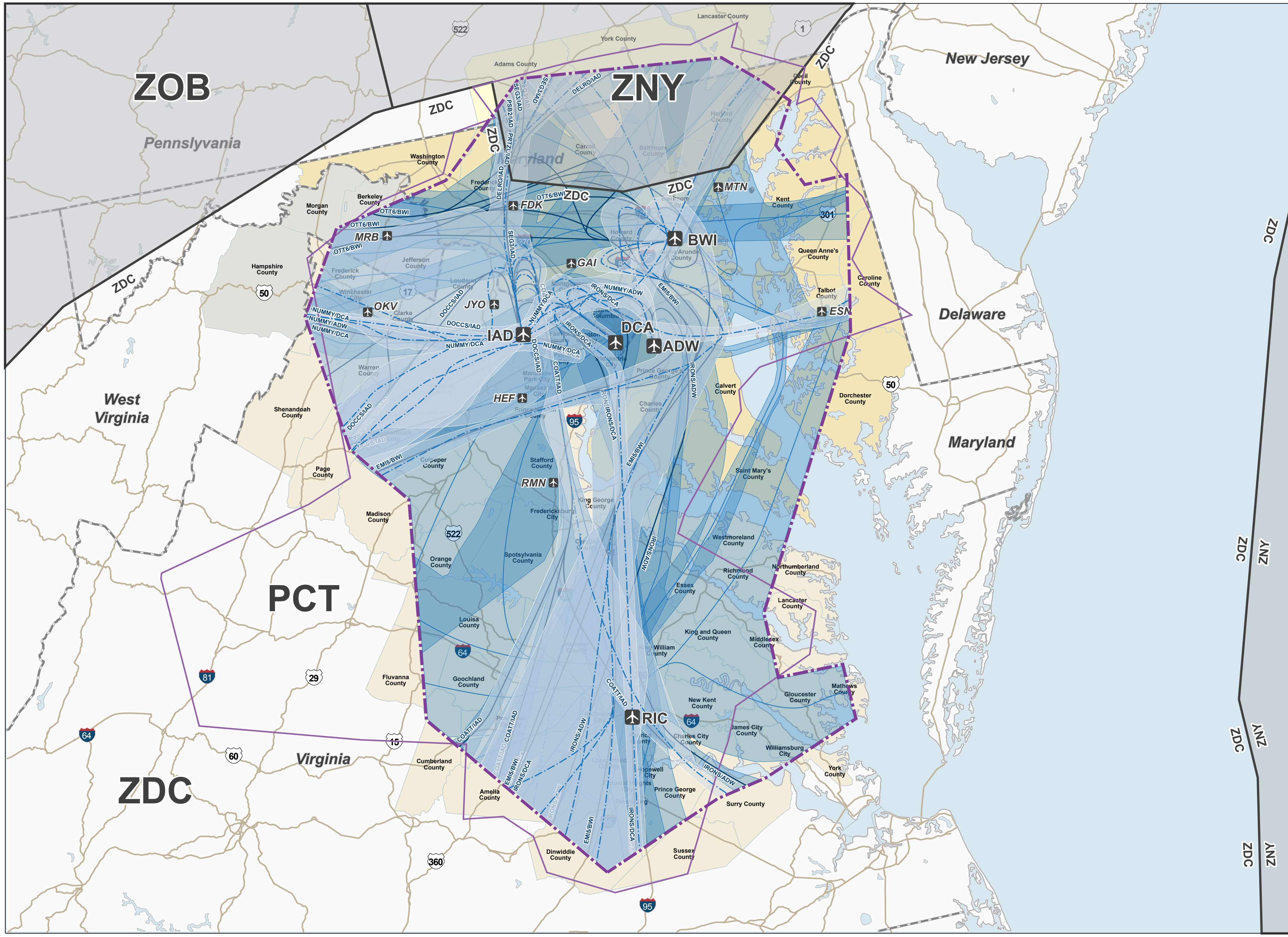

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- RNAV South Arrival
- Radar Vector South Arrival

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.

Prepared By: ATAC Corporation, February 2013.

Exhibit 3-10

No Action Alternative - Major Study Airports Arrivals, South Flow

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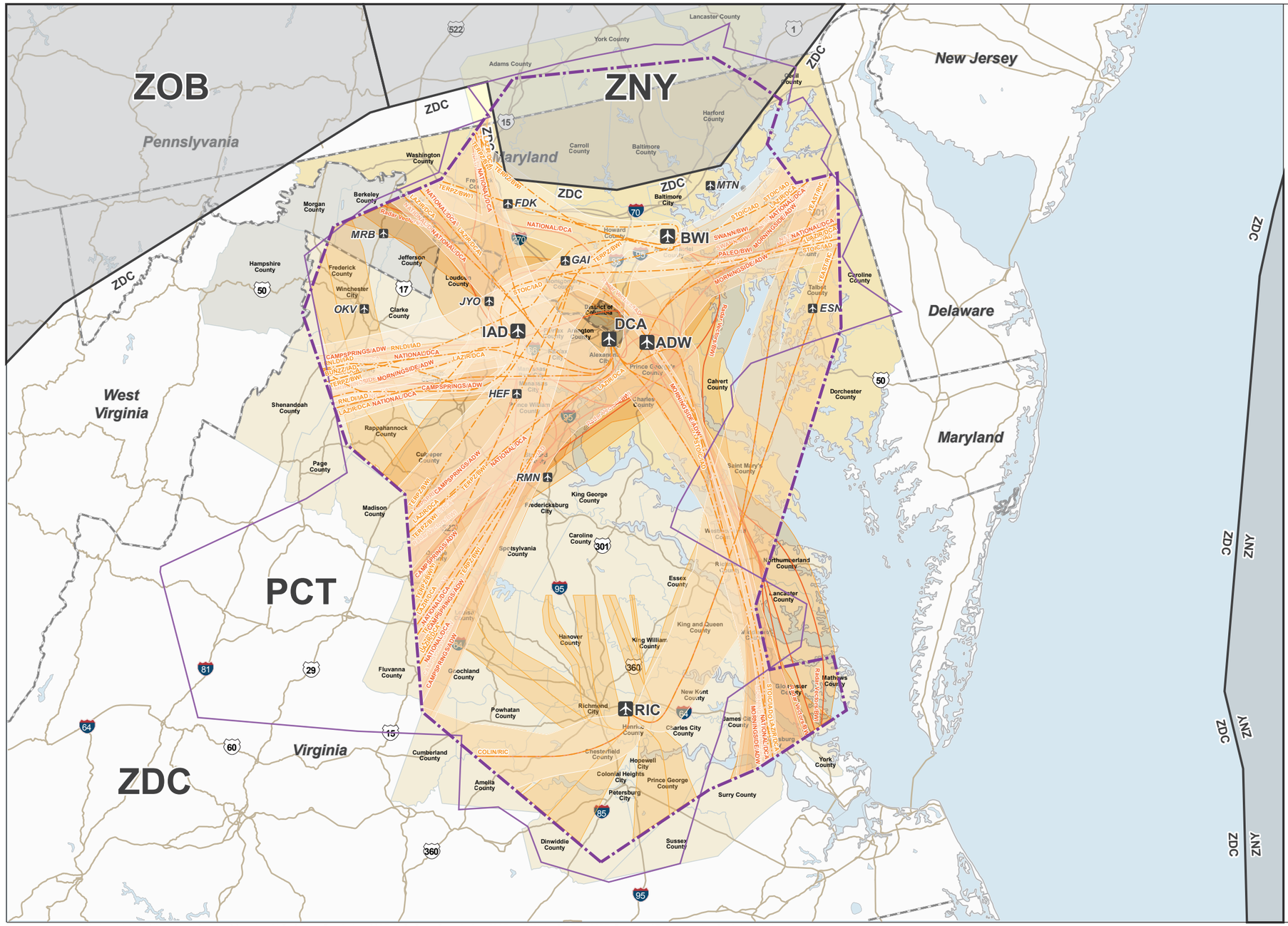

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Departure
- RNAV South Departure
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

N

0 40 nm

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-11

No Action Alternative - Major Study Airports Departures, South Flow

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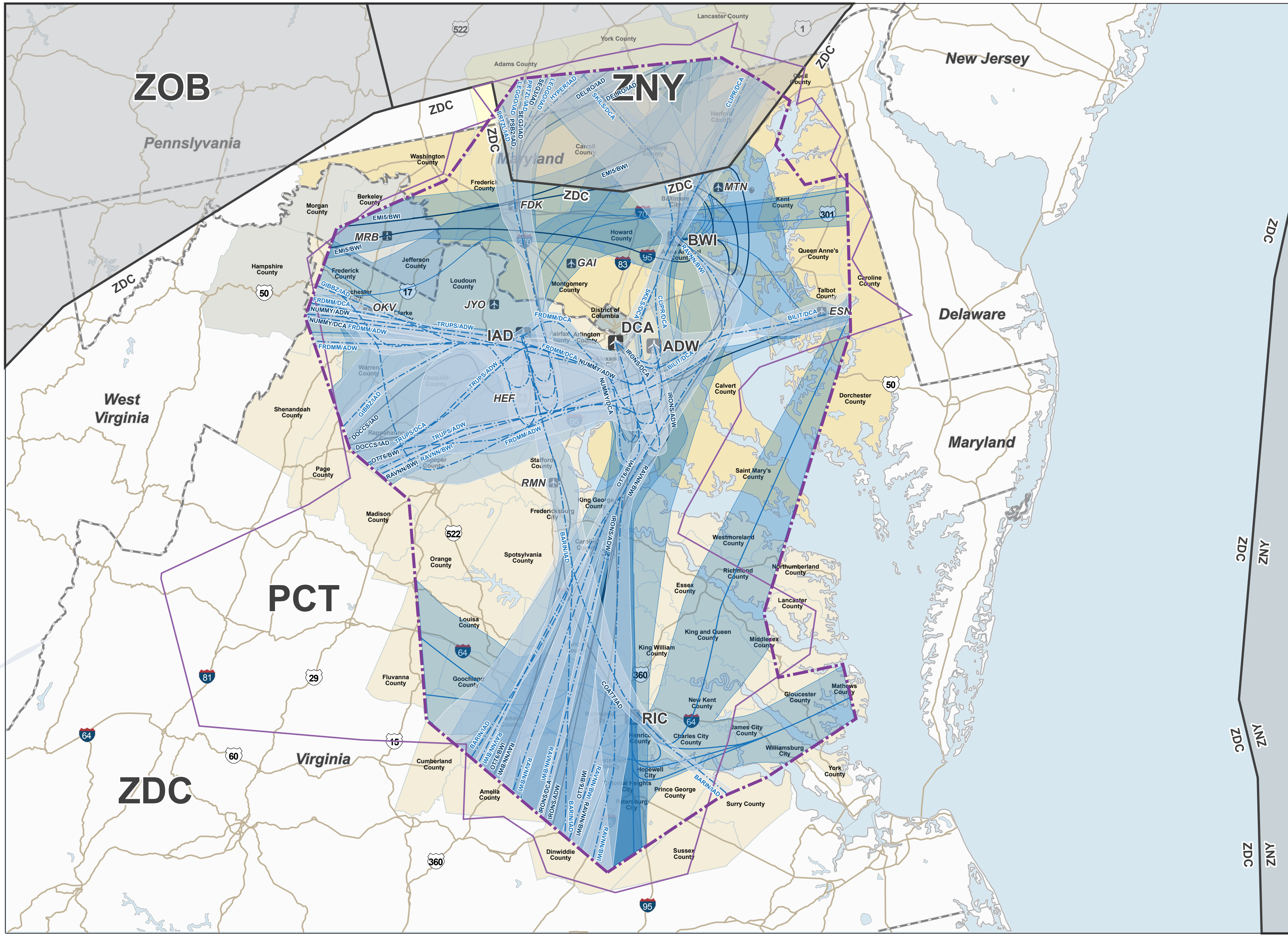

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- RNAV South Arrival
- Radar Vector South Arrival

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Newnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
STAR	Standard Terminal Arrival Route
SID	Standard Instrument Departure
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.

Prepared By: ATAC Corporation, February 2013.

Exhibit 3-12

No Action Alternative - Major Study Airports Arrivals, North Flow

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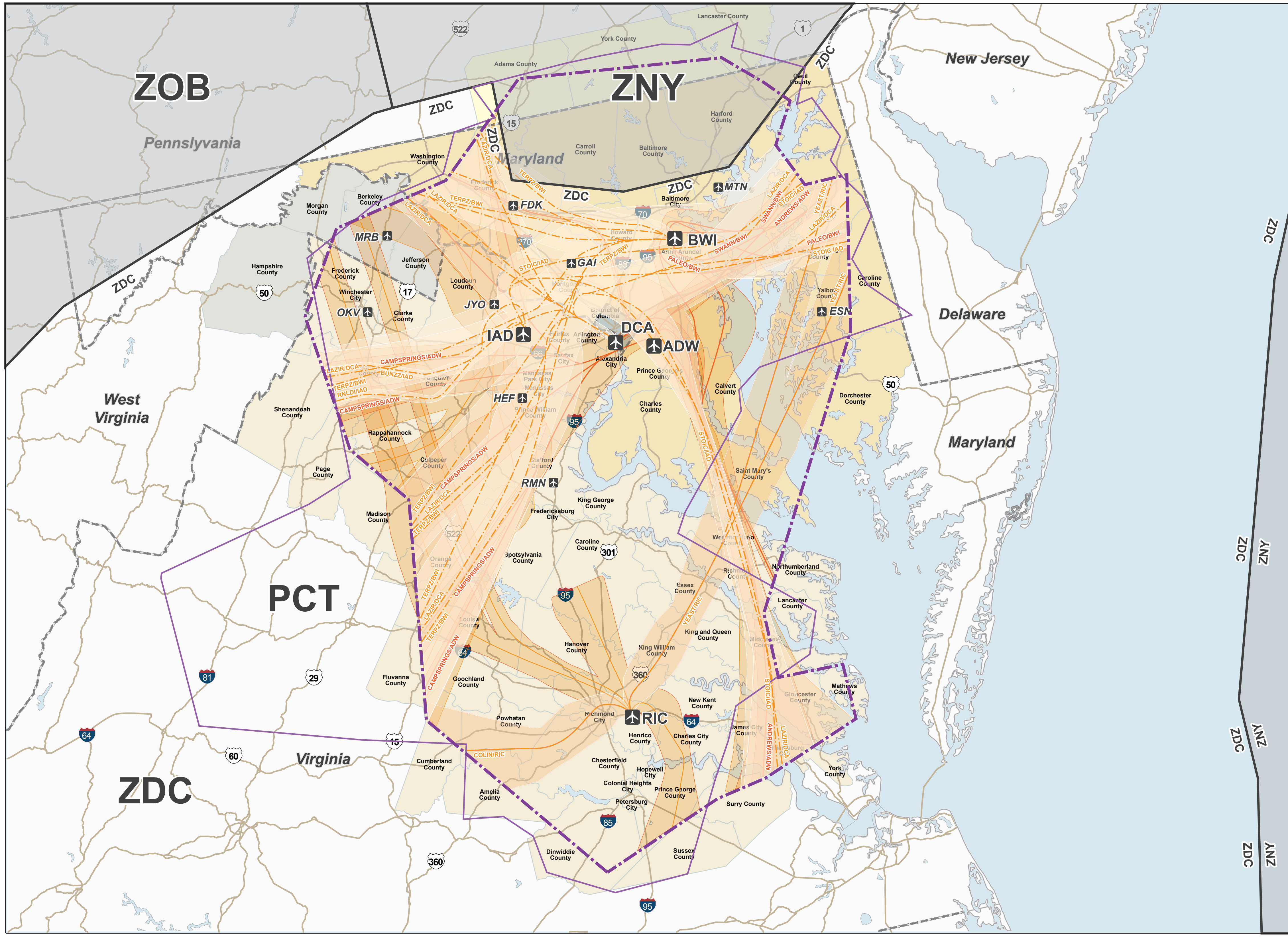

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Departure
- RNAV South Departure
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 — 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.

Prepared By: ATAC Corporation, February 2013.

Exhibit 3-13

No Action Alternative - Major Study Airports Departures, North Flow

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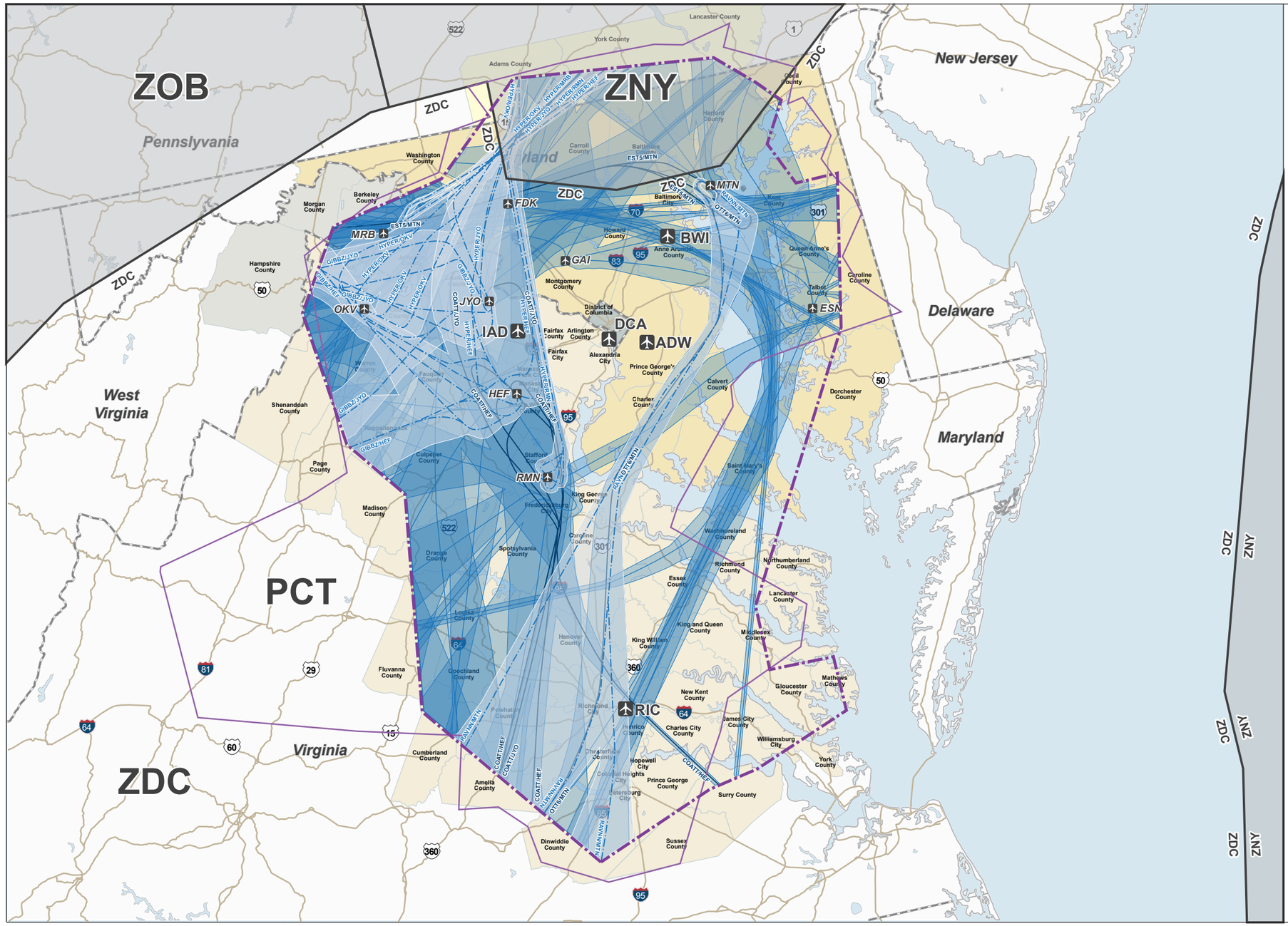

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- RNAV South Arrival
- Radar Vector South Arrival

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Random/Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-14

No Action Alternative
Satellite Study Airports Arrivals

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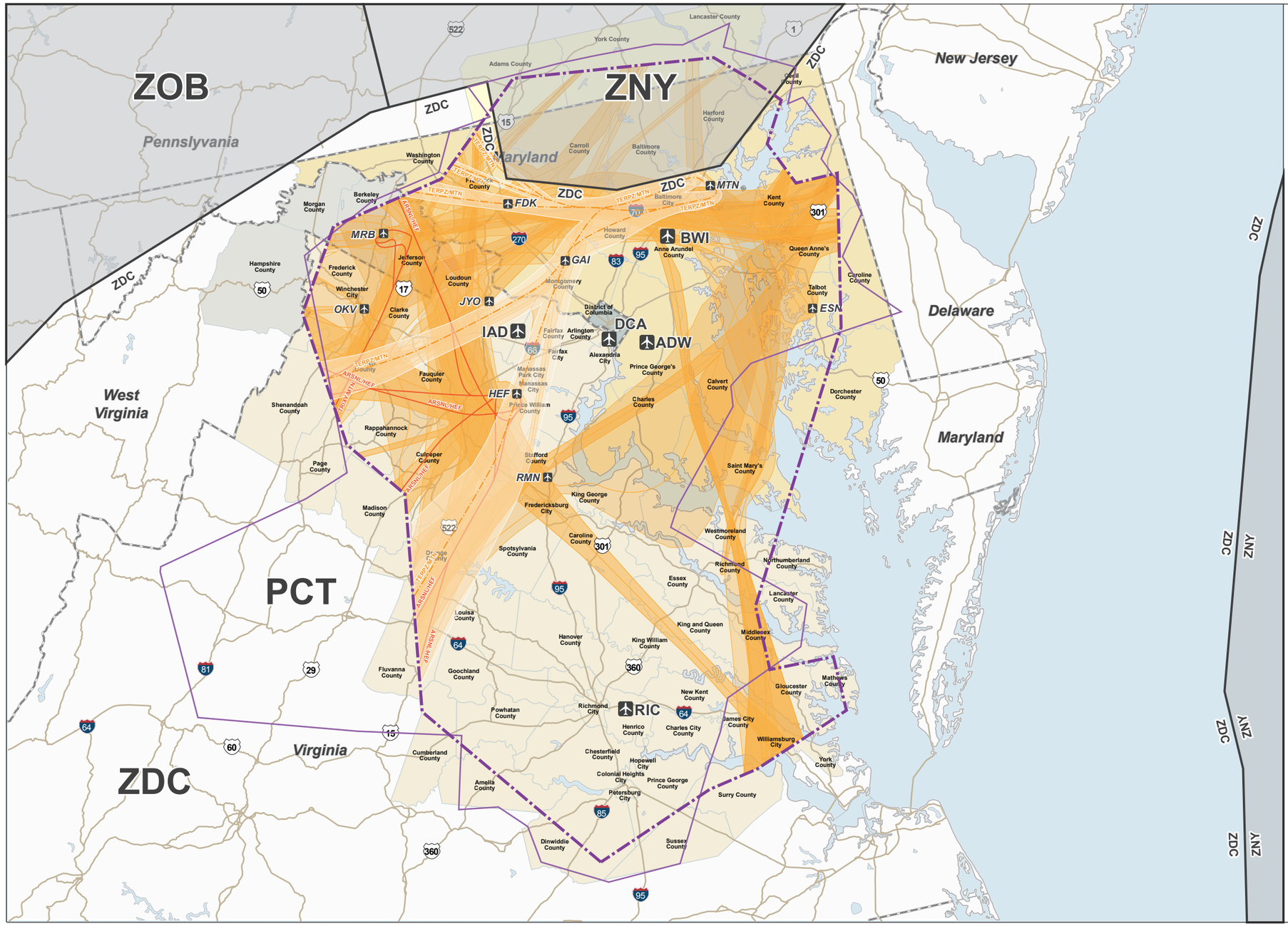

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Departure
- RNAV South Departure
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
BWI	Baltimore/Washington International Thurgood Marshall Airport
ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
ESN	Easton/Nawnam Field Airport
FDK	Frederick Municipal Airport
GAI	Montgomery County Airpark
RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

N

0 40 nm

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-15

No Action Alternative
Satellite Study Airports Departures

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3.2.2 Proposed Action Alternative

As discussed in Section 3.1, the Proposed Action includes the combined Proposed Final Designs for all procedures developed by the D&I Team as well as existing procedures that have been carried forward for continued use. This alternative is expected to add efficiency to airspace usage in the DC Metroplex by improving flexibility in transitioning aircraft, segregating arrivals and departures, and improving the predictability of air traffic flows.

The Proposed Action includes 67 procedures: 38 procedures developed by the D&I Team, 22 existing procedures, and seven previously developed procedures identified as having independent utility that have not yet been implemented. In some cases, the D&I Team determined that existing procedures are efficient and a redesign was unnecessary.[41] Of the 38 new procedures developed by the D&I Team, 21 procedures are SIDs and 17 procedures are STARs. Of the 38 procedures developed by the D&I Team, all but one are RNAV. The 22 existing and seven previously developed procedures are also included as part of the No Action Alternative.

Table 3-2 lists the names of the Proposed Action alternatives, the existing procedure the Proposed Action alternative would replace, the procedure type, and the basis of design (indicated by the type of navigational aid the procedures are based on: NAVAID [shown as VOR, RNAV, or radar vectors]). In addition, the table also shows the airports served by the Proposed Action procedures, the number of runway and enroute transitions for each procedure and, where applicable, by airport, and the entry/exit gates served by the procedure. Finally, the table lists intent of the procedure, including the objectives identified under the purpose and need for the project (predictability, flexibility and/ segregation) that each procedure design achieves. New or updated SIDs and STARs are shaded in gray.

Exhibits 3-16 and **3-17** show all arrival and departure flows to the major Study Airports associated with the Proposed Action during South Flow and North Flow conditions, respectively. Corridors are grouped by procedure type (conventional or RNAV), operation (arrival or departure), and airport. Arrival and departure corridors to/from the satellite Study Airports are shown on **Exhibit 3-18.** Different corridors can be turned on and off on **Exhibits 3-16** through **3-18** by clicking on the boxes that contain the "eye" icon on the left hand side of the exhibit.

Exhibit 3-19 and **Exhibit 3-20** depict the arrival and departure corridors to/from the major Study Airports under South Flow conditions, respectively. Similarly, **Exhibit 3-21** and **Exhibit 3-22** depict the arrival and departure corridors to/from the major Study Airports under North Flow conditions, respectively. **Exhibit 3-23** and **Exhibit 3-24** depict arrivals and departures to the satellite Study Airports, respectively.

[41] More information on the procedure designs can be found in *The Design and Implementation Team Final Report for the D.C. Metroplex*, November 2012.

Table 3-2 Proposed Action Alternative Procedures (1 of 4)

Proposed Action Procedure	No Action Alternative Procedure	Procedure Type	Basis of Design	Airport	Other Study Airports Served	Transition (enroute /runway)	Entry/ Exit Gate Served	Objective
ANDREWS ONE	ANDREWS ONE	SID	Radar Vectors	ADW	None	0/1	North	n/a
ANTHM ONE	No Procedure	STAR	RNAV	BWI	None	1/2	West	Predictability
ARSENAL TWO	ARSENAL TWO	SID	VOR	HEF	None	6/2	North, West	n/a
BULRN ONE	No Procedure	SID	RNAV	IAD	None	4/7	West	Segregation, Predictability
BUNZZ ONE	BUNZZ ONE	SID	RNAV	IAD	None	1/7	West	n/a
BUTRZ ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	West	Segregation, Predictability
CAMP SPRINGS ONE	CAMP SPRINGS ONE	SID	Radar Vectors	ADW	None	0/2	West, South	n/a
CAPITAL EIGHT	CAPITAL EIGHT	SID	Radar Vectors	IAD	None	0/0	North, South, West	Overlay of all RNAV SIDs
CAPPS ONE	OJAAY ONE	STAR	RNAV	DCA	None	2/2	South	Segregation, Predictability, Flexibility
CAVLR ONE	BARIN ONE	STAR	RNAV	IAD	None	3/3	South	Flexibility
CLIPR ONE	CLIPR ONE	STAR	RNAV	DCA	None	1/2	North	n/a
COATT FOUR	COATT FOUR	STAR	VOR	IAD	HEF, JYO	2/0	South	Overlay of HOWLL RNAV STAR
COLIN FIVE	COLIN FIVE	SID	VOR	RIC	None	1/0	South	Overlay of LUCYL RNAV SID
CONLE ONE	No Procedure	SID	RNAV	BWI	MTN, GAI	1/8, (1/0)[1]	South	Segregation, Predictability
DEALE ONE	BILIT ONE	STAR	RNAV	DCA	None	2/2	East	Segregation, Predictability
DELRO TWO	DELRO TWO	STAR	VOR	IAD	None	2/0	North	Overlay of HYPER RNAV STAR
DIXIE ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	South	Segregation, Predictability
DOCCS ONE	DOCCS ONE	STAR	VOR	IAD	JYO	1/2, (1/0)[1]	West	Overlay of GIBBZ RNAV STAR
DOCTR ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	North	Segregation, Predictability
DUCXS ONE	No Procedure	STAR	RNAV	RIC	None	2/3	South	Segregation, Predictability

Table 3-2 Proposed Action Alternative Procedures (2 of 4)

Proposed Action Procedure	No Action Alternative Procedure	Procedure Type	Basis of Design	Airport	Other Study Airports Served	Transition (enroute /runway)	Entry/ Exit Gate Served	Objective
FRDMM ONE	FRDMM ONE	STAR	RNAV	DCA	ADW	1/2, (1/0)	West	n/a
FSTER ONE	PHILIPS-BURG TWO	STAR	VOR	IAD	None	0/1	North	Overlay of GRAVZ RNAV STAR
GABBE ONE	No Procedure	SID	RNAV	HEF	None	4/4	South	Segregation, Predictability
GIBBZ ONE	GIBBZ ONE	STAR	RNAV	IAD	HEF, JYO	3/2, (3/0)	West	n/a
GRAVZ ONE	PRETZL THREE	STAR	RNAV	IAD	None	1/6	North	Segregation, Flexibility
HAFNR ONE	LAZIR THREE	SID	RNAV	DCA	None	2/4	South	Segregation, Predictability
HIICH ONE	No Procedure	SID	RNAV	HEF	None	7/4	North, West	Predictability
HORTO ONE	LAZIR THREE	SID	RNAV	DCA	None	3/4	North	Segregation, Predictability
HYPER FIVE	HYPER FOUR	STAR	RNAV	IAD	MRB,OKV, JYO,HEF, RMN	6/5, (6/0)	North	Segregation, Flexibility
IRONS FOUR	IRONS FOUR	STAR	VOR	ADW	DCA	1/0	West	Overlay of CAPPS RNAV STAR
JCOBY ONE	No Procedure	SID	RNAV	IAD	None	1/7	South	Predictability
JERES ONE	No Procedure	SID	RNAV	IAD	None	0/7	North	Predictability
KALLI ONE	YEAST ONE	SID	RNAV	RIC	None	3/6	North	Segregation, Predictability
LAZIR TWO	LAZIR TWO	SID	RNAV to Radar Vectors	DCA	None	1/2	North, South, West	n/a

Table 3-2 Proposed Action Alternative Procedures (3 of 4)

Proposed Action Procedure	No Action Alternative Procedure	Procedure Type	Basis of Design	Airport	Other Study Airports Served	Transition (enroute /runway)	Entry/ Exit Gate Served	Objective
LEGGO TWO	LEGGO TWO	STAR	RNAV	IAD	None	1/0	North	n/a
LINCN ONE	No Procedure	SID	RNAV	ADW	None	0/0	North	Predictability
LUCYL ONE	COLIN FIVE	SID	RNAV	RIC	None	1/6	South	Segregation, Predictability
MCRAY ONE	No Procedure	SID	RNAV	IAD	None	1/7	North	Predictability
MIIDY ONE	No Procedure	STAR	RNAV	BWI	MTN	1/2, (1/0)	East	Segregation, Predictability
MORNING-SIDE ONE	MORNING-SIDE ONE	SID	Radar Vectors	ADW	None	0/2	North, South	n/a
NATIONAL TWO	NATIONAL TWO	SID	VOR/ DME to Radar Vectors	DCA	None	0/0	North	Overlay for all RNAV SIDs
NOTTING-HAM SIX	NOTTING-HAM SIX	STAR	VOR	BWI	MTN	3/0	West	Overlay of RAVNN RNAV STAR
NUMMY ONE	NUMMY ONE	STAR	VOR	DCA	ADW	1/2 (1/0)	West	Overlay of FRDMM RNAV STAR
PALEO THREE	PALEO THREE	SID	VOR	BWI	None	2/0	North	n/a
POOCH ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	South	Segregation, Predictability
POWTN ONE	No Procedure	STAR	RNAV	RIC	None	1/5	South	Segregation, Predictability
PTOMC ONE	No Procedure	SID	RNAV	JYO	None	0/2	North, South, West	Segregation, Predictability
RAVNN FOUR	RAVNN THREE	STAR	RNAV	BWI	MTN	4/2, (4/0)	West	Segregation, Predictability
REBLL ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	North	Segregation, Predictability
RIGNZ ONE	STOIC TWO	SID	RNAV	IAD	None	3/7	North	Segregation, Predictability
RNLDI ONE	RNLDI ONE	SID	RNAV	IAD	None	1/7	North	n/a
SELINS-GROVE THREE	SELINS-GROVE THREE	STAR	VOR	IAD	None	1/0	North	Overlay of LEGGO RNAV STAR
SKILS TWO	SKILS TWO	STAR	RNAV	DCA	None	2/2	North	n/a

Table 3-2 Proposed Action Alternative Procedures (4 of 4)

Proposed Action Procedure	No Action Alternative Procedure	Procedure Type	Basis of Design	Airport	Other Study Airports Served	Transition (enroute /runway)	Entry/ Exit Gate Served	Objective
SOOKI ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	North	Segregation, Predictability
SPIDR ONE	No Procedure	STAR	RNAV	RIC	None	1/6	West	Segregation, Predictability
SPISY ONE	No Procedure	STAR	RNAV	ADW	None	1/2	East	Segregation, Predictability
SWANN THREE	SWANN THREE	SID	VOR	BWI	None	2/0	North	n/a
TERPZ FOUR	TERPZ THREE	SID	RNAV	BWI	MTN, GAI, ESN	8/8, (8/0)	West, North	Segregation, Predictability
TRIXY FOUR	TRIXY FOUR	SID	VOR	MRB	None	3/2	West, North	n/a
TROYZ ONE	No Procedure	STAR	RNAV	BWI	MTN, FDK, GAI	1/2, (1/0)	North	Segregation, Predictability
TRSTN ONE	No Procedure	STAR	RNAV	JYO	HEF, OKV, GAI, MTN, FDK	2/0, (2/0)	South	Segregation, Predictability
TRUPS ONE	TRUPS ONE	STAR	RNAV	DCA	ADW	2/2, (2/0)	West	n/a
VUDOO ONE	No Procedure	STAR	RNAV	ADW	None	2/2	South	Segregation, Predictability
WEST-MINSTER FIVE	WEST-MINSTER FIVE	STAR	VOR	BWI	MTN	2/0	West	n/a
WIGOL ONE	No Procedure	STAR	RNAV	IAD	None	3/1	North	Flexibility
WYNGZ ONE	LAZIR THREE	SID	RNAV	DCA	None	1/4	South	Segregation, Predictability
YEAST ONE	YEAST ONE	SID	VOR	RIC	None	3/0	North	Overlay of KALLI RNAV SID

Notes:
1\ Indicates enroute and runway transitions for other airports served.
n/a: Not applicable
New or updated SIDs and STARs are shaded in gray.

ADW – Joint Base Andrews
BWI – Baltimore/Washington International Thurgood Marshall Airport
DCA – Ronald Reagan Washington National Airport
IAD – Washington Dulles International Airport
HEF – Manassas Regional Airport/Harry P. Davis Field
MTN – Martin State Airport
JYO – Leesburg Executive Airport
GAI – Montgomery County Airpark
MRB – Eastern WV Regional Airport/Shepherd Field
OKV – Winchester Regional Airport
ESN – Easton/Newnam Field Airport
RMN – Stafford Regional Airport
SID – Standard Instrument Departures
n/a – Not Applicable
STAR – Standard Terminal Arrival Route
RNAV – Area Navigation
VOR – VHF Omnidirectional Range

Source: Proposed Action procedures based on The Design and Implementation Team Final Report for the Washington D.C. Metroplex, March 2013.
Prepared by: ATAC Corporation, April 2013.

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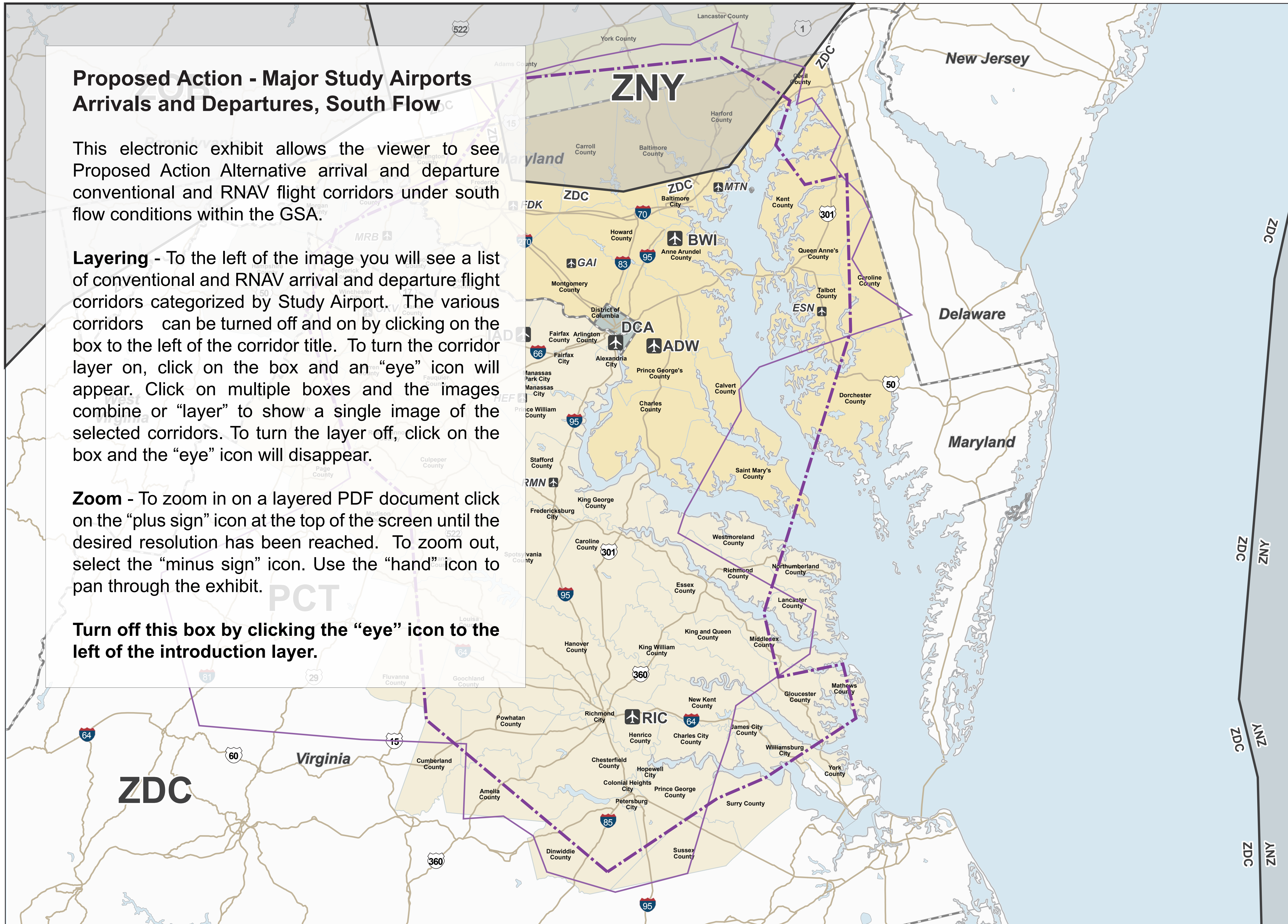

Proposed Action - Major Study Airports Arrivals and Departures, South Flow

This electronic exhibit allows the viewer to see Proposed Action Alternative arrival and departure conventional and RNAV flight corridors under south flow conditions within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

Zoom - To zoom in on a layered PDF document click on the "plus sign" icon at the top of the screen until the desired resolution has been reached. To zoom out, select the "minus sign" icon. Use the "hand" icon to pan through the exhibit.

Turn off this box by clicking the "eye" icon to the left of the introduction layer.

LEGEND

- General Study Area Boundary
- Study Airport
- District of Columbia
- Maryland County in Study Area
- Pennsylvania County in Study Area
- Virginia County in Study Area
- West Virginia County in Study Area
- State Boundary
- U.S. and Interstate Highways
- Water
- Potomac Consolidated TRACON Boundary
- ARTCC Boundary
- Conventional South Arrival
- Conventional South Departure
- RNAV South Arrival
- RNAV South Departure
- Radar Vector South Arrival
- Radar Vector South Departure

Notes:

The electronic version of this document is zoomable.
Corridor shading may vary based on layering of corridors.

DCA	Ronald Reagan Washington National Airport
IAD	Washington Dulles International Airport
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ADW	Joint Base Andrews
RIC	Richmond International Airport
MTN	Martin State Airport
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RMN	Stafford Regional Airport
JYO	Leesburg Executive Airport
HEF	Manassas Regional Airport/Harry P. Davis Field
OKV	Winchester Regional Airport
MRB	Eastern WV Regional Airport/Shepherd Field
RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

0 40 nm

N

Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.

Prepared By: ATAC Corporation, February 2013.

Exhibit 3-16

Proposed Action - Major Study Airports Arrivals and Departures, South Flow

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Proposed Action - Major Study Airports Arrivals and Departures, North Flow

This exhibit allows the viewer to see Proposed Action Alternative arrival and departure conventional and RNAV flight corridors under north flow conditions within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

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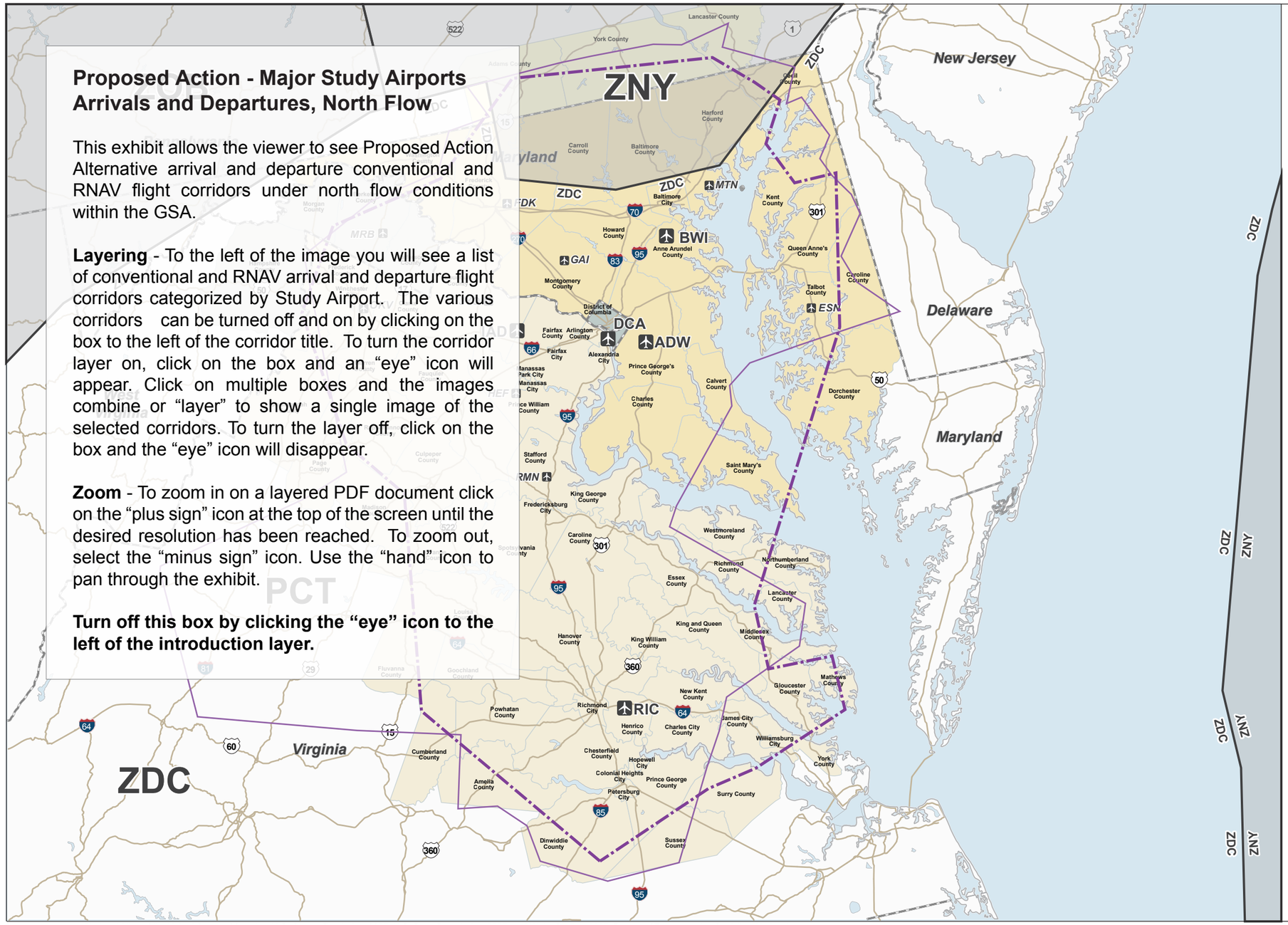

LEGEND

- General Study Area Boundary
- Study Airport
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Projection: Lambert Conformal Conic
Scale: 1,750,000

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Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.

Prepared By: ATAC Corporation, February 2013.

Exhibit 3-17

Proposed Action - Major Study Airports Arrivals and Departures, North Flow

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Proposed Action Alternative - Satellite Study Airports Arrivals and Departures

This exhibit allows the viewer to see Proposed Action Alternative arrival and departure conventional and RNAV flight corridors within the GSA.

Layering - To the left of the image you will see a list of conventional and RNAV arrival and departure flight corridors categorized by Study Airport. The various corridors can be turned off and on by clicking on the box to the left of the corridor title. To turn the corridor layer on, click on the box and an "eye" icon will appear. Click on multiple boxes and the images combine or "layer" to show a single image of the selected corridors. To turn the layer off, click on the box and the "eye" icon will disappear.

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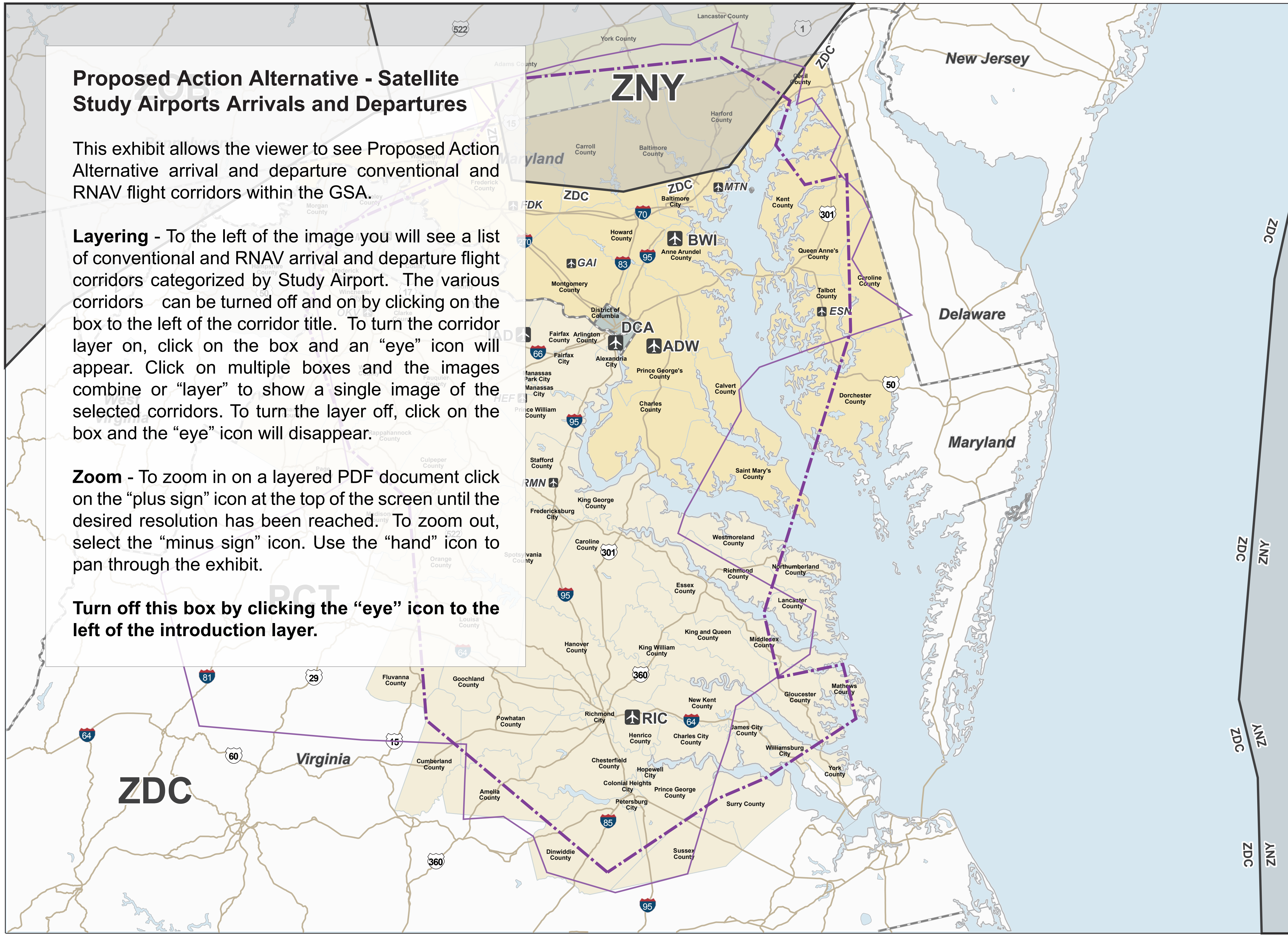

LEGEND

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Projection: Lambert Conformal Conic
Scale: 1,750,000

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Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.

Prepared By: ATAC Corporation, February 2013.

Exhibit 3-18

Proposed Action Satellite Study Airports Arrivals and Departures

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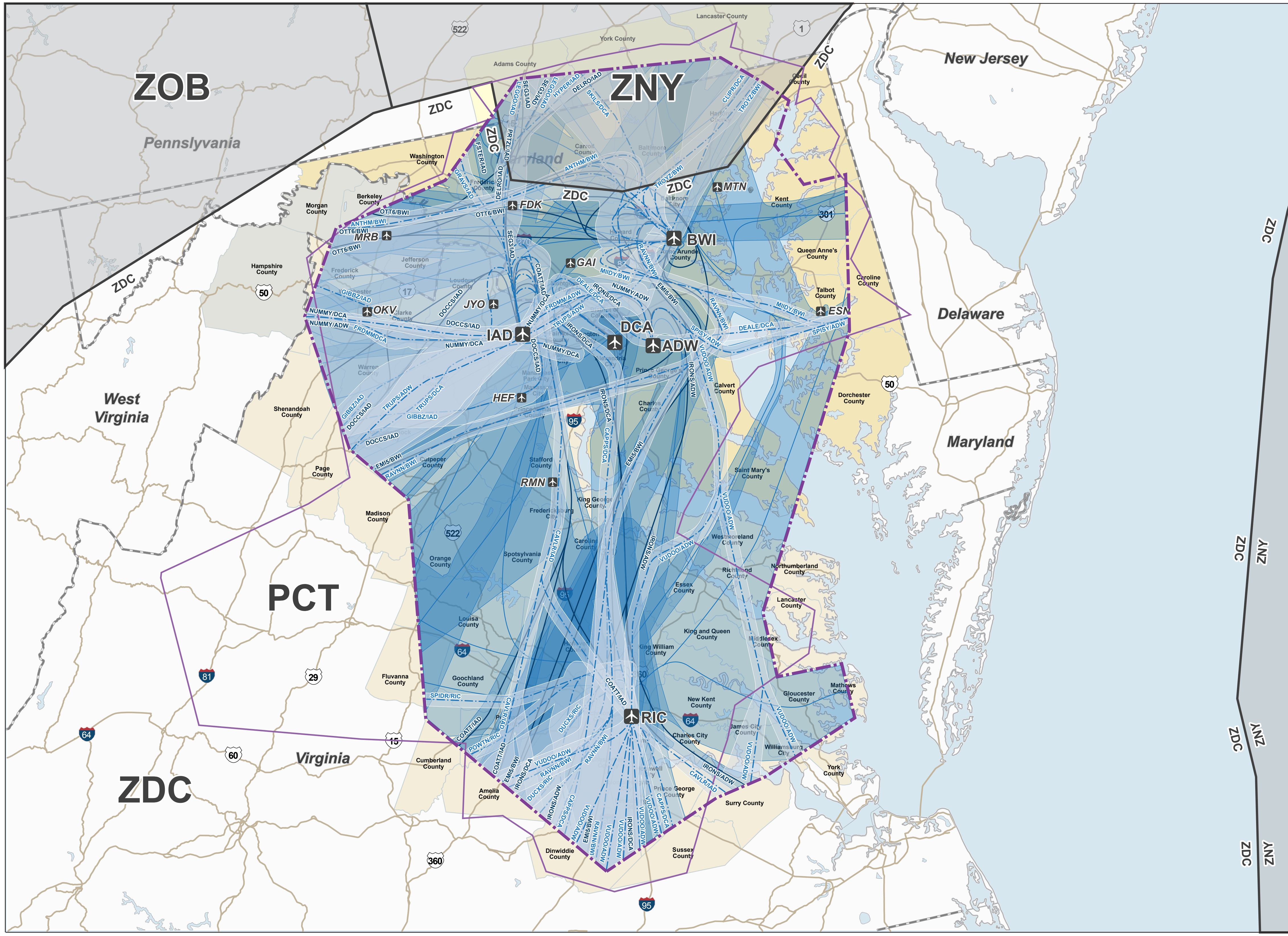

LEGEND

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RNAV	Area Navigation

Projection: Lambert Conformal Conic
Scale: 1,750,000

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Prepared By: ATAC Corporation, February 2013.

Exhibit 3-19

Proposed Action - Major Study Airports Arrivals, South Flow

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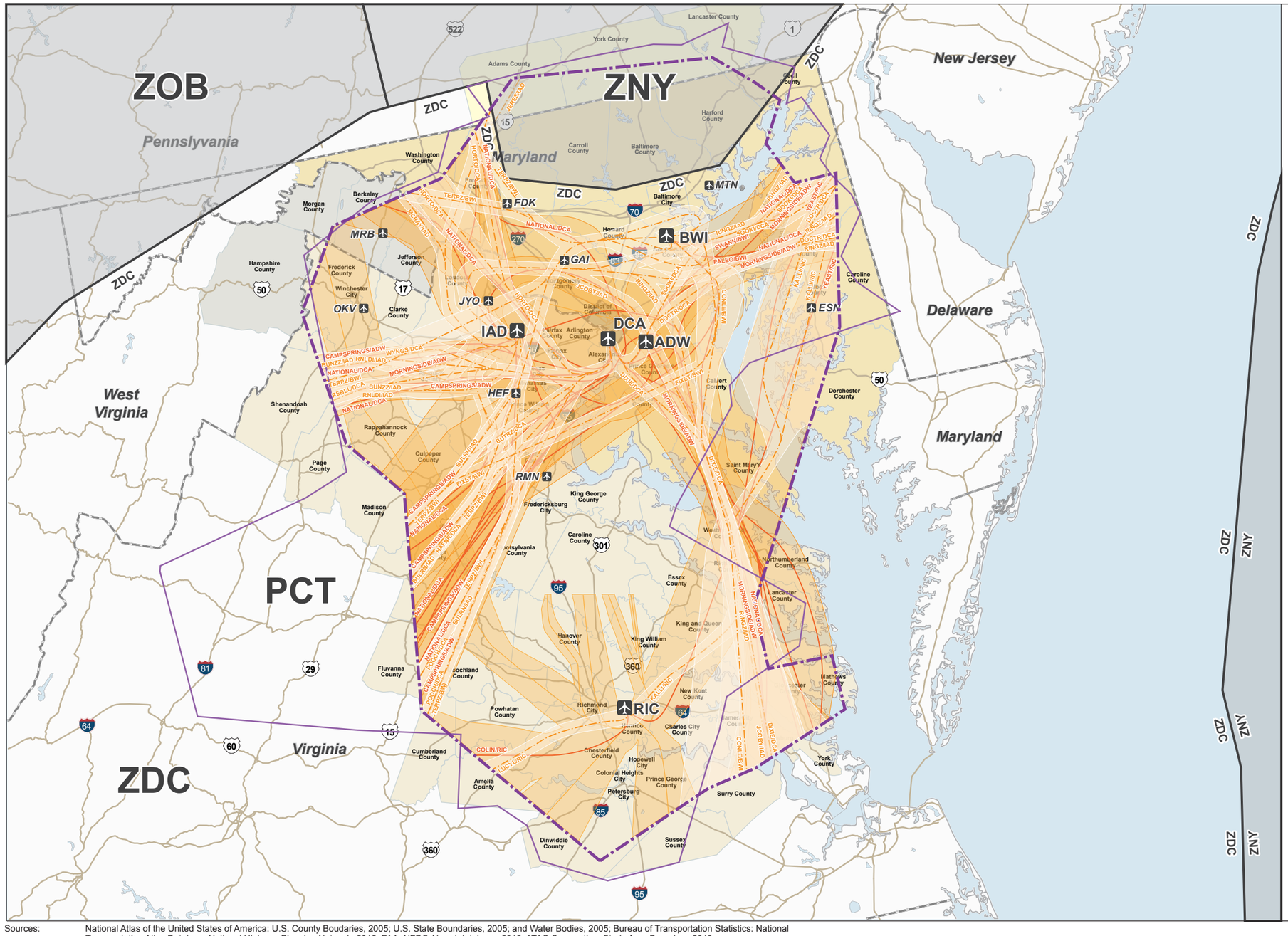

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Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-20

Proposed Action - Major Study Airports Departures, South Flow

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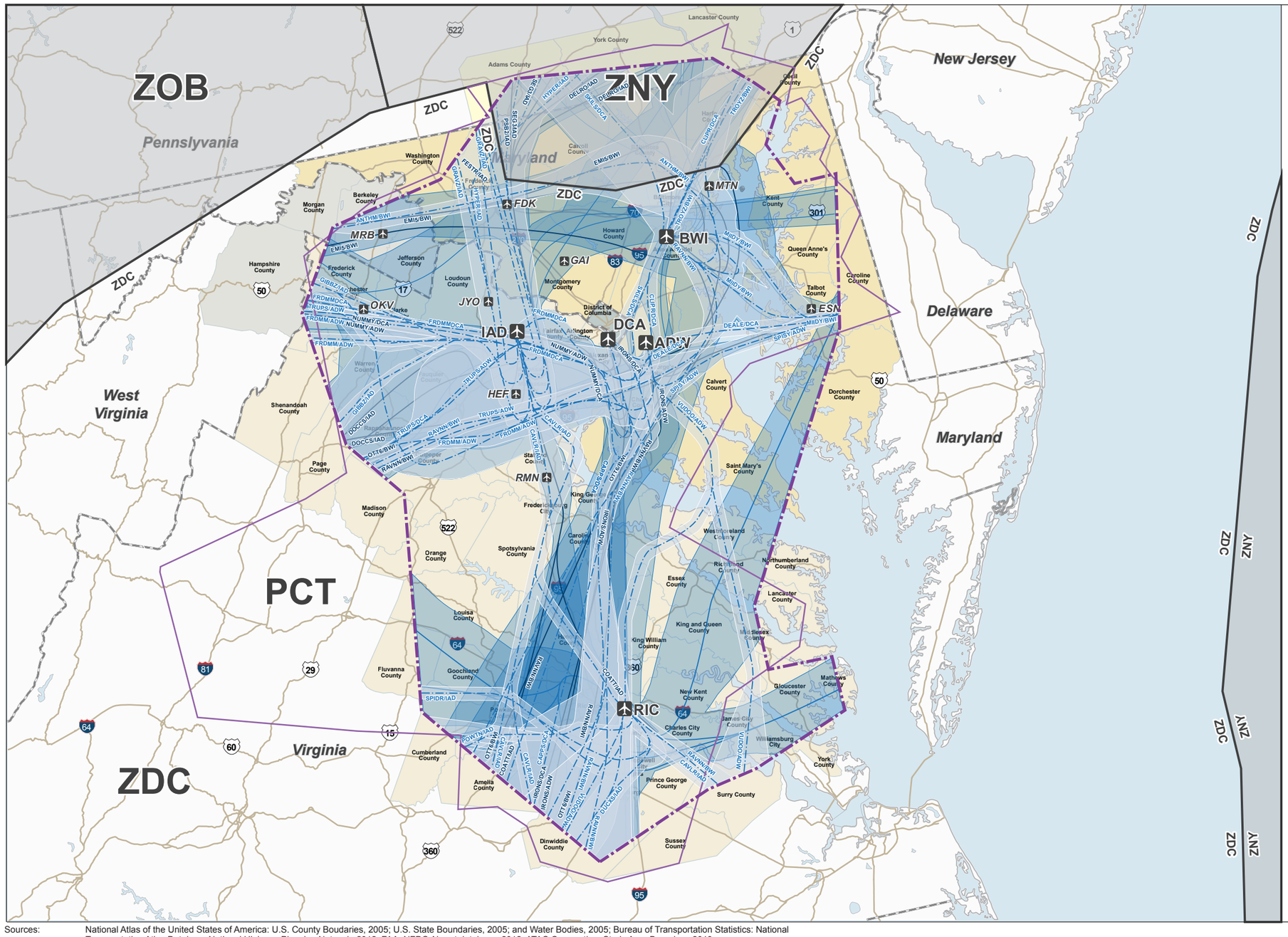

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Prepared By: ATAC Corporation, February 2013.

Exhibit 3-21

Proposed Action - Major Study Airports Arrivals, North Flow

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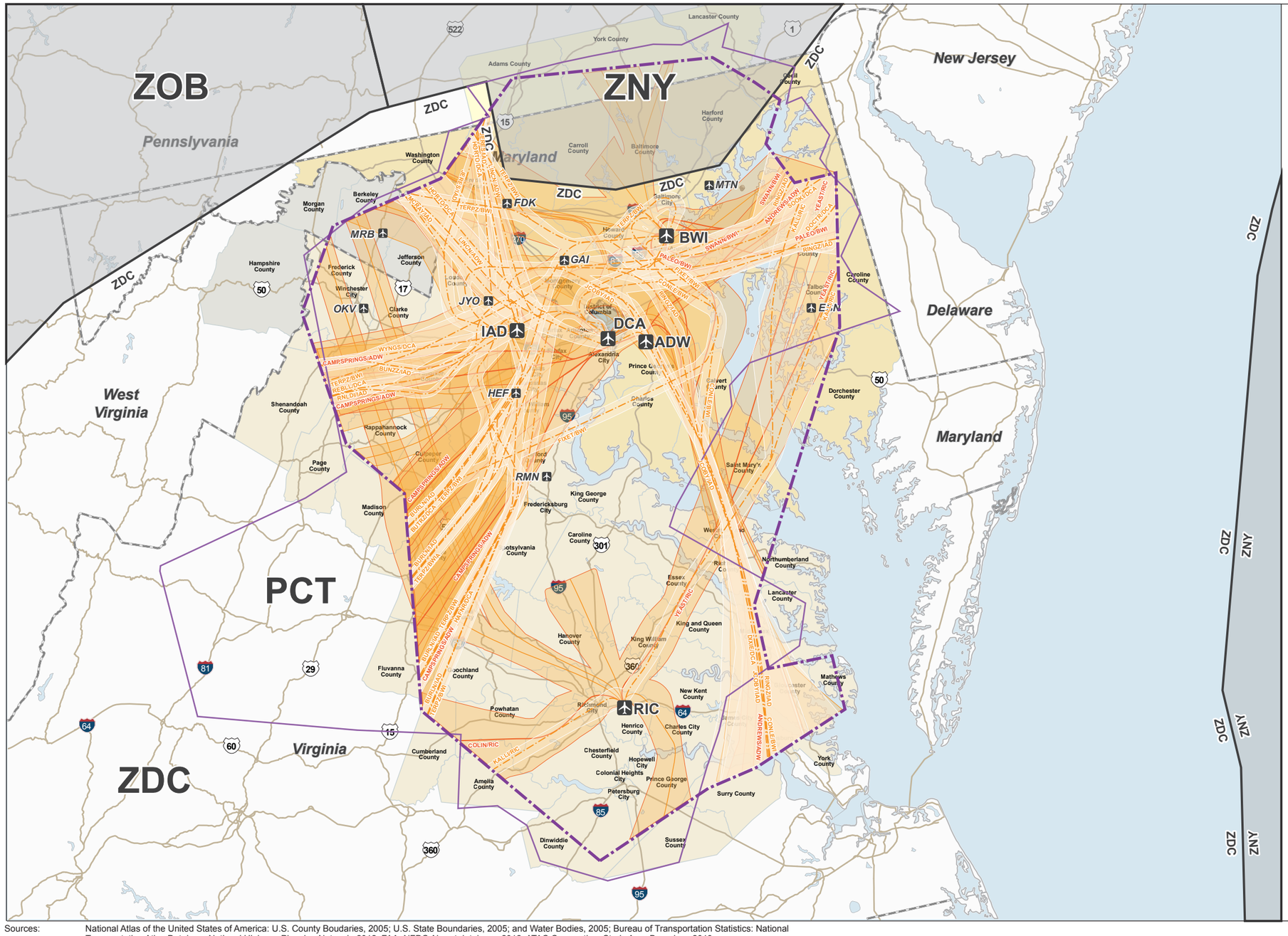

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Projection: Lambert Conformal Conic
Scale: 1,750,000

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Sources: National Atlas of the United States of America: U.S. County Boudaries, 2005; U.S. State Boundaries, 2005; and Water Bodies, 2005; Bureau of Transportation Statistics: National Transportation Atlas Database National Highway Planning Network, 2012; FAA: NFDC Airport database, 2012; ATAC Corporation: Study Area Boundary, 2013.
Prepared By: ATAC Corporation, February 2013.

Exhibit 3-22

Proposed Action - Major Study Airports Departures, North Flow

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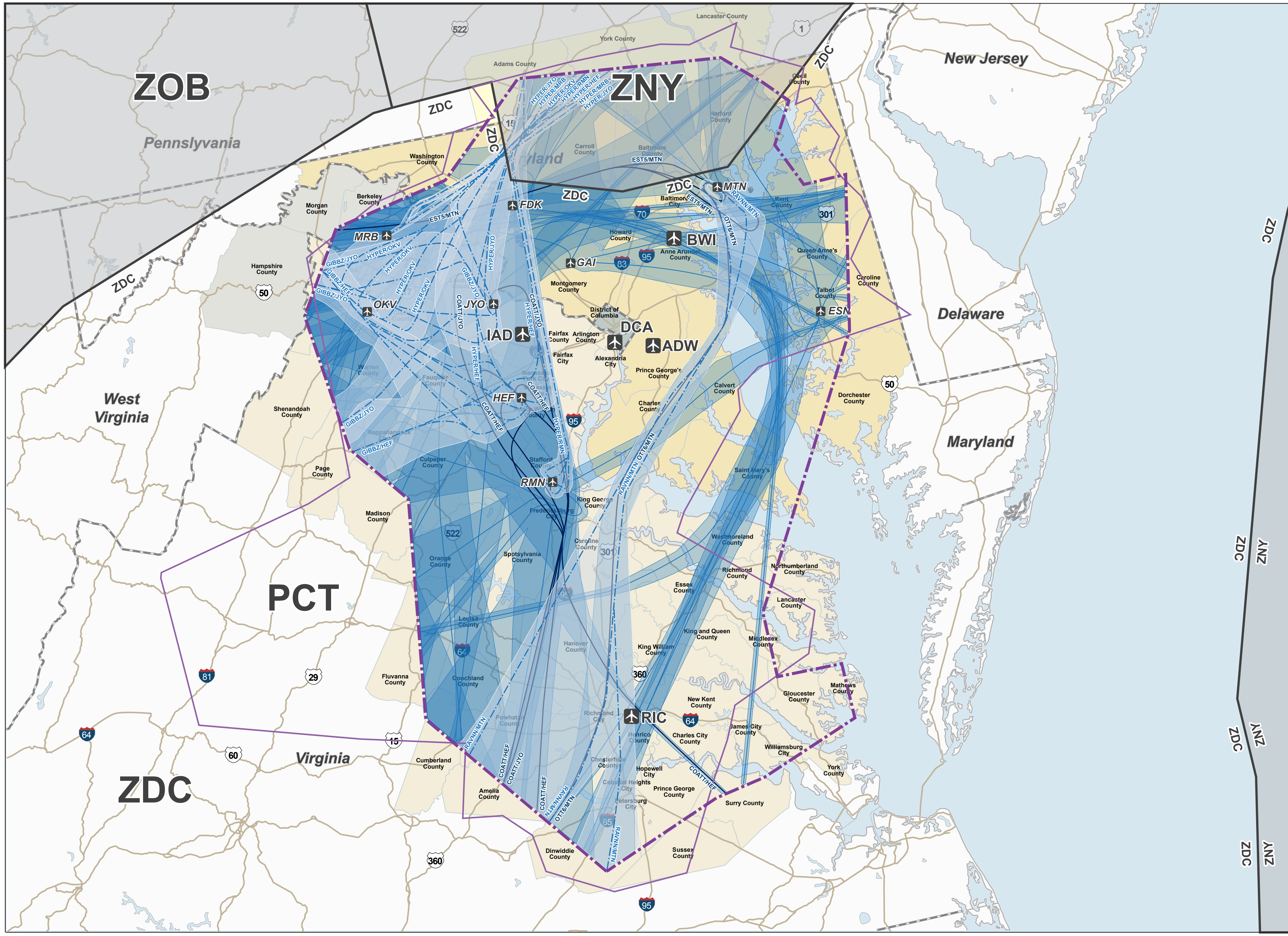

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Projection: Lambert Conformal Conic
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Prepared By: ATAC Corporation, February 2013.

Exhibit 3-23

Proposed Action
Satellite Study Airports Arrivals

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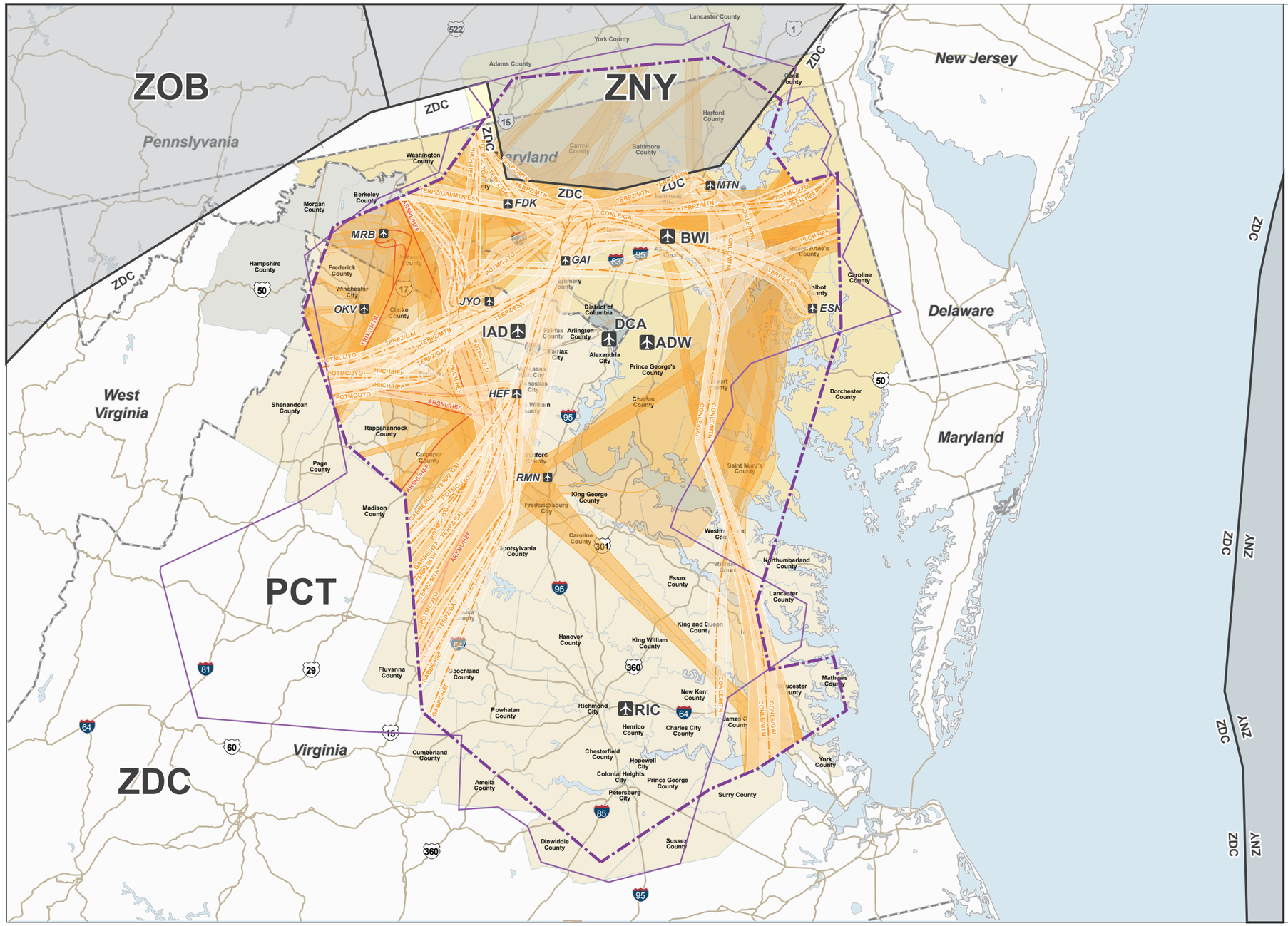

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Prepared By: ATAC Corporation, February 2013.

Exhibit 3-24

Proposed Action
Satellite Study Airports Departures

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3.3 Summary Comparison of the Proposed Action and No Action Alternative

This section provides a comparative summary between the Proposed Action and No Action Alternative based on the objectives defined in Section 2.2:

- Improve the flexibility in transitioning traffic between enroute and terminal area airspace and between terminal area airspace area and the runways;
- Improve the segregation of arrivals and departures in terminal area and enroute airspace; and
- Provide RNAV arrival and departure enroute transitional and terminal area airspace procedures for each individual runway with the intent to provide a more predictable ground and vertical path.

3.3.1 Improve the Flexibility in Transitioning Aircraft

Section 2.2.1 includes two criteria established to measure the objective to increase the flexibility in transitioning aircraft between the terminal and enroute airspace:

- Where possible, increase the number of entry and exit points compared with the No Action Alternative (measured by number of exit/entry points).
- Segregate major Study Airport traffic from other major Study Airport and/or satellite Study Airport traffic to/from Study Airports (measured by count of RNAV STARs and/or SIDs that can be used independently to/from Study Airports).

The efficient use of the DC Metroplex airspace would be improved by providing additional entry and exit points and segregating airport traffic. **Table 3-3** provides a summary comparison of the Proposed Action and No Action Alternative based on the first criteria defined above. The total number of entry and exit points overall would increase under the Proposed Action as compared to the No Action Alternative.

Therefore, the additional entry/exit points exclusive to some Study Airports indicate that the Proposed Action Alternative would achieve the objective to increase the flexibility in transitioning aircraft between the terminal airspace and the enroute airspace. This would be expected to improve the efficiency of the air traffic routes in the DC Metroplex airspace.

The Proposed Action includes 47 RNAV STARs and SIDs, 37 of which can be used independently to the Study Airports. In comparison, the No Action Alternative includes 17 RNAV procedures, 12 of which can be used independently to the Study Airports. The increased number of independent RNAV STARs and SIDs under the Proposed Action indicates that this alternative would better achieve the objective of improving flexibility in transitioning aircraft within the DC Metroplex airspace.

Table 3-3 Alternatives Evaluation: Provide Flexibility in Transitioning Aircraft

Criteria	No Action Alternative	Proposed Action
Entry Points		
Shared with Other Airports	4	14
Exclusive to IAD	0	0
Exclusive to DCA	0	2
Exclusive to BWI	8	5
Exclusive to RIC	3	2
Exclusive to Satellite Airports	5	7
Total	20	30
Exit Points		
Shared with Other Airports	20	28
Exclusive to IAD	0	1
Exclusive to DCA	0	2
Exclusive to BWI	2	1
Exclusive to Satellite Airports	0	2
Total	22	35

Notes:
Blue shading indicates alternative that achieves desired criteria.

Although the number of exit points exclusive to major airport traffic is the same between the DC Metroplex Optimization and the No Action Alternatives, FAA expects that it would dynamically assign exit points using RNAV SIDs exclusively to each of the airports based on operating conditions and demand. From an operational perspective, the Proposed Action Alternative would provide more efficient use of the exit points compared with the No Action Alternative.

Sources: ATAC Corporation based Design and Implementation Team TARGETS Final Design Package dated October 31, 2012, last updated March 29, 2013.
Prepared by: ATAC Corporation, April 2013.

3.3.2 Segregate Arrival and Departure Flows

In Section 2.2.2 one criterion was established to measure the objective to segregate traffic in portions of the airspace where arrival and departure flows cross, converge, or are within proximity of each other:

- Where possible, increase the number of RNAV STARs and SIDs compared with the No Action Alternative (Measured by total count of RNAV STARs and RNAV SIDs for the DC Metroplex.)

The Proposed Action includes 47 RNAV STARs and SIDs. In comparison, the No Action Alternative includes 17 RNAV procedures. Therefore, the additional RNAV STARs and SIDs included under the Proposed Action indicates that this alternative would achieve the objective better segregating air traffic in the DC Metroplex airspace.

3.3.3 Improve Predictability of Air Traffic Flow

In Section 2.2.3, two criteria were established to measure the objective to improve the predictability of air traffic flow in the DC Metroplex airspace:

- Ensure that the majority of STARs and SIDs to and from the Study Airports are based on RNAV technology (measured by count of RNAV STARs and SIDs for an individual Study Airport);

- Increase the number of runway transitions in the RNAV STARs and SIDs in comparison to the No Action Alternative. (measured by count of procedures that include runway transitions to/from runways); and,

RNAV procedures provide for a predictable flow of air traffic and require less controller-to-controller and controller-to-pilot communications to manage air traffic flows through the airspace. Predictability in the DC Metroplex can be further improved by increasing the number of runway transitions and altitude-controlled points defined in the RNAV STARs and SIDs. An increase in the number and use of routes defined by RNAV procedures, especially those that include runway transitions and/or altitude-controlled points, would be expected to decrease the number of controller-to-controller and controller-to-pilot communications. An increase in the number of runway transitions and procedures with altitude controls defined in the RNAV procedures would be expected to improve air traffic controllers' ability to more effectively serve all of the runways at the Study Airports and balance demand across the DC Metroplex while maintaining a predictable flow of air traffic.

Table 3-4 provides a summary comparison of the percentage of procedures based on RNAV technology under the Proposed Action and No Action Alternative; the total number of routes; and the number of RNAV procedures with altitude controls.

The majority of procedures under both the Proposed Action Alternative would be RNAV STARs and SIDs, representing 70 percent of the total number of procedures compared to 57 percent under the No Action Alternative. Overall, the number of routes that transition from/to an entry/exit gate to/from a runway end for the Proposed Action Alternative would increase over the No Action Alternative. Therefore, the Proposed Action Alternative would be expected to provide more predictability requiring less controller-to-controller and controller-to-pilot communications as compared to the No Action Alternative.

Based on the criteria above, the Proposed Action Alternative would provide a total of 47 RNAV STARs and SIDs in the DC Metroplex airspace compared to the 17 RNAV STARs and SIDs provided in the No Action Alternative. This represents an 176 percent increase in the number of RNAV procedures. With the increased number of predictable routes, the Proposed Action would provide better segregation of arrival and departure flows in comparison to the No Action Alternative.

Table 3-4 Alternatives Evaluation: Improve Predictability of Air Traffic Flow

Criteria	No Action Alternative	Proposed Action
Arrival Procedures		
Number of RNAV STARs	12	22
Total Arrival Procedures	21	31
Percent RNAV STARs of Total	57%	70%
Number of Combinations of Entry Points and Runway Ends Served by Runway Transitions in the RNAV STARs for all Study Airports	45	116
Departure Procedures		
Number of RNAV SIDs	5	25
Total Departure Procedures	16	36
Percent RNAV SIDs of Total	31%	70%
Number of Combinations of Runway Ends and Exit Points Served by Runway Transitions in the RNAV SIDs for all Study Airports	29	183

Notes:
Blue Shading = indicates alternative that achieves desired criteria.

Sources: ATAC Corporation based Design and Implementation Team TARGETS Final Design Package dated October 31, 2012, last updated March 29, 2013.
Prepared by: ATAC Corporation, September 2012.

3.4 Preferred Alternative Determination

Of the two alternatives carried forward for analysis, the Proposed Action would better meet the Purpose and Need for the DC OAPM project based on the criteria discussed above. Therefore, the Proposed Action is the Preferred Alternative. Although it would not meet the Purpose and Need, the No Action Alternative was carried forward, as required by CEQ regulations, to establish a benchmark against which decision makers can compare the magnitude of environmental effects of undertaking the Proposed Action.

3.5 Listing of Federal Laws and Regulations Considered

Table 3-5 lists the relevant federal laws and statutes, Executive Orders, and regulations applicable to the Proposed Action and the No Action Alternative and considered in preparation of this EA.

Table 3-5 List of Federal Laws and Regulations Considered – DC OAPM Project (1 of 3)

Federal Laws and Statutes	Citation
National Environmental Policy Act of 1969	42 U.S.C. § 4321 *et seq*.
Clean Air Act of 1970, as amended	42 U.S.C. § 7401 *et seq*.
Department of Transportation Act of 1966, Section 4(f)	49 U.S.C. § 303(c)
Aviation Safety and Noise Abatement Act of 1979	49 U.S.C. § 47501 *et seq*.
Federal Aviation Act of 1958, as amended	49 U.S.C. § 40101 *et seq*.
Endangered Species Act of 1973	16 U.S.C. § 1531 *et seq*.

Table 3-5 List of Federal Laws and Regulations Considered – DC OAPM Project (2 of 3)

Federal Laws and Statutes	Citation
Fish and Wildlife Coordination Act of 1958	16 U.S.C. § 661 *et seq*.
The Bald and Golden Eagle Protection Act of 1940	16 U.S.C. § 668 *et seq*.
Lacey Act of 1900	16 U.S.C. § 3371 et seq.
Migratory Bird Treaty Act of 1918	16 U.S.C. § 703 *et seq*.
National Historic Preservation Act of 1966, as amended	16 U.S.C. § 470
Archaeological and Historic Preservation Act of 1974, as amended	16 U.S.C. § 469 *et seq*.
American Indian Religious Freedom Act of 1978	42 U.S.C. § 1996
Executive Orders	**Citation**
11593, Protection and Enhancement of the Cultural Environment	36 Federal Register (FR) 8921
12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	59 FR 7629
13045, Protection of Children from Environmental Health Risks and Safety Risks	62 FR 19885
Federal Regulations	**Citation**
Council for Environmental Quality Regulations	40 C.F.R. Part 1500 to Part 1508
General Conformity Regulations	40 C.F.R. Part 93 Subpart B
Protection of Historic Properties Regulations	36 C.F.R. 800
Airport Noise Compatibility Planning Regulations	14 C.F.R. Part 150
Federal Aviation Regulations (FAR) Part 71: Designation of Class A, Class B, Class C, Class D, and Class E Airspace Areas; Airways; Routes; and Reporting Points, December 17, 1991.	41 C.F.R. Part 71

FAA/U.S. Department of Transportation Orders

U.S. DOT Order 5680.1: *Final Order to Address Environmental Justice in Low-Income and Minority Populations*, April 14, 1997.
FAA Order 1050.1E, Chng. 1: *Environmental Impacts: Policies and Procedures*, March 20, 2006.
FAA Order 7100.9D, *Standard Terminal Arrival Program and Procedures*, December 15, 2003.
FAA Order 8260.3B, Change 20, *United States Standard for Terminal Instrument Procedures (TERPS)*, December 7, 2007.
FAA Order 8260.40B, *Flight Management System (FMS) Instrument Procedures Development*, December 31, 1998.
FAA Order 8260.44A, Change 2, *Civil Utilization of Area Navigation (RNAV) Departure Procedures*, November 6, 2006.
FAA Order 8260.46D, *Departure Procedure (DP) Program*, August 20, 2009.
FAA Order 8260.48, *Area Navigation (RNAV) Approach Construction Criteria*, April 8, 1999.
FAA Order 8260.52, *United States Standard for Required Navigation Performance (RNP) Approach Procedures with Special Aircraft and Aircrew Authorization Required (SAAAR)*, June 3, 2005.
FAA Order 8260.54A, *The United States Standard for Area Navigation (RNAV)*, December 7, 2007.
FAA Order JO 7110.65U, Air Traffic Control, February 9, 2012.

Table 3-5 List of Federal Laws and Regulations Considered – DC OAPM Project (3 of 3)

FAA Advisory Circulars
FAA Advisory Circular 150/5020-1: *Noise Control and Compatibility Planning for Airports*, August 5, 1983.
FAA Advisory Circular 150/5200-33B: *Hazardous Wildlife Attractants on or near Airports*, August 28, 2007.
FAA Advisory Circular 36-3H: *Estimated Airplane Noise Levels in A-Weighted Decibels*, April 25, 2002.
U.S. DOT Order 5680.1: *Final Order to Address Environmental Justice in Low-Income and Minority Populations*, April 14, 1997.

Source: ATAC Corporation, January 2013.
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