# Reagan National Airport – South of Airport Aircraft Noise Abatement and Mitigation Project

## BASELINE REPORT

A study of aircraft operations and noise exposure impacting communities south of the Reagan National Airport.

vianair

## Executive Summary

In 2015, the Federal Aviation Administration (FAA) implemented changes in airspace and flight procedures for Reagan National Airport (DCA). This was part of a program to upgrade the air transportation system across the United States. This program included modernizing aircraft navigation and flight procedures, including the integration of performance-based navigation (PBN), leveraging advanced satellite navigation technologies, enabling aircraft to follow published flight procedures (flight paths) with high precision and predictability. This improved precision can be extremely beneficial when the assigned flight procedure is over compatible areas such as the Potomac River. However, for flight procedures or flight segments over non-compatible areas, such as residential communities, the increased precision results in what communities often characterize as a "highway in the sky" causing concentrations of overflights along the prescribed flight path.

The Metropolitan Washington Airport Authority (MWAA) operates a Community Working Group (CWG) dedicated to collaboration among key stakeholders, including community representatives, the airport, airlines, and the FAA, to discuss and address aircraft noise issues around DCA. Information about the CWG can be found here: https://www.flyreagan.com/about-airport/aircraft-noise-information/dca-reagan-national-community-working-group.

Following the changes implemented in 2015, the CWG has been working to address the increased impacts to communities surrounding DCA. At the request of the North of Airport Committee (NOA), Arlington and Montgomery Counties hired the consulting team at ABCx2[1] to help assess and mitigate the increase in aircraft noise impacts to communities **north of DCA**.

In 2021 the City of Alexandria, in collaboration with Fairfax and Prince Geroge's County, contracted with Vianair, Inc., to conduct a similar project to assess and mitigate aircraft noise impacts for communities **south of DCA**.

Component 1 of this project includes a baseline assessment intended to analyze the historical and current conditions, including airspace, flight patterns, and noise exposure, then to identify changes in the airspace and flight procedures that the FAA can implement, which will reduce impacts for communities south of the airport.

[1] ABCx2 merged with Vianair, Inc. in January 2022. The ABCx2 consulting team who led the North of Airport project is now leading the South of Airport project.

## Introduction

Aircraft noise has been a growing concern for communities in proximity to Ronald Reagan Washington National Airport (DCA). This is especially true for communities to the north and south of the airport, along the Potomac River. Maximizing overflight of the Potomac River has been the preference from a community perspective, as this reduces overflights and noise exposure in highly noise-sensitive, dense, residential areas.

The Metropolitan Washington Airport Authority (MWAA) operates a Community Working Group (CWG) dedicated to collaboration among key stakeholders, including community representatives, the airport, airlines, and the FAA, to discuss and address aircraft noise issues around DCA. Building on the general recommendations developed by the CWG, Montgomery and Arlington Counties contracted with the consulting firm, ABCx2[2] to develop specific arrival and departure procedures that would reduce noise exposure for residential communities north of DCA. Working with the North of Airport Committee, modifications to the airspace and existing flight procedures were developed. This work was conducted in collaboration with the FAA, MWAA, and the CWG, and resulted in a set of operational and procedural recommendations that were submitted to the FAA. Those recommendations were accepted, and implementation began in 2021.

Following the success of the effort to address flight operations over communities north of the Airport, the City of Alexandria partnered with Fairfax County and Prince George's County to initiate a similar effort for communities to the south. Vianair was hired in 2023 to support this effort.

The DCA South of Airport project includes four (4) components or areas of support. These include:

**Component I:** Baseline Assessment – Analysis of aircraft operations and noise exposure (historical and current conditions) south of DCA

**Component II:** Identification and Evaluation of Alternatives to Reduce Aircraft Noise

**Component III:** Community Outreach and Engagement

**Component IV:** Industry Advocacy and Implementation Support

[2] ABCx2 merged with Vianair, Inc. in January 2022. The ABCx2 consulting team who led the North of Airport project is now leading the South of Airport project.

This Baseline Assessment Summary Report is the main deliverable for Component I and will help the project team, Steering Committee, and Design Team understand the current conditions and will provide historical context. This in turn will help inform Component II, which includes identification and evaluation of strategies (i.e., airspace changes and flight procedures) to reduce aircraft noise impacts in communities south of DCA.

## Airport Location and Governance

Reagan Washington National Airport is located in Arlington County, Virginia, situated on the west bank of the Potomac River, south of the Capital Mall in Washington, D.C. The Airport is bordered by the Potomac River on the north, east, and south. The Potomac River runs south from the airport, providing an ideal corridor for flights departing and landing on DCA's primary runway (RWY 1-19).

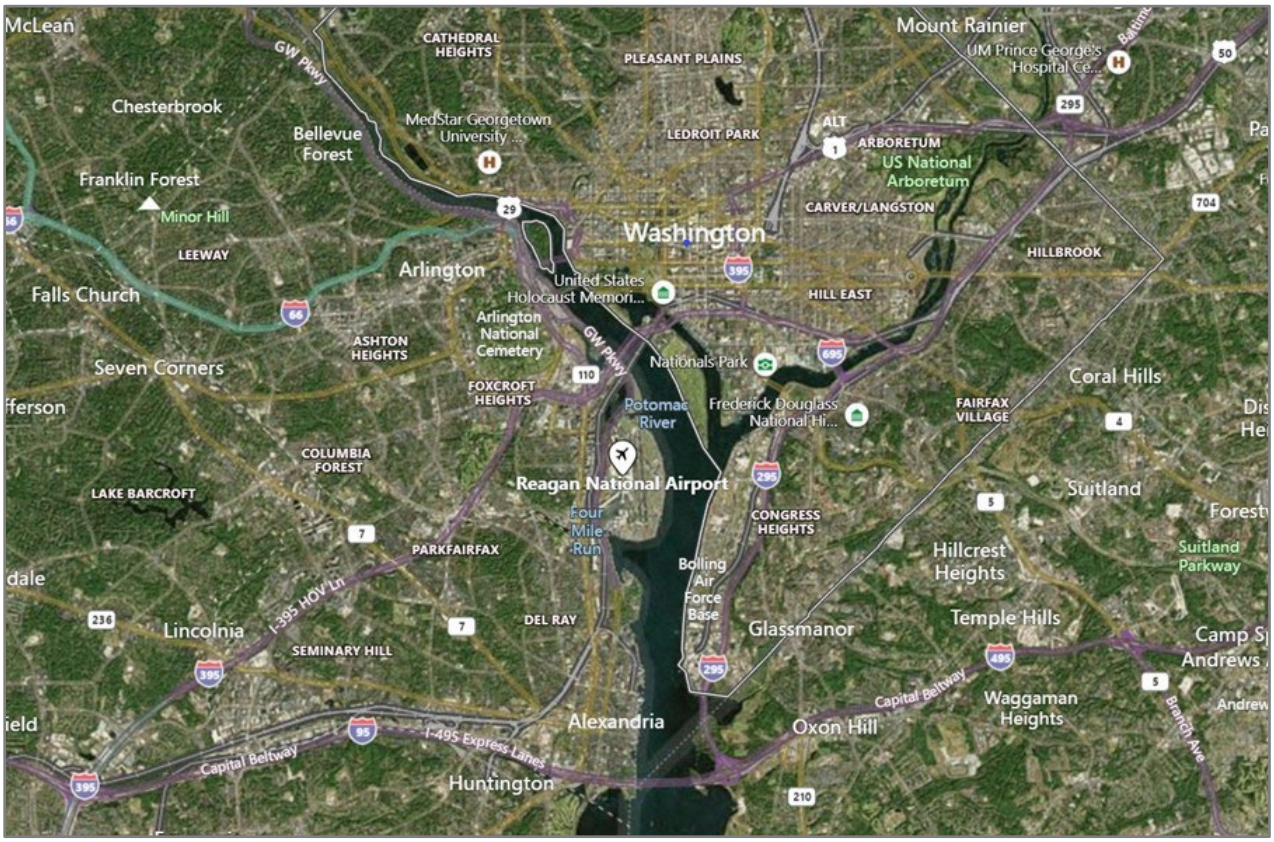


*Figure 1 - Regional Map. (Source: Bing Maps)*

## Airport Layout

DCA has three runways. Runway 1-19 is the primary runway, orientated in a north-south direction), with a length of 7,169 feet. Runway 15-33 is 5,204 feet long and Runway 4-22 is 5,000 feet long. (See Figure 2 below.)


*Figure 2 - Airfield Layout*

## Runway Use

RWY 1-19 is the primary runway at DCA and accounts for approximately 90% of total annual operations. This is the longest runway at DCA and is closely aligned with the Potomac River, particularly to the south, enabling flight procedures that maximize overflight of the river corridor.

Runway use is based primarily on wind conditions. Aircraft typically land and depart into the wind. So, during **South Flow** (winds coming from the south/southeast), aircraft arrive and depart to the south/southeast using runways 15, 22, and 19. During **North Flow** (winds coming from the north or northwest) aircraft arrive and depart to the north/northwest using runways 1, 04, and 33. MWAA data[3] indicates DCA operations utilize a North Flow approximately 60% of the year.

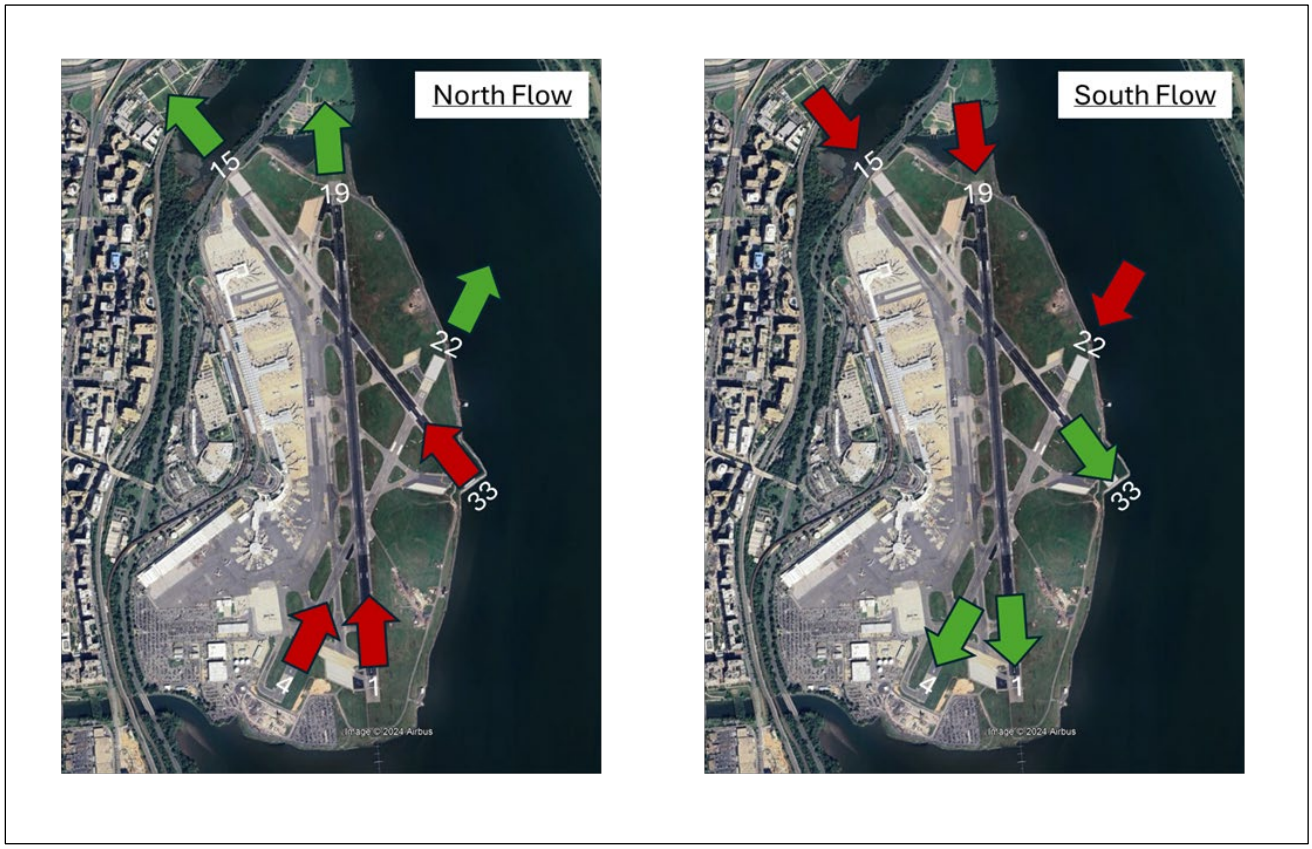


*Figure 3 - DCA South and North Flow Runway Use*

[3] Source: MWAA Annual Aircraft Noise Reports, 2000-2022

Changes in runway use can result in noticeable differences in the number of community overflights and aircraft noise exposure. A review of runway use data was conducted for the period between 2015 and 2023. The results of this analysis showed consistent runway use patterns for the entire period. Runway 1 (north flow) accounted for an average of 58% of arrivals and 60% of total departures annually, over this period.

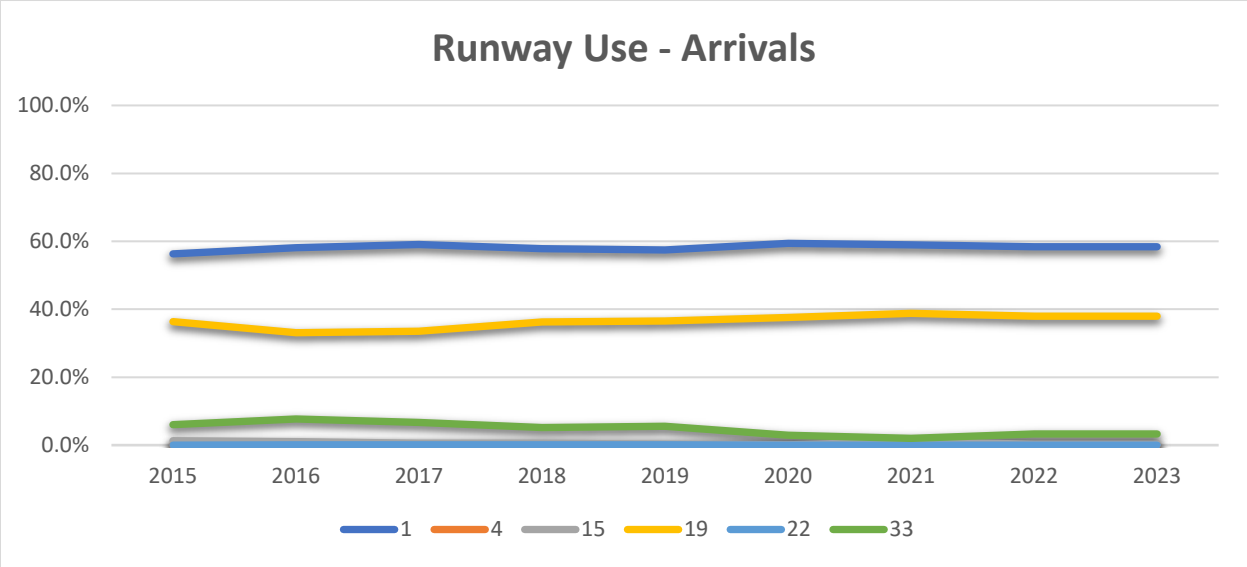


*Table 1 - Annual Runway Use - Arrivals*

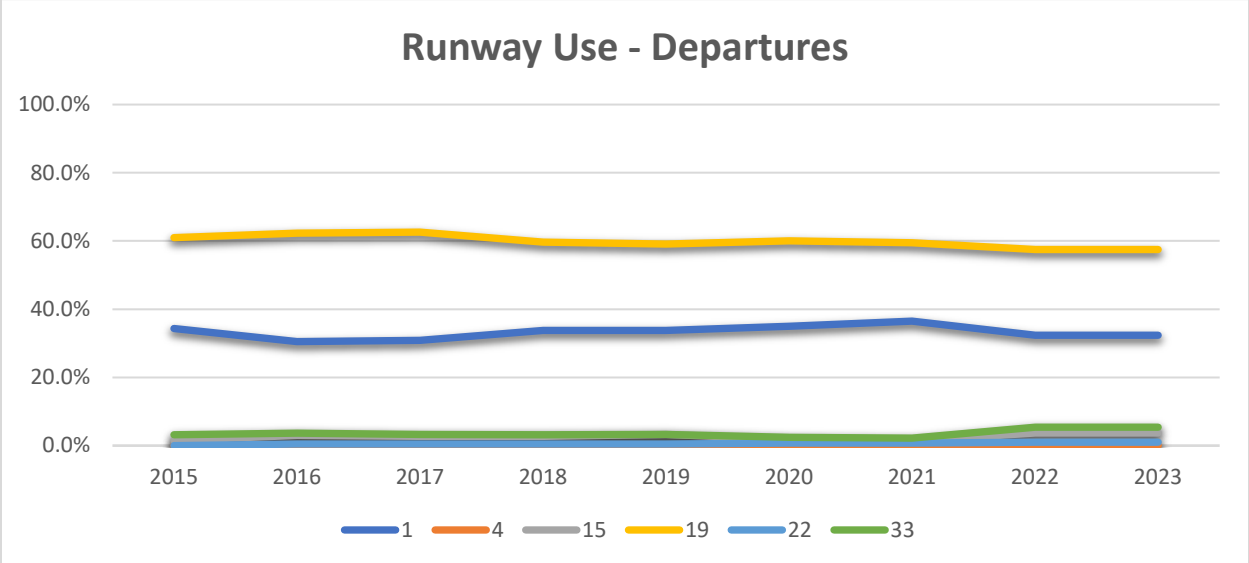


*Table 2 - Annual Runway Use - Departures*

## Annual Operations

Runway use patterns did not appear to vary over the study period. However, total operations can have a significant impact on what individual communities observe in terms of total overflights and noise exposure. A review of total annual operations revealed that total annual operations levels were flat between 2015-2019, averaging around 293,000 operations each year. Then in 2020, the COVID pandemic resulted in a drastic drop in air travel across the United States and the world. Total operations in 2020 dropped to just over 131,000, equating to a drop of approximately 55% from the prior year. Through 2021 and 2022, aircraft operations across the US recovered and, as of 2023, total operations at DCA exceeded 2019 numbers, resulting in the highest total operations since 2001. *(Annual operations dropped drastically in 2002, following the terrorist events of September 11, 2001).*

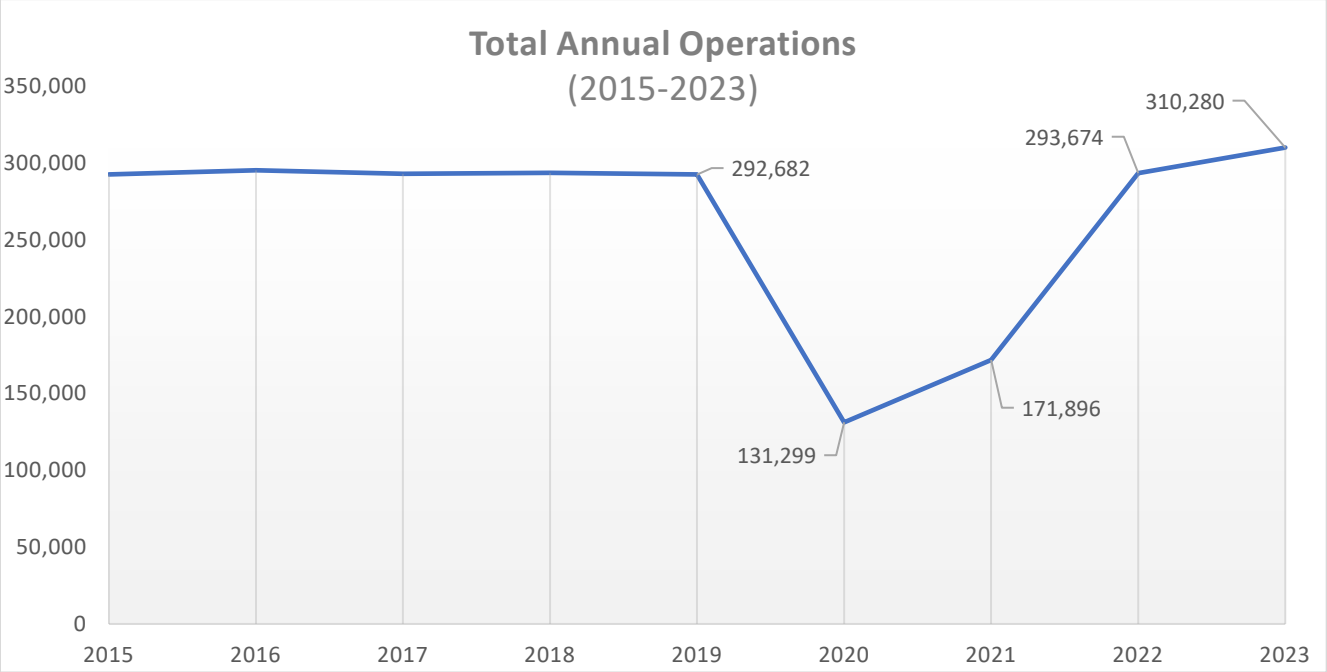


*Table 3 -Total Annual Operations*

## Fleet Mix

DCA operations are made up largely of regional/commuter jet aircraft. This includes aircraft such as the Bombardier CRJ700 and CRJ900 and Embraer E175 and E190. Figure 5 shows the total operations by aircraft type, for the top 10 aircraft operating at DCA (January 2024).

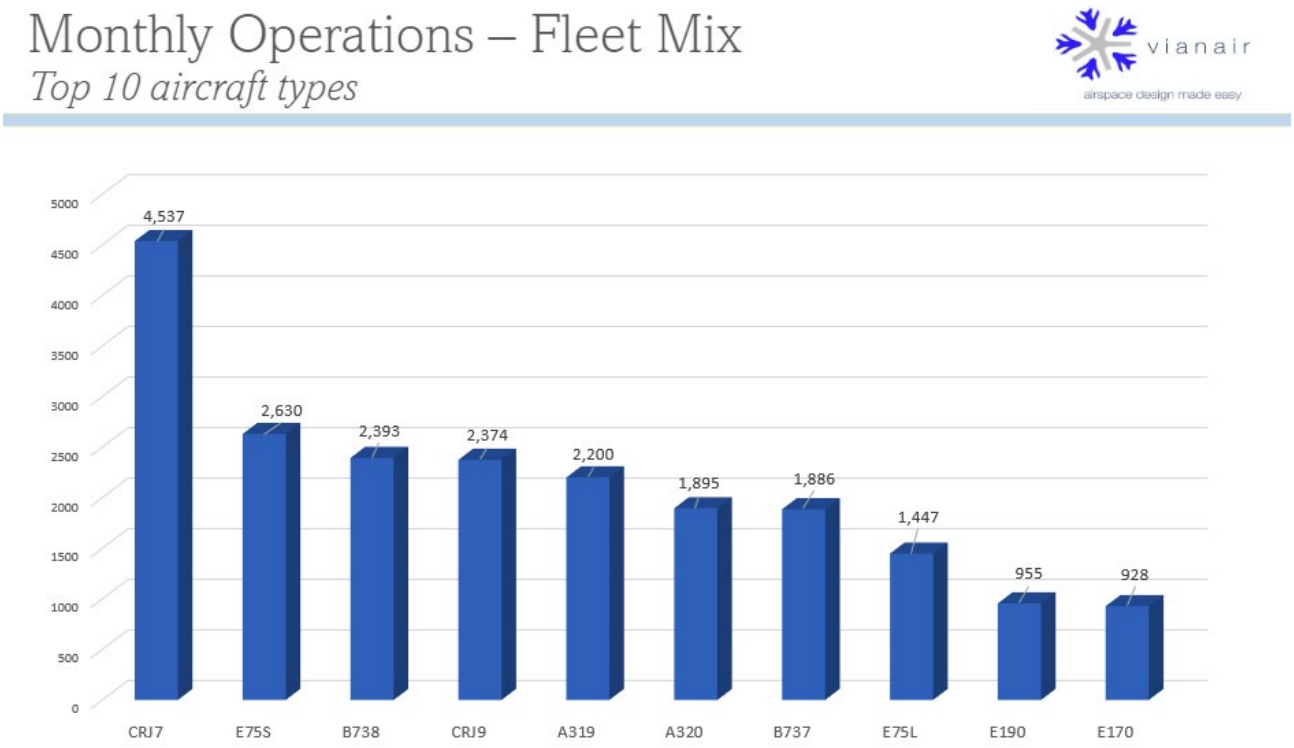


*Figure 4 - Fleet Mix – Top 10 Aircraft Types, January 2024. (Source: Vianair, Inc.)*

## Noise Complaints - Overview

Noise complaint data from 2013 through 2023 was analyzed. Figure 5 below shows total DCA noise complaints submitted to MWAA. The data shows noise complaint submissions between 2013 and 2015 were fairly flat, then in 2015, the complaint volumes grew exponentially. This increase in complaints coincided with airspace and flight procedure changes implemented by the FAA in 2015.

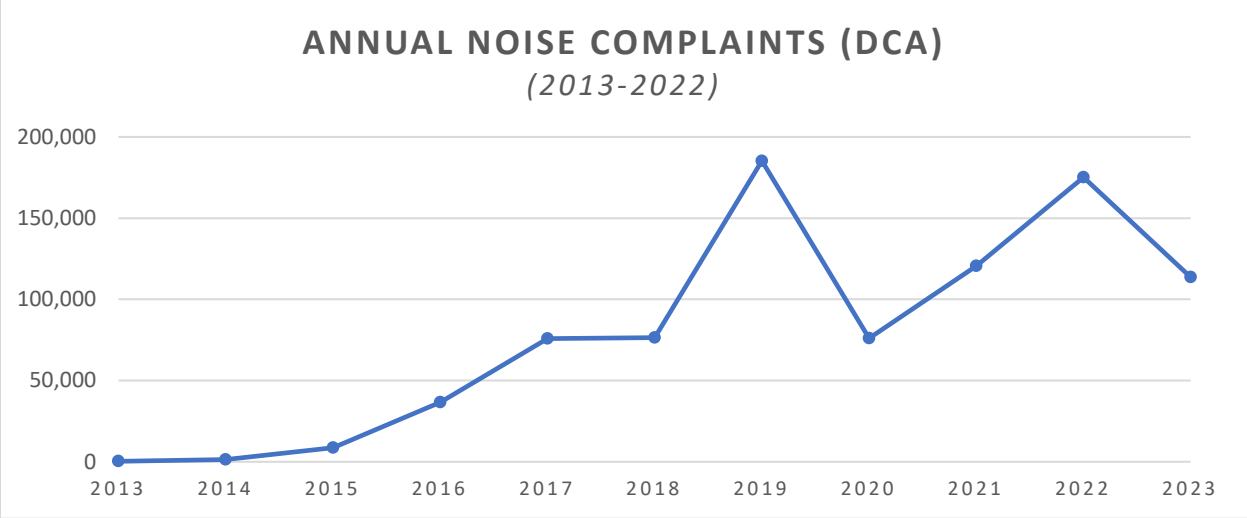


*Figure 5 - Annual Noise Complaints. (Data source: MWAA)*

Noise complaint submissions continued to grow through 2019. With the COVID pandemic starting in 2019, aircraft operations dropped dramatically, as did noise complaints. Then, as operations began to recover, so did the noise complaint submissions.

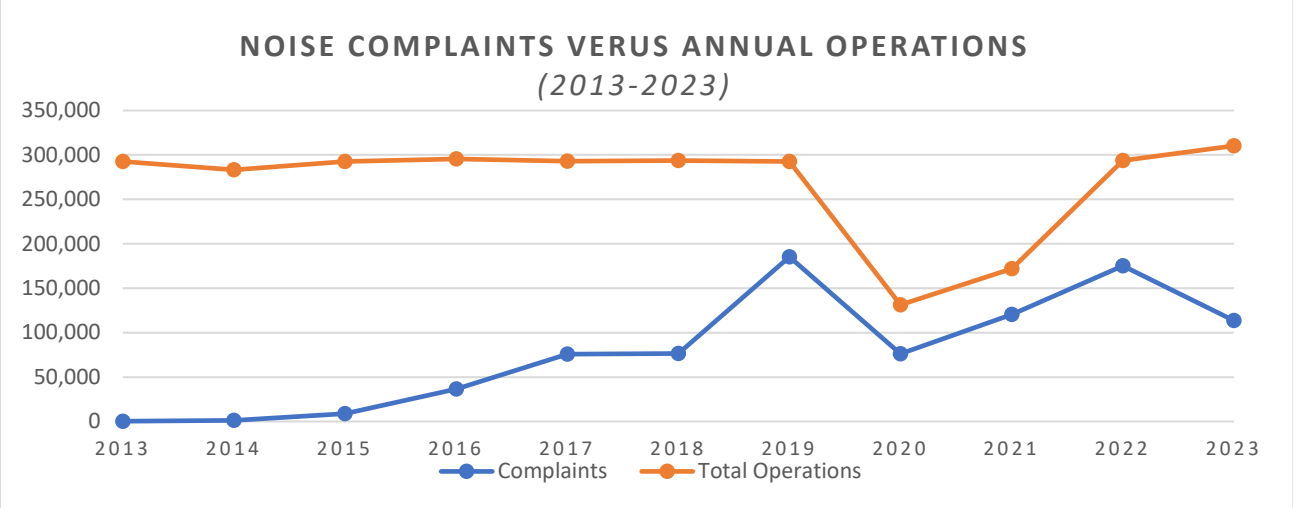


*Figure 6 - Noise Complaints Versus Total Operations (Data source: MWAA)*

Table 4 (below) shows a decline in total callers between 2018 and 2023, while noise complaint submissions have continued to grow (with a drop in 2020 following COVID). For context, the top 11 callers each submitted 500+ complaints in 2022, with the top 2 submitting close to 1,200 each.

Total noise complaint submissions were also tracked against the number of individuals submitting complaints. Many airports have callers who account for large percentages of the noise complaints submitted. It is important when analyzing complaint data to look at both the complaint volume and the number of individuals or households submitting the complaints.

| | Callers | Complaints | CPI |
|---|---|---|---|
| **2013** | 77 | 299 | 3.9 |
| **2014** | 149 | 1,286 | 8.6 |
| **2015** | 330 | 8,670 | 26.3 |
| **2016** | 836 | 36,653 | 43.8 |
| **2017** | 1,838 | 75,819 | 41.3 |
| **2018** | 885 | 76,505 | 86.4 |
| **2019** | 591 | 185,280 | 313.5 |
| **2020** | 352 | 75,995 | 215.9 |
| **2021** | 245 | 120,485 | 491.8 |
| **2022** | 305 | 175,057 | 574.0 |
| **2023** | 272 | 113,606 | 417.7 |

*Table 4 - Noise Complaints Versus Callers (Data source: MWAA)*

Table 4 lists the number of individuals submitting complaints for each year and the total complaints submitted. The *Complaints Per Individual (CPI)* accounts for the ratio of total submissions versus the number of individuals submitting complaints. This data is also reflected in Figure 7 below.

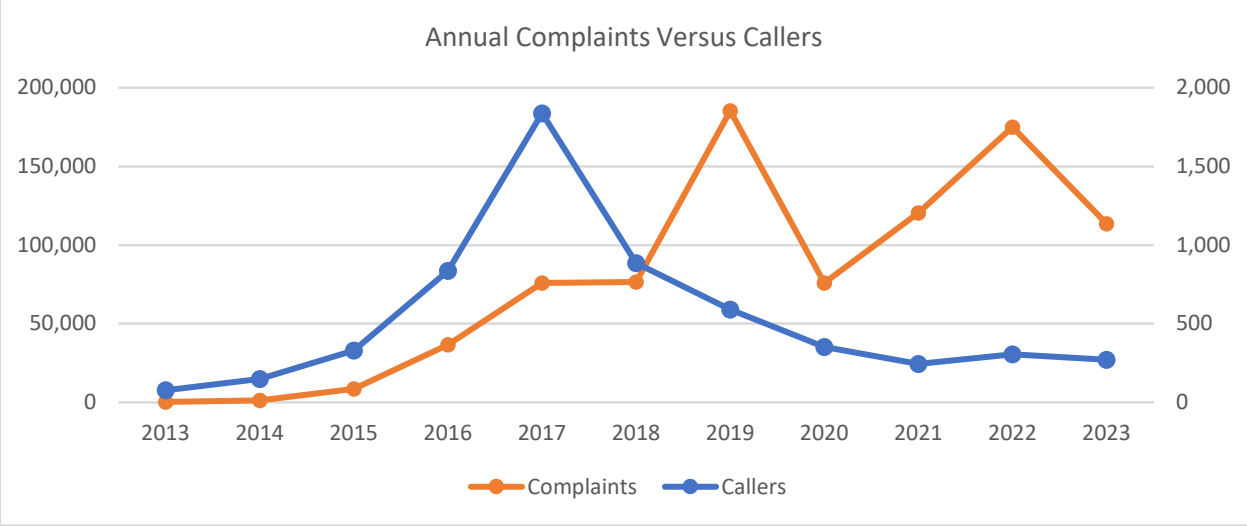


*Figure 7 - Annual complaints versus callers (Data source: MWAA)*

Combining the research conducted during the North of Airport project and the more recent research conducted as part of the South of Airport project, the two primary issues as reported by the community may be attributed to: 1) an increase in nighttime operations; and 2) changes in airspace and flight procedures starting in 2015.

MWAA reports nighttime operations between 5AM-7AM and 10PM-1AM. MWAA data shows an increase in nighttime operations, consistent with the increase in total operations following the post-COVID annual operations recovery. Although the nighttime operations are comparable to the pre-COVID numbers, this increase in total operations and, further, the increase in nighttime operations would be noticeable to residents, especially those along the DCA arrival and departure paths.

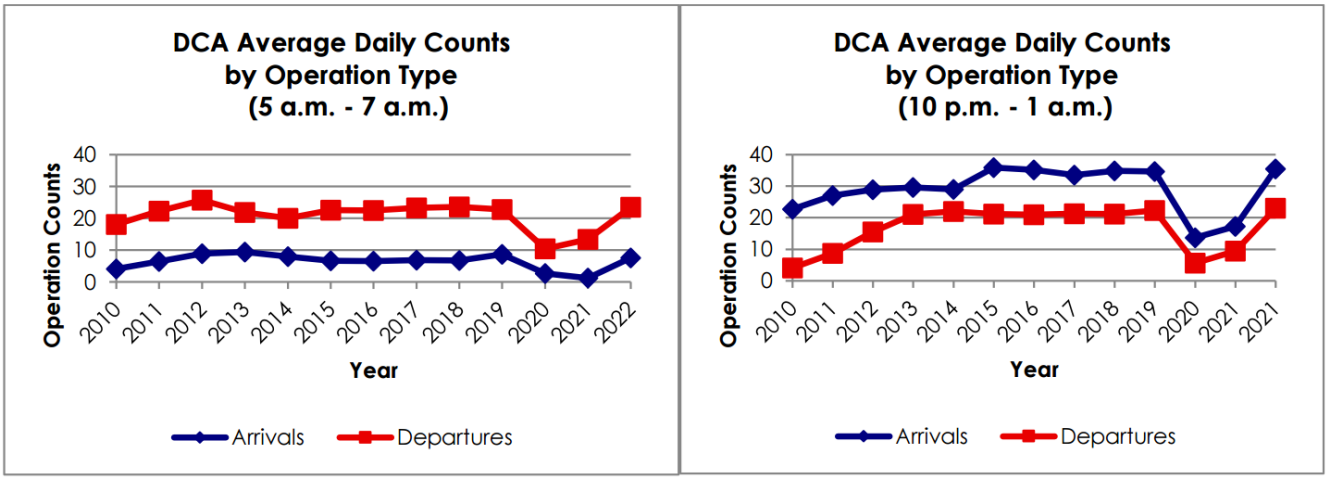


*Figure 8 – Annual Average of Late Night and Early-Morning Operations. (Source: MWAA 2022 Annual Aircraft Noise Report)*

To ensure an understanding of the community concerns, the review of DCA noise complaints was supplemented by a review of technical reports, community reports, conventional media, and social media. The predominant issue raised by communities in both Virginia and Maryland related to the FAA's implementation of Performance-Based Navigation (PBN) which significantly improves the precision with which aircraft fly when following prescribed routes (arrival and departure procedures).

The use of PBN results in better precision, which can improve both safety and efficiency. However, the increased precision results in aircraft following the same paths inbound and outbound, resulting in what many communities describe as a "highway in the sky." The precision and subsequent concentration may be beneficial for communities when the flight path is over non-noise-sensitive areas, such as industrial areas or the Potomac River. However, when the flight path is over noise-sensitive areas, such as residential communities, the concentration of operations can result in increased impacts on residents below.

## Noise Complaints – Geographic Analysis

DCA noise complaint data published by MWAA for 2013-2022 (the most recent available data) was analyzed geographically to gain an understanding of complaint distribution by location. Only communities south of DCA were analyzed. The tables below highlight the noise complaint data that was analyzed.

Complaint submissions are often considered an indicator of the level of aircraft noise impact, or the level of community concern. It is therefore assumed that communities with the highest number of complaints are the most impacted. However, complaint data by itself is not a reliable metric for assessing community impact or even community dissatisfaction attributed to aircraft operations or noise. Noise complaint data from communities in Maryland is summarized below. Communities listed are those in Maryland that are south of DCA and had a minimum of 10 annual noise complaints submitted.

**Noise Complaint Submissions - Maryland (South of Airport)**

| | 2013 | | 2014 | | 2015 | | 2016 | | 2017 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Callers | Complaints | Callers | Complaints | Callers | Complaints | Callers | Complaints | Callers | Complaints |
| Accokeek | 1 | 1 | 4 | 8 | 38 | 116 | 23 | 158 | 35 | 2,497 |
| Fort Washington | 0 | 0 | 3 | 3 | 2 | 2 | 0 | 0 | 15 | 16 |
| La Plata | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1,102 |
| Waldorf | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |

| | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Callers | Complaints | Callers | Complaints | Callers | Complaints | Callers | Complaints | Callers | Complaints |
| Accokeek | 23 | 2,694 | 31 | 34,255 | 18 | 15,810 | 13 | 33,444 | 20 | 58,670 |
| Fort Washington | 8 | 3,875 | 3 | 953 | 1 | 13 | 1 | 139 | 1 | 10 |
| La Plata | 1 | 2,082 | 1 | 1,707 | 1 | 287 | 1 | 255 | 1 | 1,812 |
| Waldorf | 0 | 0 | 1 | 979 | 1 | 243 | 2 | 826 | 4 | 416 |

*Table 5 - Noise Complaint Submissions 2013-2022 – South of Airport, Maryland*

Complaint submissions in the top four Maryland communities highlighted follow a pattern similar to the total annual noise complaints for DCA, shown in Figure 5 (above). Accokeek complaints began to climb in 2015 following change in flight procedures implemented as part of the FAA's *Next Generation Air Transportation System (NextGen) program.* Accokeek accounted for substantial growth in total submissions, climbing to 34,255 in 2019, the number of individuals submitting those complaints was only 31. From 2015-2018, the average annual complaint count from Accokeek was just over 1,366, with the average number of individuals submitting complaints of 30. From 2019-2022, the average annual complaint count from Accokeek was just over 35,544, with the average number of individuals submitting complaints of 20.

Complaint submissions in the top four south of airport communities in Virginia are summarized below in Table 6. The complaint submissions follow a similar pattern to that in Figure 5 (above), particularly for the City of Alexandria. Complaint submissions begin to climb steadily after 2015. While the total number of complaints from Alexandria grew, so did the number of individuals submitting complaints. MWAA differentiates noise complaints by "City of Alexandria" and "Alexandria (Fairfax County)," so data is described the same way in this report.

**Noise Complaint Submissions - Virginia (South of Airport)**

| | 2013 | | 2014 | | 2015 | | 2016 | | 2017 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Individuals | Complaints | Individuals | Complaints | Individuals | Complaints | Individuals | Complaints | Individuals | Complaints |
| Alexandria | 15 | 32 | 18 | 29 | 39 | 180 | 65 | 212 | 85 | 713 |
| Alexandria (Fairfax County) | 0 | 0 | 0 | 0 | 0 | 0 | 262 | 6,473 | 358 | 23,945 |
| Fairfax County | 1 | 1 | 2 | 3 | 2 | 2 | 3 | 6 | 2 | 52 |
| Springfield | 0 | 0 | 1 | 12 | 3 | 26 | 8 | 1,201 | 7 | 1,726 |

| | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Individuals | Complaints | Individuals | Complaints | Individuals | Complaints | Individuals | Complaints | Individuals | Complaints |
| Alexandria | 46 | 543 | 43 | 12,136 | 18 | 654 | 24 | 2,539 | 18 | 23,606 |
| Alexandria (Fairfax County) | 154 | 17,765 | 73 | 17,797 | 49 | 7,962 | 30 | 13,893 | 44 | 19,215 |
| Fairfax County | 2 | 52 | 3 | 69 | 2 | 68 | 1 | 89 | 2 | 265 |
| Springfield | 5 | 14 | 1 | 50 | 1 | 29 | 1 | 105 | 2 | 611 |

*Table 6 – Noise Complaint Submissions 2013-2022 – South of Airport, Virginia*

For the period between 2015-2022, the average number of complaint submissions from Alexandria was 5,073 with an average of 42 individual submitters. Alexandria (Fairfax County) averaged 13,381 complaints for the same period, and 117 individual submitters.

Based on the typical (south flow) flight patterns, the communities of Alexandria, Springfield, Fort Washington, and Waldorf appear to be most impacted (overflown) by southbound departures using Runways 15 and 19. Portions of Alexandria, particularly those near the waterfront, are exposed to aircraft noise attributed to the initial segment and climb out. Some aircraft may overfly the shoreline. Most appear to remain over the river but remain close to the shore. As aircraft initiate their turn to the west, portions of Alexandria may also be overflown.

Multiple PBN departure procedures, including the CLTCH-Three, JDUBB-Four, and WINGS-Five, include legs which overfly portions of Fairfax, including Springfield, resulting in concentrated overflights for portions of these communities. Prior to NextGen, these communities were overflown. However, the introduction of PBN improved the precision and repeated occurrence of these departures resulting in the "highway in the sky" concentration that many communities experience and report.

**Runways 15 & 19 Departures – Single Day**

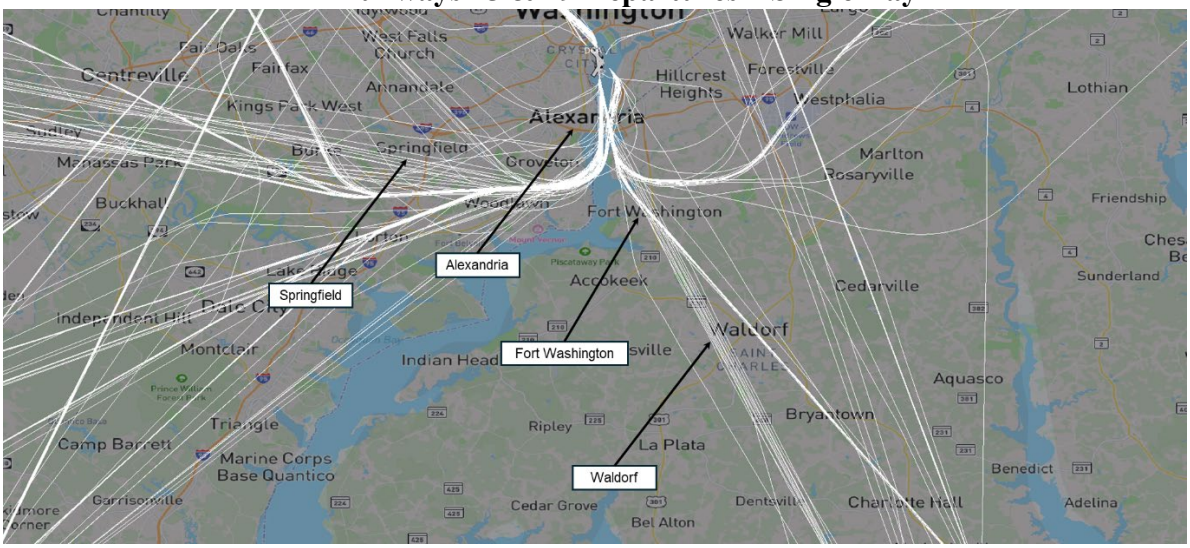


*Figure 9 – Runways 15 & 19 Departures, Single Day (Data source: Vianair, Inc.)*

Arrival paths were also reviewed to identify the impacts to communities, particularly those with high complaint volumes. Arrivals from the north and west overfly Fairfax, Springfield, and portions of Alexandria as they fly inbound to intercept the final approach to DCA. La Plata, Accokeek, and Fort Washington are also overflown with arrivals. The final approach path to DCA (Runways 1 and 33) have not changed as part of NextGen. However, concentrations over some areas may have resulted in increased overflights. Accokeek for example, is overflown by the CAPSS Arrival, which likely increased overflights following NextGen implementation.

**Runways 1 & 33 Arrivals – Single Day**

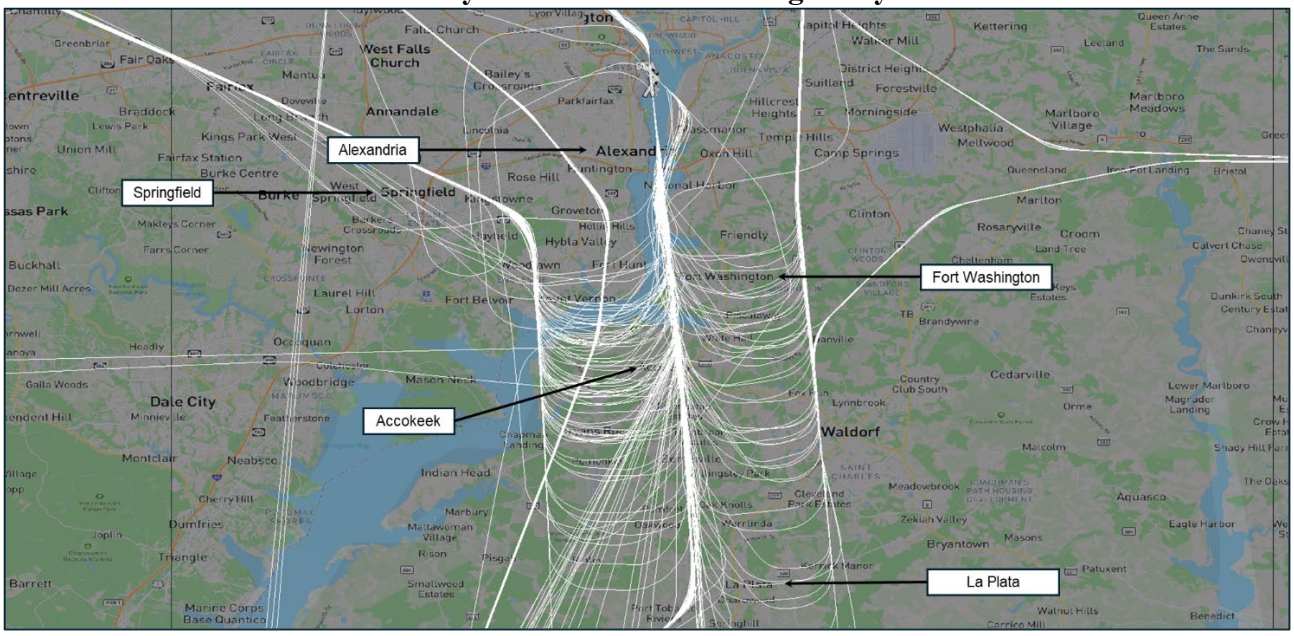


*Figure 10 - Runways 1 & 33 Arrivals, Single Day (Data source: Vianair, Inc.)*

## Noise Exposure Data

MWAA operates and maintains 15 noise monitor terminals (NMTs) located in proximity to DCA flight paths. These NMTs enable airport staff to monitor aircraft noise levels, to observe trends in aircraft noise exposure, and to analyze the impacts of changes in flight procedures. This data is reported on a monthly basis. Data for this analysis came from Annual Noise Summary Reports published by MWAA. These reports included data going back to 2015.

A review of noise exposure was conducted using data from five MWAA noise monitors located within the study area south of DCA. The noise monitors included in this analysis are shown in the map below. The noise monitors included in this study are denoted with blue circles with white numbers.

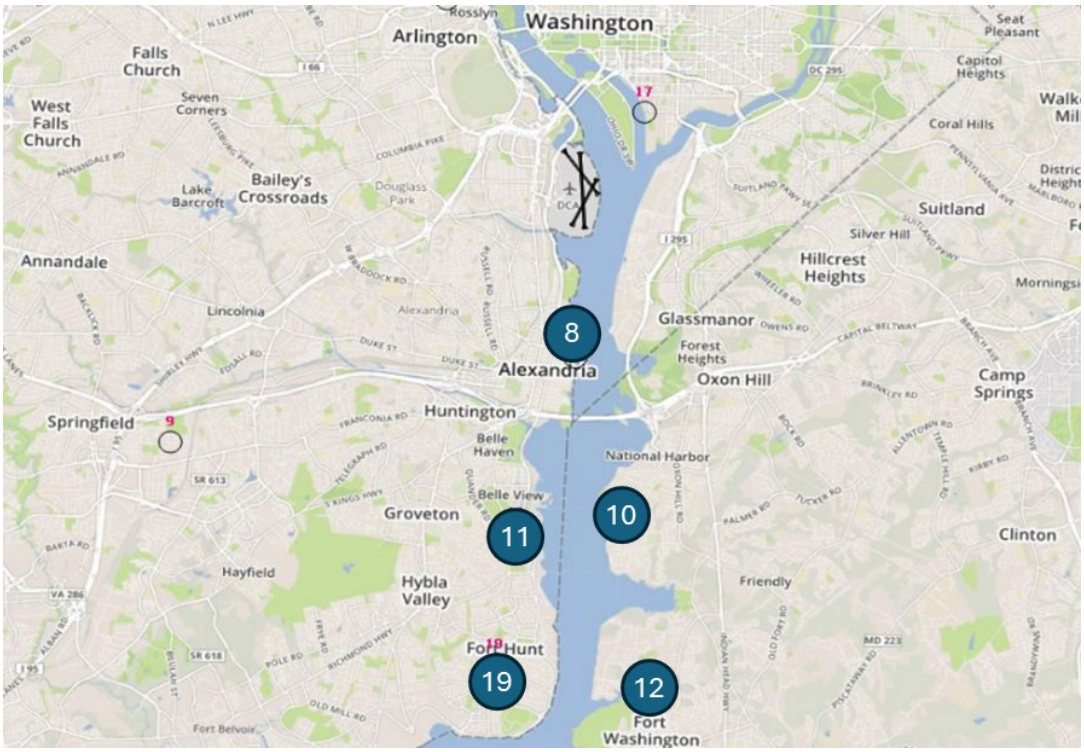


*Figure 11 - DCA Noise Monitors (south of DCA)*

The NMTs used in this analysis are listed in the table below:

| Noise Monitor | City | Jurisdiction |
|---|---|---|
| 8 | Old Town | City of Alexandria |
| 10 | Fort Foote | Prince George's County |
| 11 | Marlan Forest | Fairfax County |
| 12 | Tantallon | Prince George's County |
| 19 | North Mount Vernon | Fairfax County |

*Figure 12 - DCA Noise Monitor Locations (South of Airport)*

Noise exposure data from 2015 through 2023 was reviewed. Two key noise metrics were analyzed: Monthly Average Noise Events and Average Monthly Noise Exposure based on Day-Night Average Sound Level (DNL). DNL is described below.

The Monthly Average Noise Events indicates how many noise events were captured by each NMT. Analyzing the number of events over time would help identify any significant increases or decreases in noise events (overflights) at each monitor. DNL exposure over time was also calculated. Similar to the Monthly Noise Events, monthly DNL values were averaged for each year, to identify increases or decreases in noise exposure at each NMT location. Basic definitions of the two metrics are provided below:

> **Number-of-Aircraft-Events (NA)** represents the number of noise events captured by the noise monitor that are attributed to aircraft operations.
>
> The **Day-Night Average Sound Level (DNL)** metric is the standard noise metric required by the FAA for measuring noise exposure around airports. The FAA defines DNL as "the metric used to reflect a person's cumulative exposure to sound over a 24-hour period, expressed as the noise level for the average day of the year on the basis of annual aircraft operations." A 10-decibel penalty is applied to each take-off or landing occurring after 10:00 PM and before 7:00 AM to reflect the increased impact of aircraft noise during nighttime and early morning hours.

**Average Monthly Noise Events**

| NMT | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|
| 8 | 11,537 | 11,898 | 11,921 | 11,765 | 11,789 | 5,351 | 6,843 | 11,479 | 11,991 |
| 10 | 11,122 | 11,760 | 11,680 | 11,756 | 11,497 | 5,156 | 6,738 | 11,725 | 11,127 |
| 11 | 5,559 | 5,820 | 6,003 | 5,708 | 5,558 | 2,778 | 3,639 | 6,843 | 7,134 |
| 12 | 6,244 | 6,950 | 7,059 | 6,958 | 7,070 | 3,151 | 4,079 | 7,503 | 7,607 |
| 19 | 1,876 | 2,380 | 2,726 | 2,420 | 2,610 | 1,506 | 1,724 | 3,351 | 3,452 |

*Table 7 - Monthly Average Noise Events (Data source: MWAA)*

The number of aircraft noise events captured by each of the NMTs is listed in the table above. The number of aircraft noise events will differ based on changes in total operations, runway use, and other factors. The total events provide insights into trends over time. The graph below presents the data in Table 7, but in a line-graph enabling trending analysis.

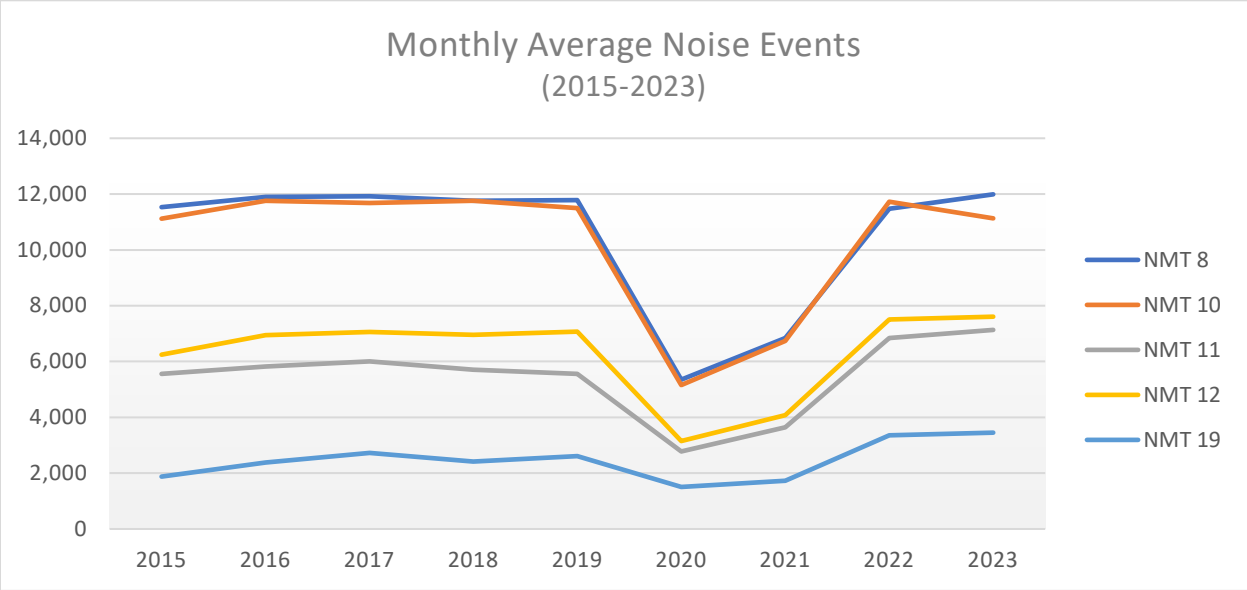


*Figure 13 - Monthly Average Noise Events*

The graph clearly shows the drop in operations due to COVID (2019-2020) and the recovery in operations from 2020-2022. Aside from the changes due to COVID, no other significant trending changes were observed.

**Monthly Average DNL values for selected monitor locations**

| NMT | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|
| NMT 8 | 60.0 | 60.0 | 60.1 | 60.4 | 60.5 | 55.7 | 57.9 | 60.8 | 60.7 |
| NMT 10 | 57.1 | 57.2 | 56.9 | 57.1 | 57.1 | 52.0 | 54.1 | 57.5 | 57.3 |
| NMT 11 | 49.4 | 50.1 | 50.6 | 50.2 | 49.9 | 46.3 | 47.8 | 50.2 | 50.5 |
| NMT 12 | 48.8 | 49.0 | 48.8 | 49.2 | 49.4 | 45.1 | 46.6 | 50.2 | 50.2 |
| NMT 19 | 41.8 | 44.6 | 46.4 | 43.8 | 45.0 | 42.0 | 42.5 | 46.2 | 46.0 |

*Table 8 - Monthly Average DNL (Data source: MWAA)*

Monthly DNL values at each monitor were converted into annual averages. Similar to the total events, most of the changes in DNL can be attributed to the drop in annual operations and the recovery which followed.

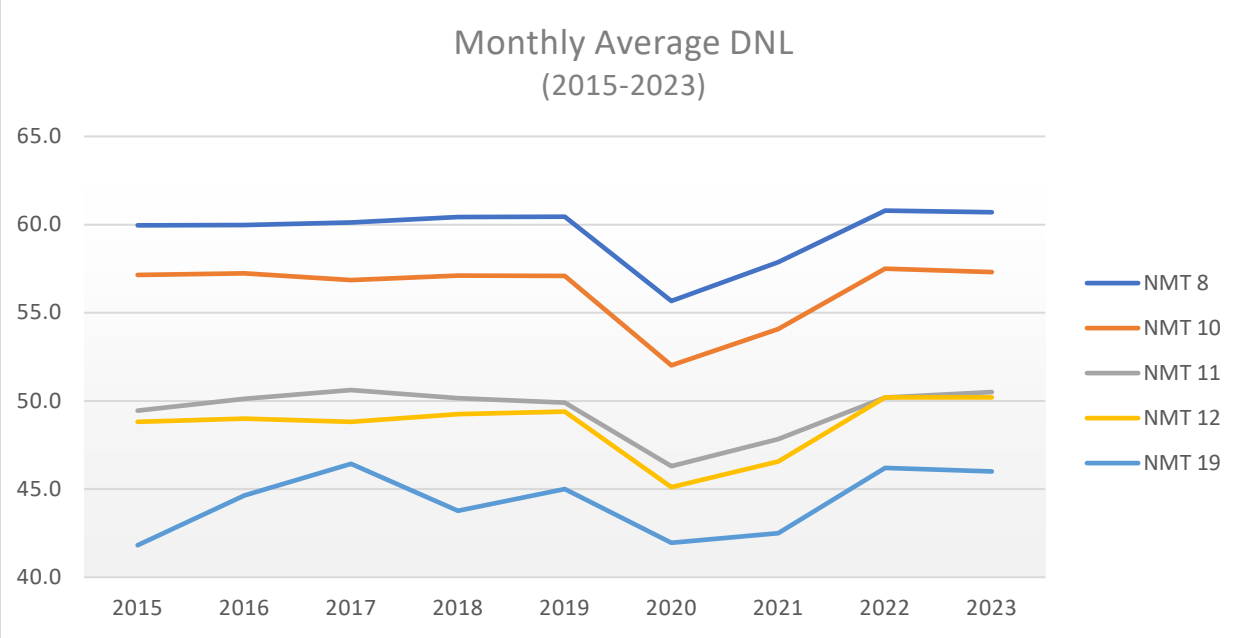


*Figure 14 - Monthly Average DNL*

Noise exposure at NMT 19 (North Mount Vernon, Fairfax County) went up in 2016 and 2017. It is unclear what drove this change. It is worth noting that total operations rose between 2022 and 2023, resulting in an increase in total noise events at each monitor. However, noise exposure (based on DNL) went down at three of the noise monitor locations.

## Airspace and Flight Procedures

In 2003, Congress passed the *Vision 100 - Century of Aviation Reauthorization Act*, which led to the creation of the *Next Generation Air Transportation System (NextGen) Integrated Plan*. The NextGen program included modernization and updates to all aspects of the National Airspace

System (NAS). This included improvements in aircraft navigation technologies, such as performance-based navigation (PBN), Area Navigation (RNAV), and Required-Navigation Performance (RNP). The use of PBN was intended to result in significant improvements in NAS efficiency and safety while reducing environmental impacts.

One of the key benefits of PBN is improvements in precision and predictability in aircraft navigation. Using PBN, aircraft can navigate with extreme precision following a prescribed flight path with minimal divergence. This is especially beneficial when flight paths are designed over non-noise-sensitive (non-residential) areas, such as industrial areas, major transportation corridors, and major bodies of water.

Prior to the use of PBN, flight procedures relied on conventional technologies, most of which were ground-based navigational aids (NAVAIDS), rather than satellite-based navigation, which is the foundation of PBN.

In 2015, as part of the NextGen Modernization program, new flight procedures were developed for DCA. As a result of these modifications, flight path changes resulted in a reduction in overflights and aircraft noise for some communities and an increase in overflights and aircraft noise for others.

**South-Flow Departures**

The years before 2015 were the pre-NextGen era in which conventional navigation was used. The National-Two departure, in use at DCA, was based on the use of ground-based navigation technology. This departure used a ground-based system called a very-high-frequency omnidirectional range facility (VOR). VOR navigation is less precise than PBN, resulting in a natural dispersion of arrivals and departures following similar procedures.

Prior to the implementation of NextGen, aircraft departing off Runway 19 would typically fly the National-Two departure. Departures would maintain runway heading for a minimum of 5 nautical miles before being directed to turn by air traffic control. Figure 15 (below) shows a typical day of operations in 2010. This graphic shows that most departures (red tracks) depart to the south and maintain runway heading, resulting in a path centered on the Potomac, with turns initiated after the Wilson Bridge.

In south-flow, departures using Runway 15 turn right, and departures using Runway 19 fly straight ahead and then follow a similar path along the center of the Potomac River. This path would be maintained until reaching a minimum of 5 nautical miles, when air traffic control would turn (vector) them east or west.

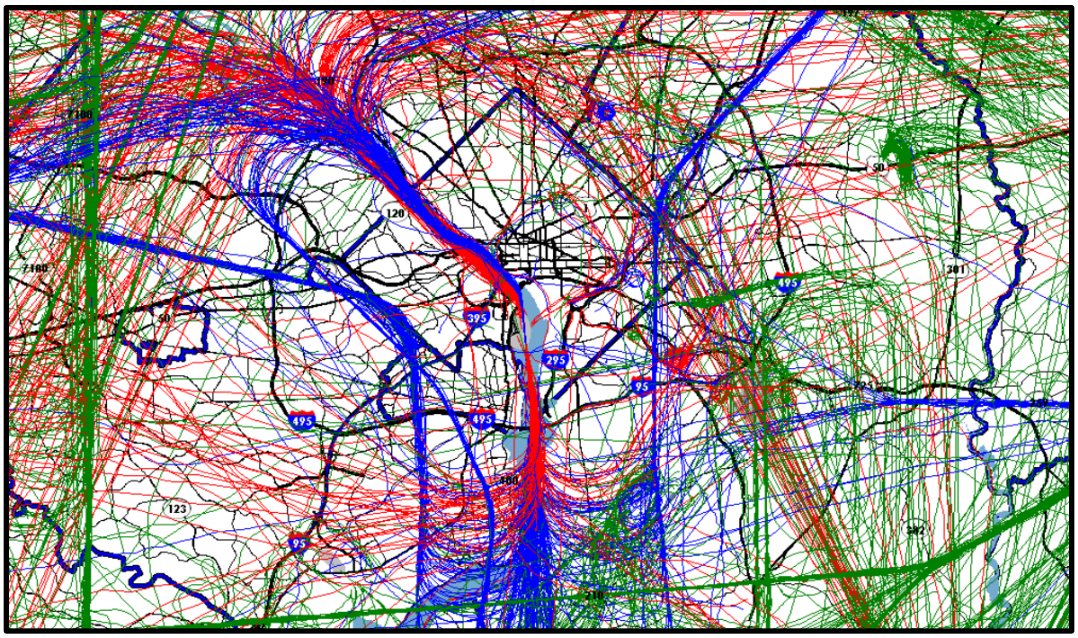

*Figure 15 - Typical Day, Mixed-Flow Operations, 2010. (Source: MWAA)*

The red tracks in Figure 15 depict departures from DCA. Departing aircraft climb to 5,000 feet and are then given headings by air traffic control to keep them over the river. This typically resulted in aircraft turning between 6-10 miles from DCA.

The 2015 NextGen deployment included the development of new departure procedures. The new procedures incorporated PBN technology improving aircraft navigation precision, which concentrated outbound flights. Prior to NextGen implementation in 2015, departures from Runway 19 relied on conventional navigation using either instrument departure procedures or air traffic control instructions (i.e., heading/direction to fly, airspeed, and climb rate). Conventional departure procedures were based on a flight path that approximated the center of the Potomac River, maintaining a heading close to runway heading. Aircraft were directed by air traffic control to overfly the Potomac River for a minimum of 5 nautical miles, after which, air traffic controllers would direct the aircraft to turn on course [4].

Figure 16 illustrates the generalized departure paths for Runways 15 and 19. The use of conventional navigation and air traffic control vectors (headings to fly) resulted in most flights

[4] *FAR Part 150 Noise Compatibility Maps and Noise Compatibility Program, 2008*

overflying the river during their initial climb-out leg. However, the dispersion of tracks ran the width of the river, resulting in overflights of communities along the waterfront.

**South-Flow Departures, Runway 15 & 19**

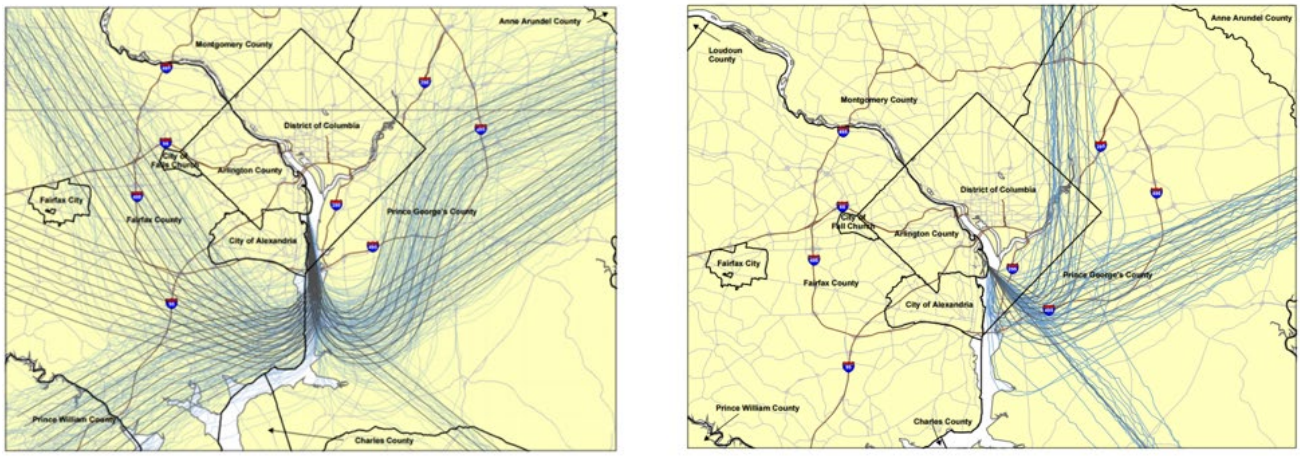


*Figure 16 - South Flow Departures, Runways 15 & 19. (Source: DCA Part 150 Study, 2008)*

While the NextGen procedures implemented in 2015 approximated the conventional procedures, there were distinct differences. Departures using the NextGen (RNAV) procedures utilize on-board navigation (Global Positioning System, or GPS) to follow a prescribed flight path. Aircraft depart the runway, climb to an altitude of 515 feet, then turn toward the CAPVC or FIMBI waypoints.

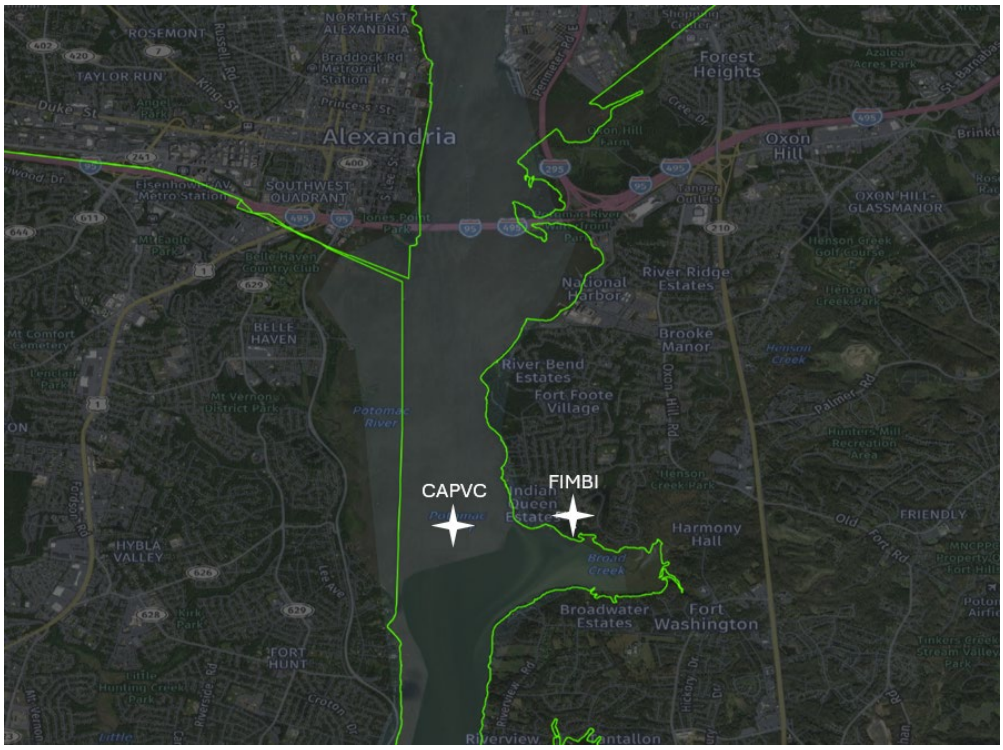


*Figure 17 - Location of CAPVC and FIMBI Waypoints*

Although the Nextgen procedures are similar in design to the conventional departure procedures, the differences have resulted in changes in overflights for the communities below. As noted, NextGen navigation is significantly more precise, resulting in concentrations of flight paths, as compared to the wider dispersion of flights using conventional navigation. Flying RNAV, departing aircraft follow the same path repeatedly, resulting in concentrations of overflights above smaller geographic areas. Many communities refer to this as developing "highways in the sky." The differences in flight path concentration can be seen in Figure 18. This compares the Pre-Nextgen flight paths from 2011 and the Post-NextGen flight paths from 2016.

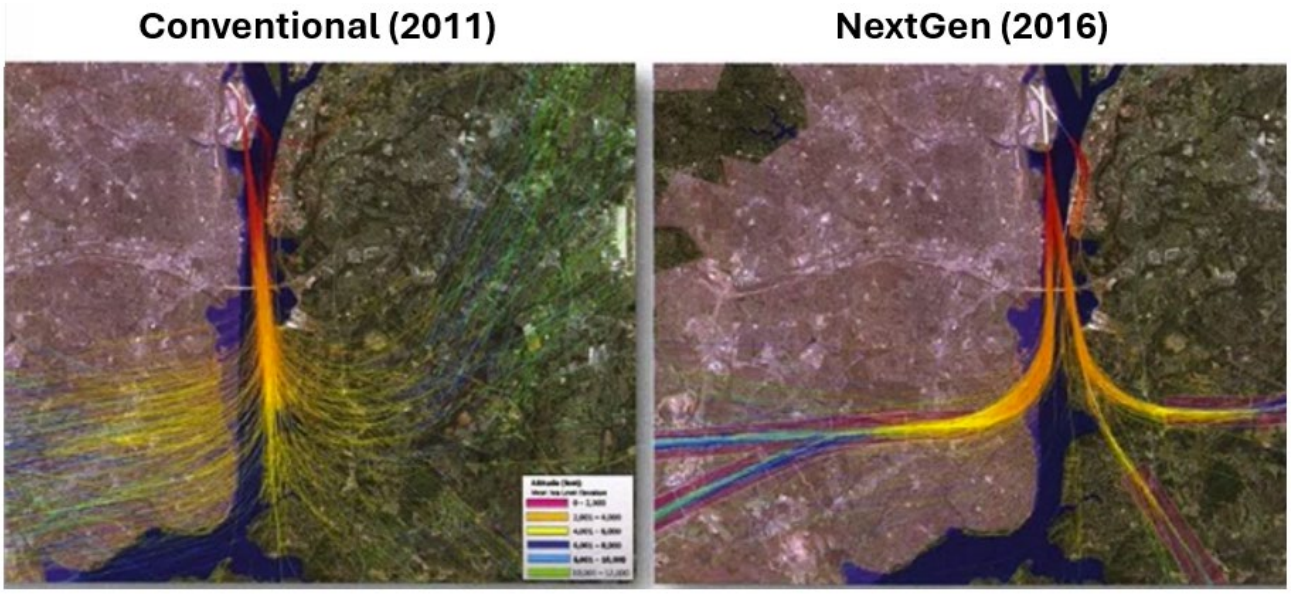


*Figure 18 – Conventional versus NextGen Departures Source:*
*(Adapted from a Story Map developed by Representative Don Beyer).*
*https://houseofreps.maps.arcgis.com/apps/MapJournal/index.html?appid=04b6ea5feb1e4b61b8bb4be439bd882b*

Another flight path change attributed to the NextGen departure is the split in the departure stream. A review of Figure 18 shows two distinct streams of departures to the south. This is due to how the procedure was designed. When flying the NextGen departure procedures, aircraft maintain runway heading until reaching 515 feet, then turn toward the CAPVC or FIMBI waypoints. As noted, the FIMBI waypoint is slightly east of the conventional flight path and the CAPVC waypoint is slightly west of the conventional flight path, resulting in aircraft flying closer to or over Alexandria, Prince George's, and Fairfax communities. When flying the NextGen departure, aircraft fly toward the CAPVC or FIMBI waypoint, then initiate their turn to the next waypoint (west or east) prior to reaching CAPVC or FIMBI. This results in the highly concentrated departure streams (highways in the sky) shown in Figure 18. Comparing the two, under conventional navigation, much larger areas to the east and west are overflown throughout the day. However, with NextGen, the flights are highly concentrated, resulting in increased overflights over smaller areas. Figure 19 depicts a typical day (all operations) at DCA. In the figure, the flight tracks in green are departures.

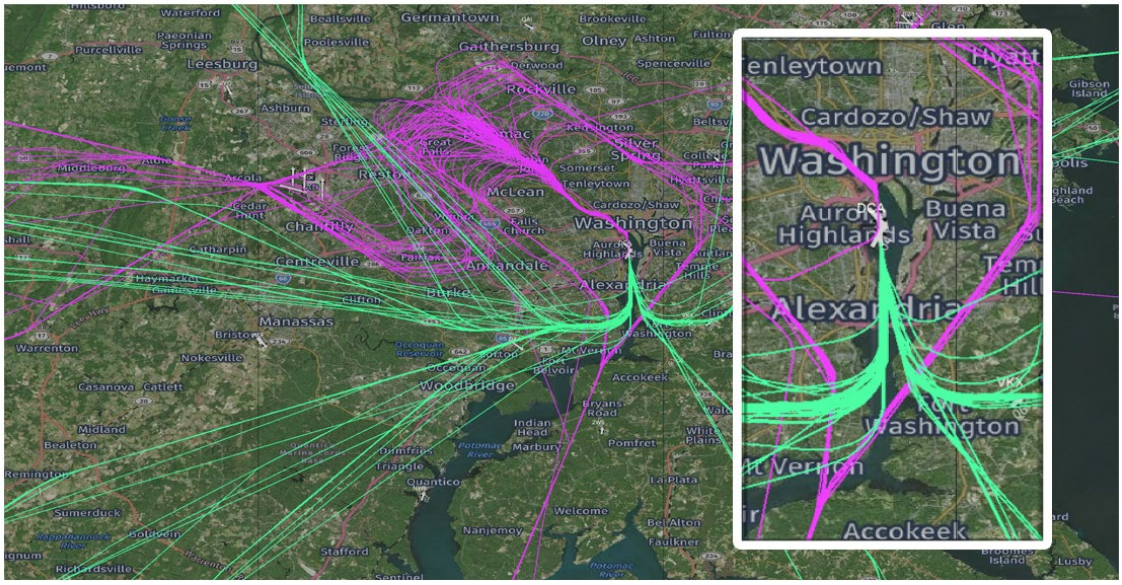


*Figure 19 - Same Day, South-Flow Operations. Departures are in green.*

**North-Flow Arrivals**

Pre-and-Post NextGen arrival procedures to Runways 1 and 33 were also reviewed. NextGen implementation included the transition of arrivals and approaches to be converted from conventional navigation to more modern, PBN technologies. Figure 20 depicts a sample day of flights (mixed flow) in and out of DCA in 2013 (pre-NextGen). Arrivals are shown in blue. Figure 21 depicts a sample day of flights in and out of DCA, showing north-flow operations only. Arrivals are shown in magenta.

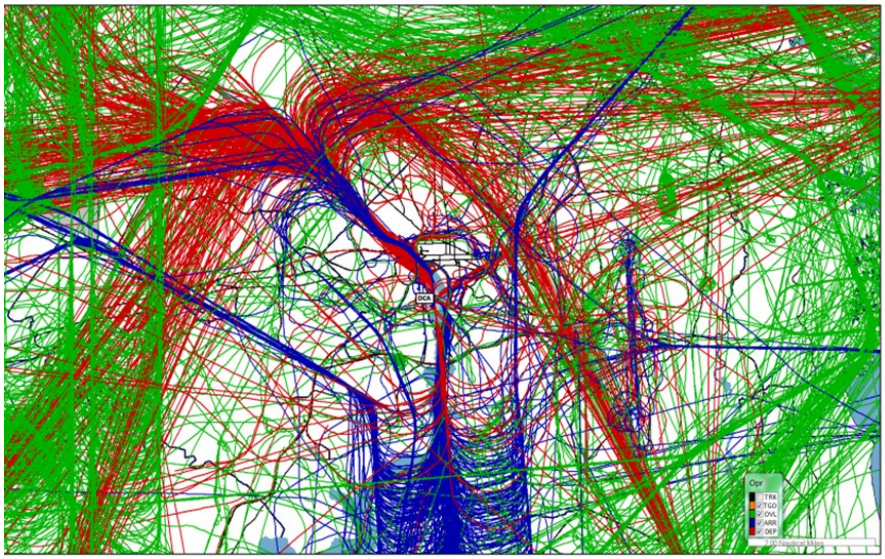

*Figure 20 - Sample Day, Mixed-Flow Operations, 2013 (Source: MWAA)*

Figure 21 (below) is a sample day in 2023. A visual comparison between 2013 (Pre-NextGen) and 2023 (Post-NextGen) shows similar arrival patterns, although some areas have an increased concentration of overflights.

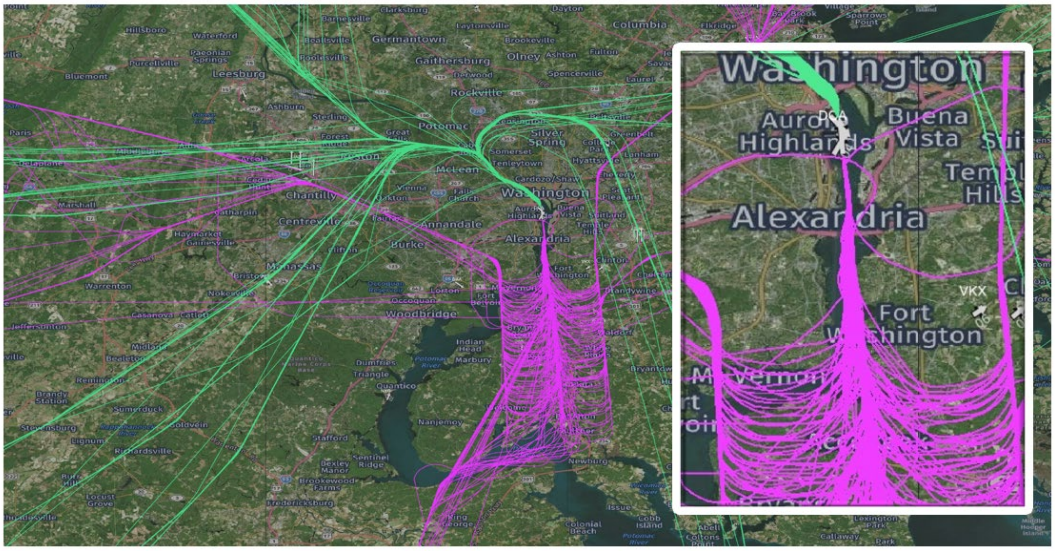


*Figure 20 - Sample Day, North-Flow Operations, 2023 (Source: Vianair, Inc.)*

The NextGen changes included new arrival procedures which increased concentration and shifted some arrival paths, resulting in increased overflights in some areas, while decreasing overflights for others. Figure 22 (below) shows the arrival paths as identified in a 2008 Part 150 (noise) Study.

**North Flow Arrivals – Runways 1 and 33**

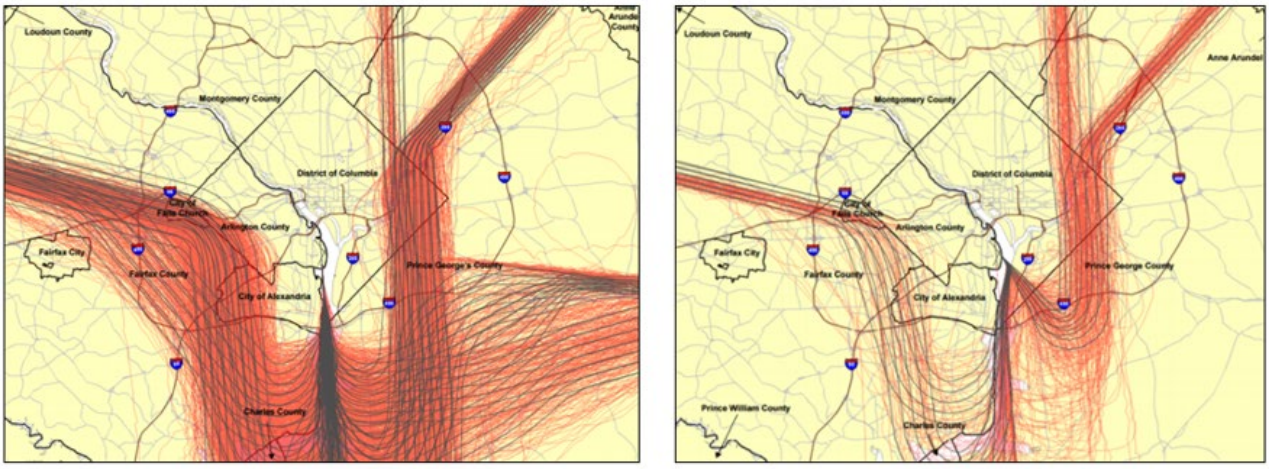


*Figure 22 - North Flow Arrivals, Runways 1 & 33. (Source: DCA Part 150 Study, 2008)*

## Summary of Findings

The FAA implemented changes in the airspace and flight procedures around DCA as part of a larger National Airspace System (NAS) modernization effort for the region. For DCA, this resulted in the shifting of flight patterns for many communities south of DCA. The greatest changes were attributed to the implementation of new aircraft navigation technology, moving from conventional navigation to performance-based navigation (PBN). PBN technology enables much greater precision, resulting in a concentration of aircraft departures and arrivals along narrow corridors or "highways in the sky." Although the modified procedures were similar in design to the existing procedures, changes in flight track geometry resulted in increased overflights and aircraft noise for some communities.

A common complaint was related to a shift in overflights from the center of the Potomac River toward the shorelines, increasing aircraft noise in Alexandria, particularly the Old Town/Waterfront communities, as well as portions of Fairfax and Prince George's Counties. Modifications in flight procedure design and increased flight concentration may explain these issues. Shifting flights closer to the center of the Potomac might address many of the concerns reported.

Adding to the complaints was the increase in total operations following COVID. In 2020, noise complaints dropped, likely because of the reduction in total operations due to the COVID pandemic. Complaints peaked in 2022 as total operations reached pre-COVID levels. Then, in 2023, complaints began to taper off again. While total complaints have increased since 2013, the number of individuals submitting complaints has decreased since 2017. For this reason, noise complaint volumes and complaints by community should also consider the number of individuals submitting complaints. Targeted outreach to those communities with the highest complaint volumes may help the jurisdictions to get a better understanding of community concerns and to help educate residents on what can and cannot be done to address aircraft noise issues.

## Next Steps

The next steps in this effort included development of a Project Design Team to help identify and recommend strategies to address and reduce community impacts associated with DCA aircraft operations. This included development of a "Design Philosophy," which prioritized specific objectives for airspace and procedure design changes. Based in part on the findings in the baseline study, maximizing overflight of the Potomac River is included as part of the design philosophy. A Project Steering Committee was also developed to provide general project guidance.

Community engagement will include project kick-off meetings in the respective jurisdictions to introduce the project to the residents of the City of Alexandria, Fairfax County, and Prince George's County. As part of this initial outreach, a project website is developed, and an online survey will be published, to encourage community input and to better understand the communities' concerns. This information will be used in conjunction with the findings in the baseline assessment to inform the work of the project Steering Committee and Design Team as they explore ways to reduce community impacts.