



BWI-Thurgood Marshall Airport Operations and Noise Exposure

Presented by DC Metroplex BWI Community Roundtable in cooperation with Vianair, Inc

Monthly Report for August 2024

DC Metroplex BWI Community Roundtable link to Noise Exposure Monthly Reports below.

The reports can be found at the bottom of the page within the tab labeled
“Noise Exposure Monthly Reports (Howard/Anne Arundel County Contractor)”.

<https://marylandaviation.com/environmental/environmental-compliance-sustainability/dc-metroplex-bwi-community-roundtable>



Introduction



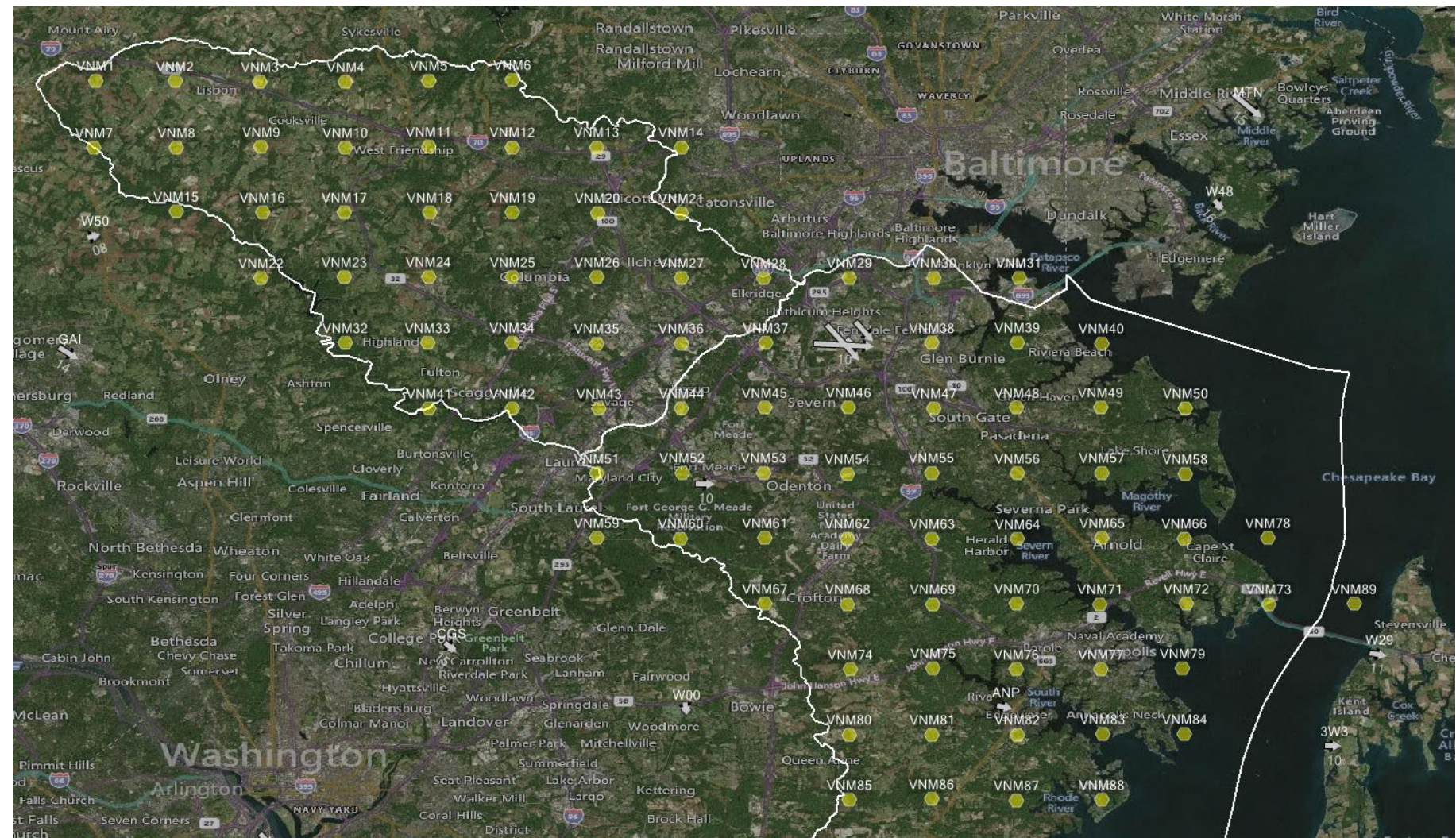
This is a summary of a larger report (the “Monthly Report”) prepared by Vianair, Inc. (“Vianair”) for the benefit of the DC Metroplex BWI Community Roundtable (the “BWI Roundtable”).

The Monthly Reports are the first comprehensive data detailing the noise pollution generated by daily commercial jet plane operations across the entire geography of significantly overflowed communities in our region. The BWI roundtable believes that the analysis of the full environmental impact of airport operations on overflowed communities has been understudied, but it is essential information in order to improve the likelihood of success in achieving balanced solutions for the complex set of stakeholders involved in airport operations.

Howard and Anne Arundel Counties hired Vianair to help analyze flight activity in and out of BWI Thurgood Marsha Airport (“BWI-Marshall”). In coordination with representatives from the two counties and support from the BWI Roundtable, Vianair developed the Monthly Report which includes the analysis of key elements (operational and acoustic) to help the wide array of stakeholders understand the existing noise exposure and to provide the ability to track changes over time.

While comprehensive, the elements in the report were selected by those who contributed to the report development (representatives from the two counties and the BWI Roundtable). This report will be published monthly, beginning with April 2022. Report content may change based on input from the contributors and/or the community. This report uses A-weighted decibels or dBA and DNL, described later within this summary report.

What is the Virtual Noise Monitoring Grid?



The BWI Roundtable could locate no single data source covering the entire region for the noise pollution generated by commercial aviation at BWI-Marshall. Although the Maryland Aviation Administration (MAA) maintains noise 24 permanent monitors in areas immediately surrounding the airport, these monitors are not widely dispersed across the entirety of overflowed communities. Therefore, the Roundtable asked Vianair, Inc. to establish a **virtual noise monitoring grid** with a total of 89 monitors evenly spread at 2.5-mile intervals covering most of Anne Arundel and Howard Counties (see the map on this page). An additional 36 locations in each county were selected, representing specific areas of interest or “Landmarks” (see pages 5 and 6 of this Executive Summary). The result is a total of 125 discrete locations for which aircraft noise data is collected and analyzed. These locations are referred to as “virtual noise monitor locations” in this report and result in more comprehensive coverage of the study area.



Definitions

Decibel (dB(A)): A unit of measurement of sound pressure adjusted for the human ear's response to particular frequencies

Day-Night Average Sound Level (DNL): A descriptor of 24-hour noise (midnight to midnight) that adds a ten-decibel (dB) nighttime penalty to noise events which occur between the hours of 10 p.m. and 7 a.m. to account for the intrusive nature of noise at night. DNL is the standard metric used by the Federal Aviation Administration (" FAA") as required by federal regulation. Federal guidelines require DNL 65 as the level of aircraft noise exposure that is incompatible with noise-sensitive applications including residential development. This metric is required by FAA and COMAR

The Noise-above (NA): A noise metric that counts the number of times the noise level exceeds a specific threshold. In this report, the Number-of-Events-Above 55 metric (NA55) is calculated. NA55 quantifies the number of aircraft events resulting in noise exposure of 55 decibels or higher at each location depicted.

Day-evening-night level (Lden): It is a descriptor of noise level defined by the European Environment Agency ("EEA") and based on energy equivalent noise level (Leq) over a whole day with a penalty of 10 dB(A) for night-time noise (11.00 pm -7.00 am) and an additional penalty of 5 dB(A) for evening noise (7.00 pm -11.00 pm).

Airport Noise Zone (ANZ): An area of land surrounding the airport within which noise levels are equal to or greater than DNL 65 dBA.

Maryland Department of Transportation Maryland Aviation Administration (MDOT MAA): Operator of Baltimore/ Washington International Thurgood Marshall Airport (BWI Marshal Airport).

Code of Maryland Regulations (COMAR): Requires MDOT MAA to control development in areas where noise levels are DNL 65 dBA or more.

Disclaimer and Information Sources and Disclosures

Disclaimer: The views and opinions expressed in this document are those of the BWI Roundtable and do not necessarily reflect the views or positions of the state senators who appoint voting members to the BWI Roundtable, the MDOT/MAA, the FAA, Howard or Anne Arundel County elected or appointed officials, commercial carriers or Vianair, Inc. Technical presentations prepared by Vianair Inc. are labeled with the Vianair logo.

Information Sources and Disclosures:

Page 7 - Economic Impact of BWI-Marshall. **Regional Economic Impact of BWI Marshal Airport, December 2017, a brochure of the Maryland Aviation Administration.** In response to a Public Information Act (PIA) request made on November 1, 2022, MDOT/MAA provided "The Economic Impact of Public Use Airports in Maryland", July 2015. The study was prepared by Martin Associates and Landrum and Brown, consultants. MDOT/MAA states that "The 2017 Economic Impact Brochure [..] is an update to the 2015 Economic Impact Report. The 2015 Economic Impact Report and Monthly BWI Statistical Report Summaries serve as the source for the 2017 Economic Impact Brochure." Once the BWI Roundtable verifies the underlying sources of the brochure's statements, we will update this section.

Page 7 - Commercial Aviation and Health.

- Zafari Z and Park, J. "Projecting the health and economic burden of aircraft noise". University of Maryland School of Pharmacy, 2022

<https://www.pharmacy.umaryland.edu/media/SOP/wwwpharmacyumarylandedu/about/depts/p-shor/pdf/projecting-the-health-and-economic-burden-of-aircraft-noise-final-report.pdf>

- Quarterly Noise Reports, Maryland Aviation Administration

<https://marylandaviation.com/environmental/environmental-compliance-sustainability/quarterly-noise-reports/>

- World Health Organization: Environmental Noise Guidelines for the European Union. 2018

https://www.euro.who.int/data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf

- European Environment Agency: European Noise Directive. 2018

<https://www.eea.europa.eu/airs/2018/environment-and-health/environmenta1-noise>

Seeking Balance at BWI-Marshall Airport

The growth in operations at BWI-Marshall brings a number critically important social and economic impacts to communities surrounding the airport and to the State of Maryland, including economic development, jobs, and taxes collected. However, this also results in significant negative impacts, especially for residents of Anne Arundel and Howard counties, including stress, likely adverse health outcomes and a diminished quality of life. **Over the course of our almost six (6) years of existence, the BWI Roundtable has come to believe those impacts are unsustainably unbalanced in favor of economic impacts in our region.**



Economic Impact of BWI-Marshall

Airport-Generated	Visitor-Generated
\$4.4 B Total Impact	\$4.9 B Total Economic Impact
<u>Total Jobs 24,211</u> Direct 12,753 Indirect 11,458	<u>Total Jobs 82,277</u> Direct 46,857 Indirect 35,420
\$1.6 B Total Earnings	\$2.5 B Total Earnings
\$175.4 M Total State/Local Taxes	\$416.5 M Total State/Local Taxes

State taxes are estimated to be \$336.3 million and Local taxes are estimated to be \$255.7 million

Commercial Aviation and Health

University of Maryland- Baltimore study shows over \$800 million (2022 dollars) in health costs over 30-years from current BWI-Marshall operations

123,133 BWI-Marshall noise complaints (230 individuals) during 2nd Quarter of 2022. The airport received a total of 620,276 noise complaints in 2021.

The World Health Organization recommends aircraft noise levels in Europe to below 45 dB during the day (40 dB at night). Higher levels of noise is associated with adverse health effects.

55 dB Lden is the EU threshold for excess exposure defined in the Environmental Noise Directive

FAA has adopted 65 dBA DNL as the threshold of significant noise exposure, below which residential land uses are compatible

BWI Airport Noise Zone is noise above 65 dBA DNL

Runway Use

BWI has six runways: 10, 15R, 15L, 28, 33R, and 33L. Runway selection is based primarily on wind direction. BWI operates in two flows. When winds are out of the east or south, aircraft will arrive and depart in an **EAST FLOW** and when winds are out of the west or north, aircraft will arrive and depart in a **WEST FLOW**. Aircraft noise levels vary when below an aircraft landing or taking-off. Runway use also influences routes to and from the airport, which also affects aircraft noise for communities below.



EAST FLOW



WEST FLOW



East and West Flow

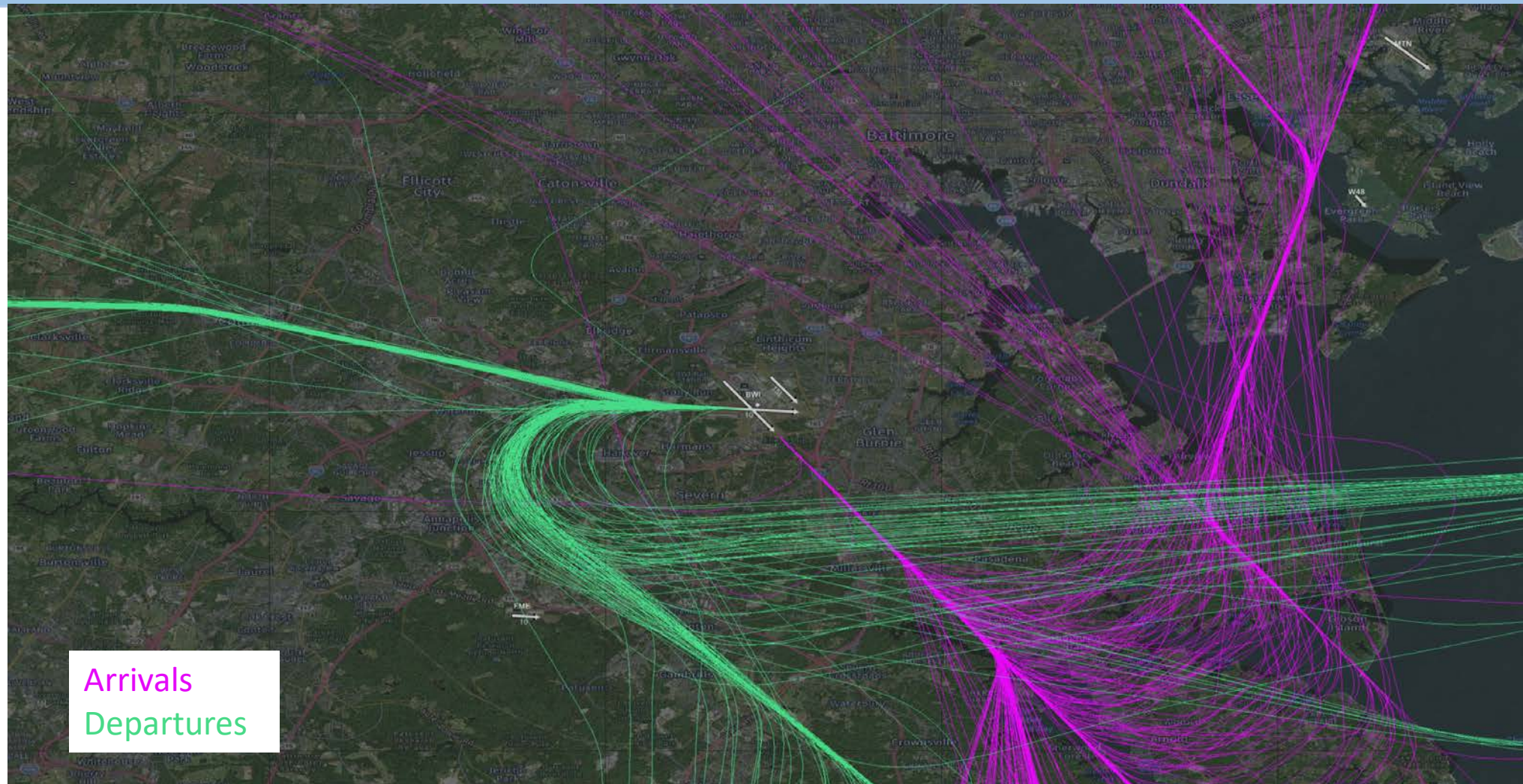
Prevailing wind speed, direction and weather factors determine the direction of air traffic flow from BWI Marshall airport. Aircraft usually take off and land into the wind to meet safety and operational requirements.

During **EAST FLOW** conditions (winds from the south or east), aircraft arrive and depart toward the east. This includes runways 15L, 15R, and 10.

During **WEST FLOW** conditions (winds from the north or west), aircraft arrive and depart toward the west. This includes runways 33L, 33R, and 28. The following slides are intended to illustrate arrival and departure flight paths across the region during sample EAST and WEST flows days.

The next two pages illustrate a typical East Flow day and a typical West Flow day at the airport. Sample days were analyzed by Vianair and then depicted as all arrivals and departures consistent with a specific flow on a given day. While these flight patterns are typical, they may vary on other days based on operational conditions.

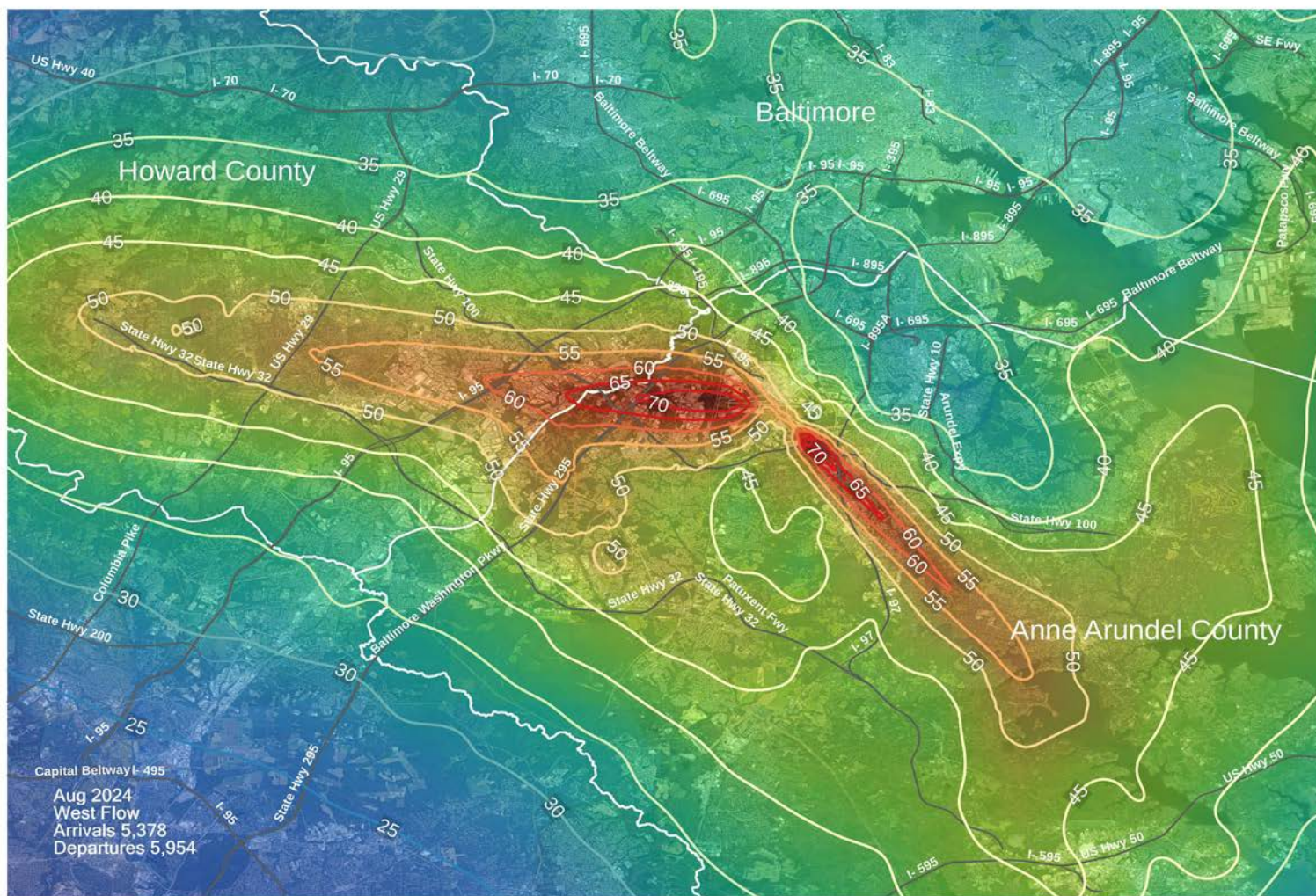
Visual representation of a typical day of traffic over the Baltimore region during West Flow operations at BWI-Marshall



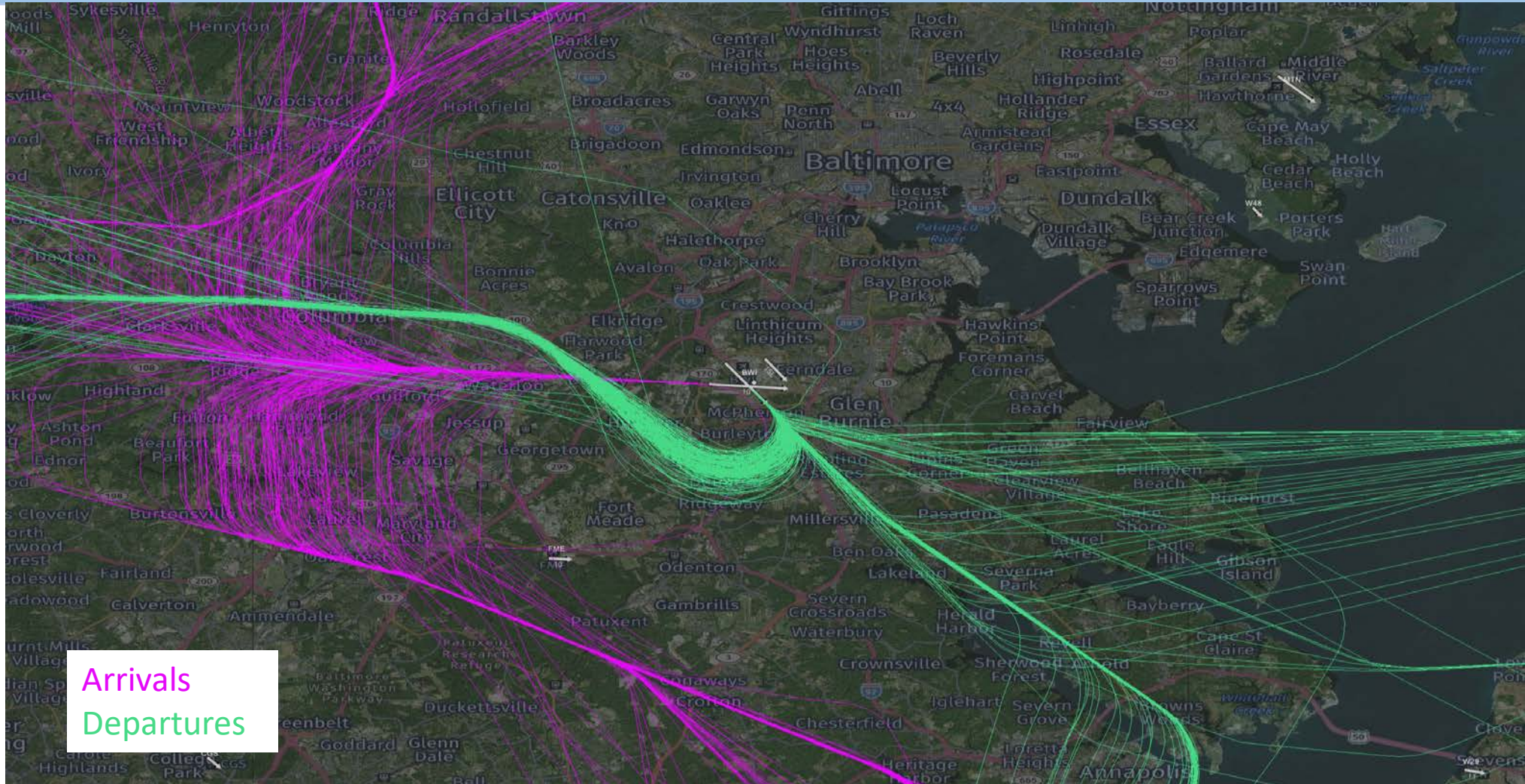
West Flow Operations – DNL Noise Exposure

West Flow: Arrivals Runway 33L & Departures Runway 28

Note: The DNL Map for KBWI West Flow is calculated for Arrivals to Runway 33L only, and Departures from Runway 28 only, over the entire month, which equals the sum of all time periods when the airport was in a West Flow and these specific runways were in use. Arrivals/Departures to/from other runways during this time period are excluded from this calculation.



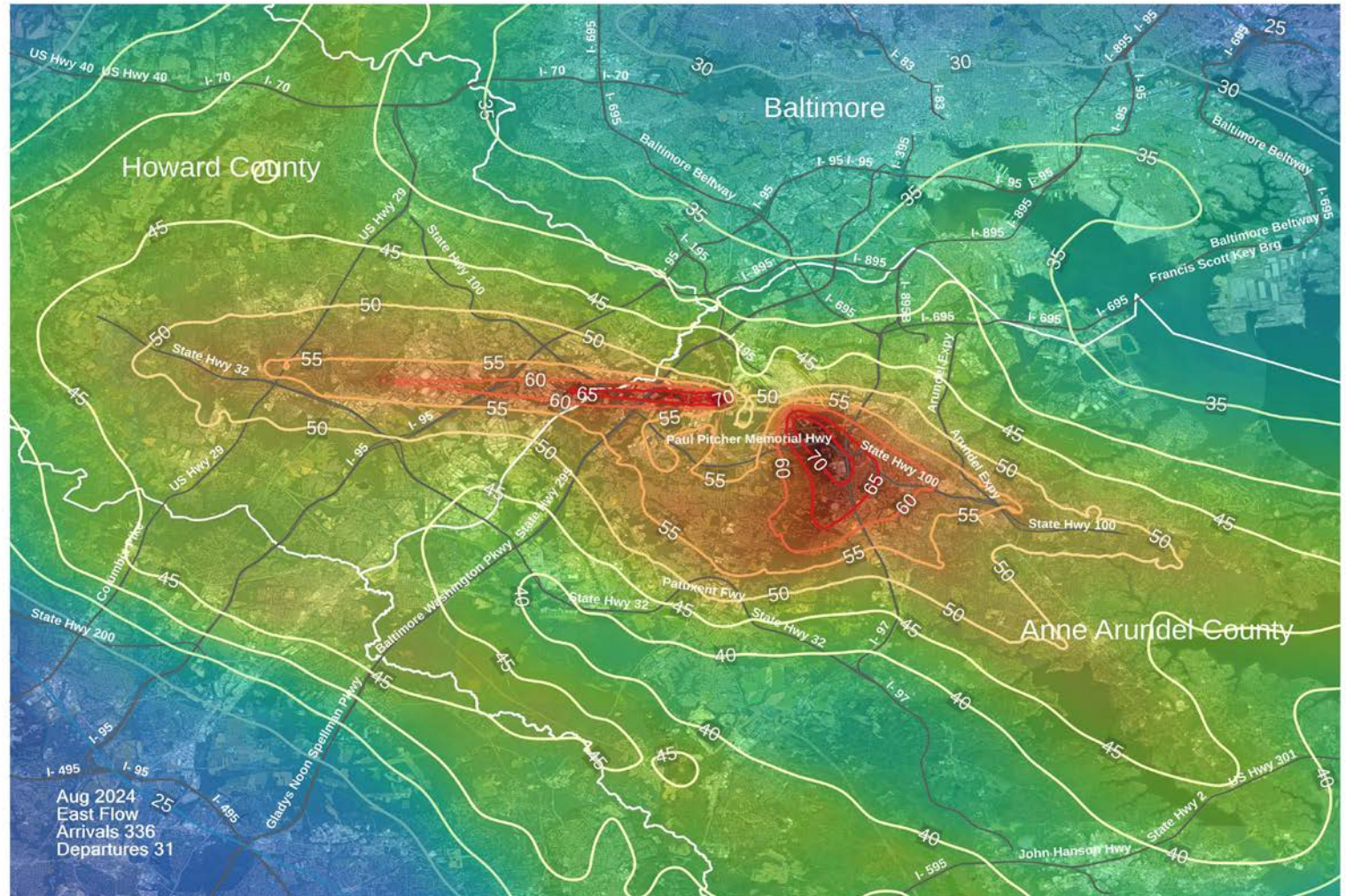
Visual representation of a typical day of traffic over the Baltimore region during East Flow operations at BWI-Marshall



East Flow Operations – DNL Noise Exposure

East Flow: Arrivals Runway 10 & Departures Runway 15R

Note: The DNL Map for KBWI East Flow is calculated for Arrivals to Runway 10 only, and Departures from Runway 15R only, over the entire month, which equals the sum of all time periods when the airport was in an East Flow and these specific runways were in use. Arrivals/Departures to/from other runways during this time period are excluded from this calculation.



Monthly Noise Exposure – Anne Arundel County Landmark Locations

August 2024 – Both East and West Flow Operations

Name	Description	Number of Events Above 55dBA (Monthly)	Daily Average (Monthly)	Number of Events Above 55 dBA (YTD)	DNL (Monthly)
AAR_VNM1	RAVNN	0	0	5	13.85
AAR_VNM2	JETNA	2	0	12	24.11
AAR_VNM3	Arden on the Severn	5,356	173	38,755	54.89
AAR_VNM4	London Public House	1,362	44	10,811	38.07
AAR_VNM5	Annapolis Middle School	599	19	4,290	37.43
AAR_VNM6	West Annapolis Elementary	1,204	39	8,784	43.1
AAR_VNM7	Herald Harbor	0	0	10	8.18
AAR_VNM8	Eastport Terrace	537	17	3,777	37.38
AAR_VNM9	Truxton Park	633	20	4,706	38.94
AAR_VNM10	Shipley's Choice Elementary	6,712	217	50,218	57.45
AAR_VNM11	Robinwood	531	17	3,887	35.72
AAR_VNM12	Wordour Bluffs	1,139	37	8,177	42.01
AAR_VNM13	Millersville Elementary School	722	23	4,908	42.25
AAR_VNM14	Sherwood Forest	1,836	59	13,638	47.19
AAR_VNM15	Brookeville, Montgomery County	25	1	144	27.11
AAR_VNM16	Rolling Knolls	1,966	63	14,452	45.89
AAR_VNM17	Maryland State House	946	31	6,518	40.87
AAR_VNM18	I-97 and MD 178 Crownsville	429	14	2,787	40.64

This table shows the noise pollution metrics at the “Landmark” locations identified by the Roundtable for Anne Arundel County, which primarily experiences arrivals to the airport.

Locations closest to the airport and/or concentrated flight corridors many miles away from the airport will typically see the highest noise exposure. For instance, **West Annapolis Elementary School (WAES)** is approximately 23.4 miles from the end of Runway 33L, the dominant runway for arrivals. Yet, the DNL is over 43, there were an average of 39 flight per day over 55 decibels (**8,784 such flights year-to-date in 2024**).

Monthly Noise Exposure – Howard County Landmark Locations

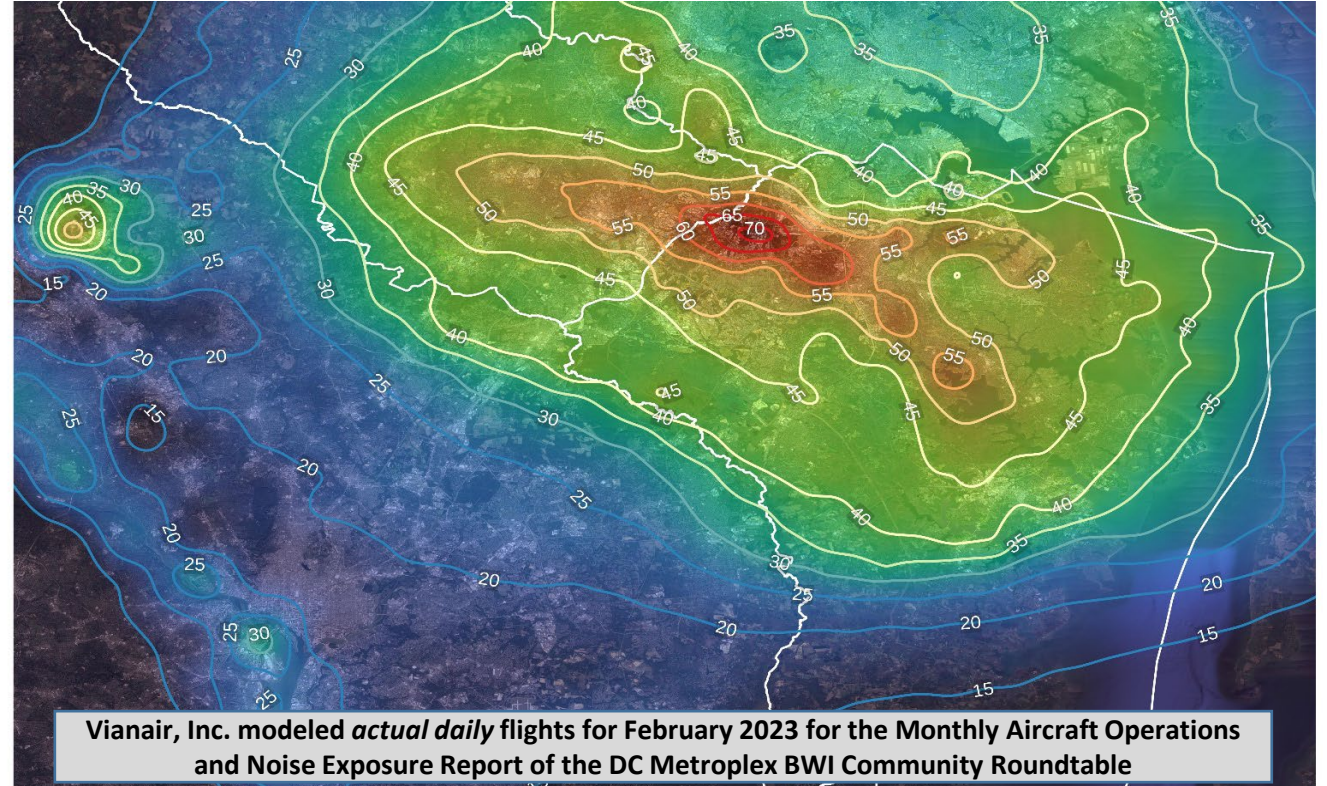
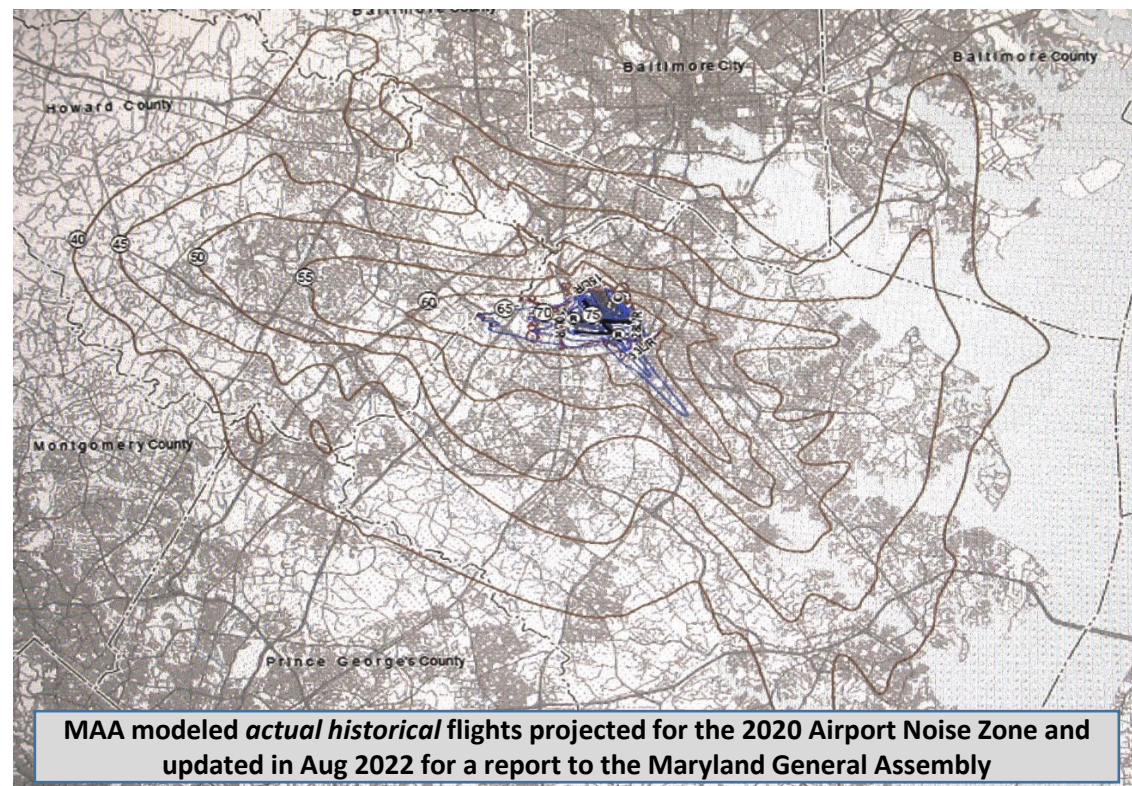
August 2024 – Both East and West Flow Operations

Name	Description	Number of Events Above 55dBA (Monthly)	Daily Average (Monthly)	Number of Events Above 55 dBA (YTD)	DNL (Monthly)
HOCO_VNM1	Howard Square Apartments	10,431	336	78,244	57.48
HOCO_VNM2	HCPSS Administration Campus	1,864	60	30,896	46.85
HOCO_VNM3	Centennial Park	596	19	19,097	45.44
HOCO_VNM4	HoCo General Hospital	5,734	185	45,893	51.6
HOCO_VNM5	Merriweather Post Pavillion	5,896	190	48,174	52.12
HOCO_VNM6	Oakland Mills HS	6,048	195	49,363	52.65
HOCO_VNM7	Long Reach HS	6,089	196	49,313	52.59
HOCO_VNM8	Troy Park	7,760	250	59,633	54.93
HOCO_VNM9	Harwood Park N'hood	7,798	252	60,157	55.44
HOCO_VNM10	Abiding Savior Lutheran	6,832	220	45,395	53.25
HOCO_VNM11	Tridelphia Ridge ES	294	9	1,877	37.57
HOCO_VNM12	Atholton HS	7,332	237	40,870	54.83
HOCO_VNM13	Christ Church Episcopal	8,835	285	60,290	58.25
HOCO_VNM14	Mayfield Woods MS	6,617	213	50,837	54.95
HOCO_VNM15	Manor Woods ES	248	8	1,496	39.05
HOCO_VNM16	Gateway Site	9,110	294	63,706	58.59
HOCO_VNM17	Wordour Bluffs	11,785	380	91,717	62.22
HOCO_VNM18	St. Louis Catholic	4,188	135	26,997	49.35

This table shows the noise pollution metrics at the “Landmark” locations identified by the Roundtable for Howard County, which primarily experiences departures from the airport.

Due to the high level of thrust required for take-offs, Howard County noise metrics are generally quite high, especially under concentrated flight corridors. For instance, **Oakland Mills High School (OMHS)** is approximately 8.3 miles from the end of Runway 28, the dominant runway for departures. Yet, the DNL is over 52 and there were an average of 195 flight per day over 55 decibels (**45,893 such flights year-to-date in 2024**).

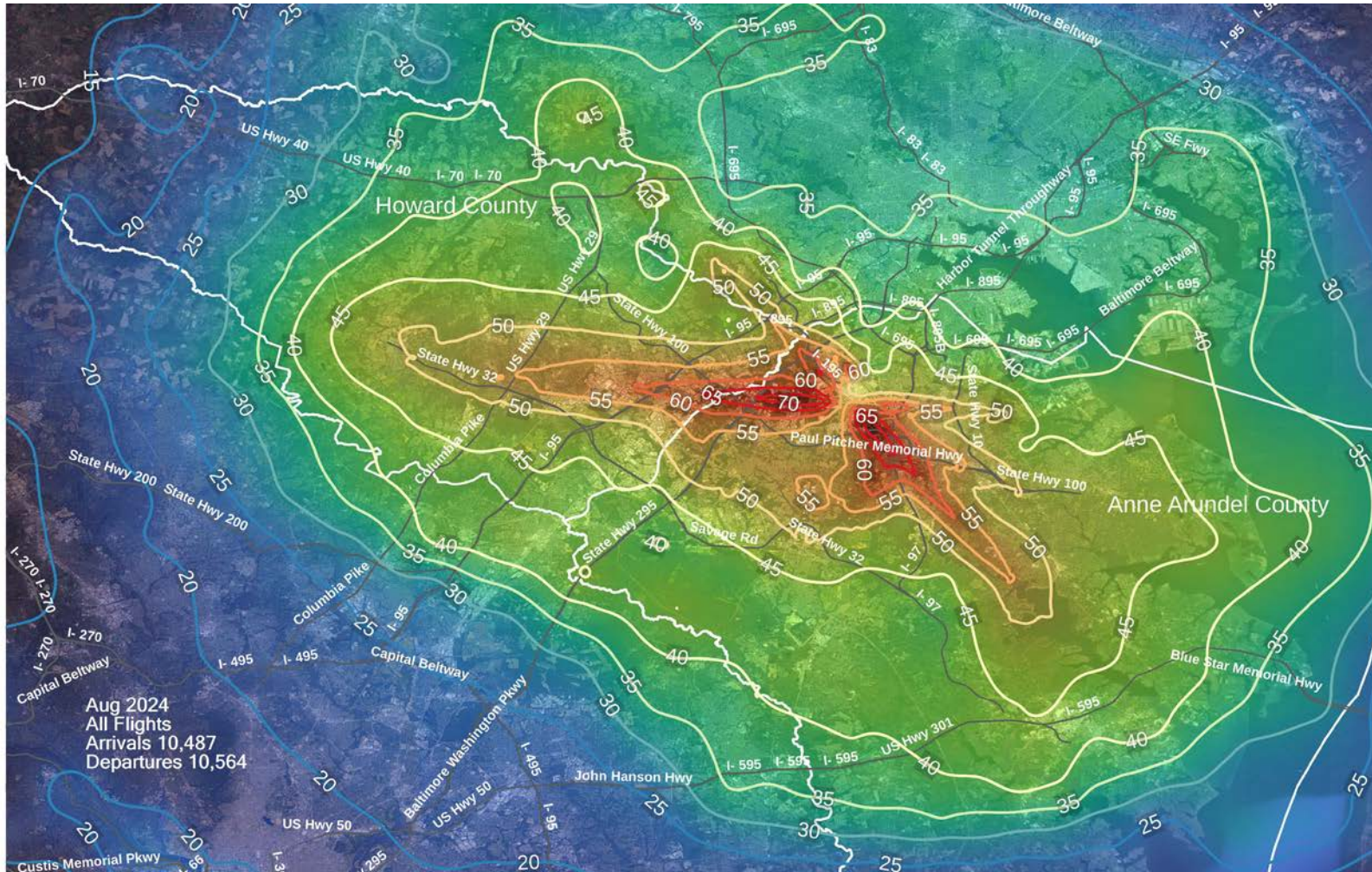
REGIONAL MAPS OF BWI-MARSHALL NOISE POLLUTION



These images represent two versions of the mapped regional noise pollution generated by commercial flight operations at BWI-Marshall. The map on the left was generated by MDOT-MAA based on actual **historical** operations collected by the MDOT MAA's Airport Noise and Operations Monitoring System (ANOMS) with computer modeling of future expected noise. It is focused on the 65 DNL contour of the Airport Noise Zone. The Vianair-generated map on the right is based on **actual daily flights** from the airport with computer modeling of the resulting expected noise, creating a more in-depth look at all DNL noise contours.

Noise Exposure – DNL Contours

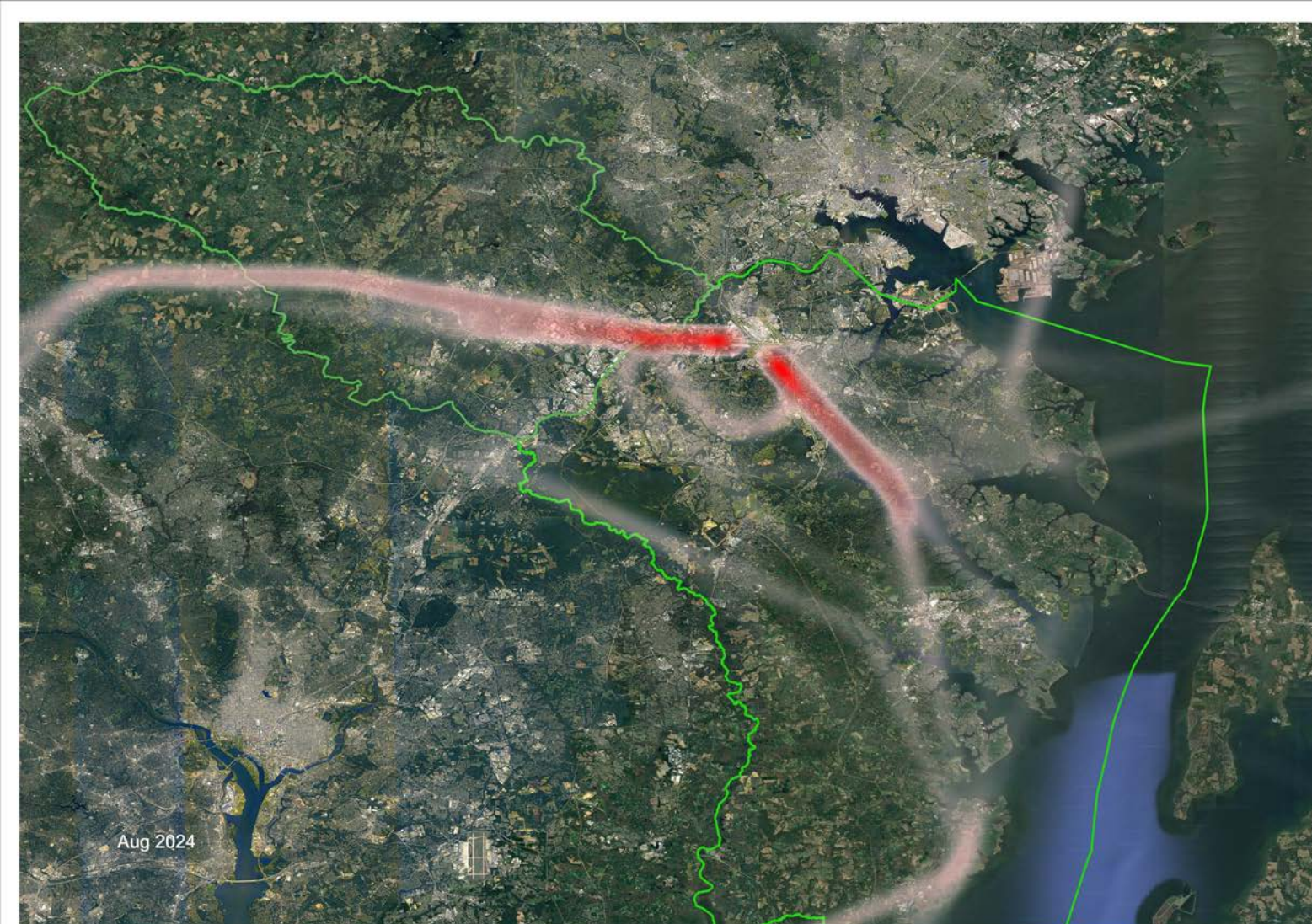
Howard and Anne Arundel Counties



In this Vianair-generated map, noise is expressed in DNL contours. For reference, the **50 DNL** contour stretches westward to encompass the approximate boundaries of **Columbia/Clarksville**, eastward to **Fort Smallwood/Lake Shore/Annapolis** and south to **Crownsville /Millersville/Fort Meade**.

The WHO has identified adverse health effects at this noise level.

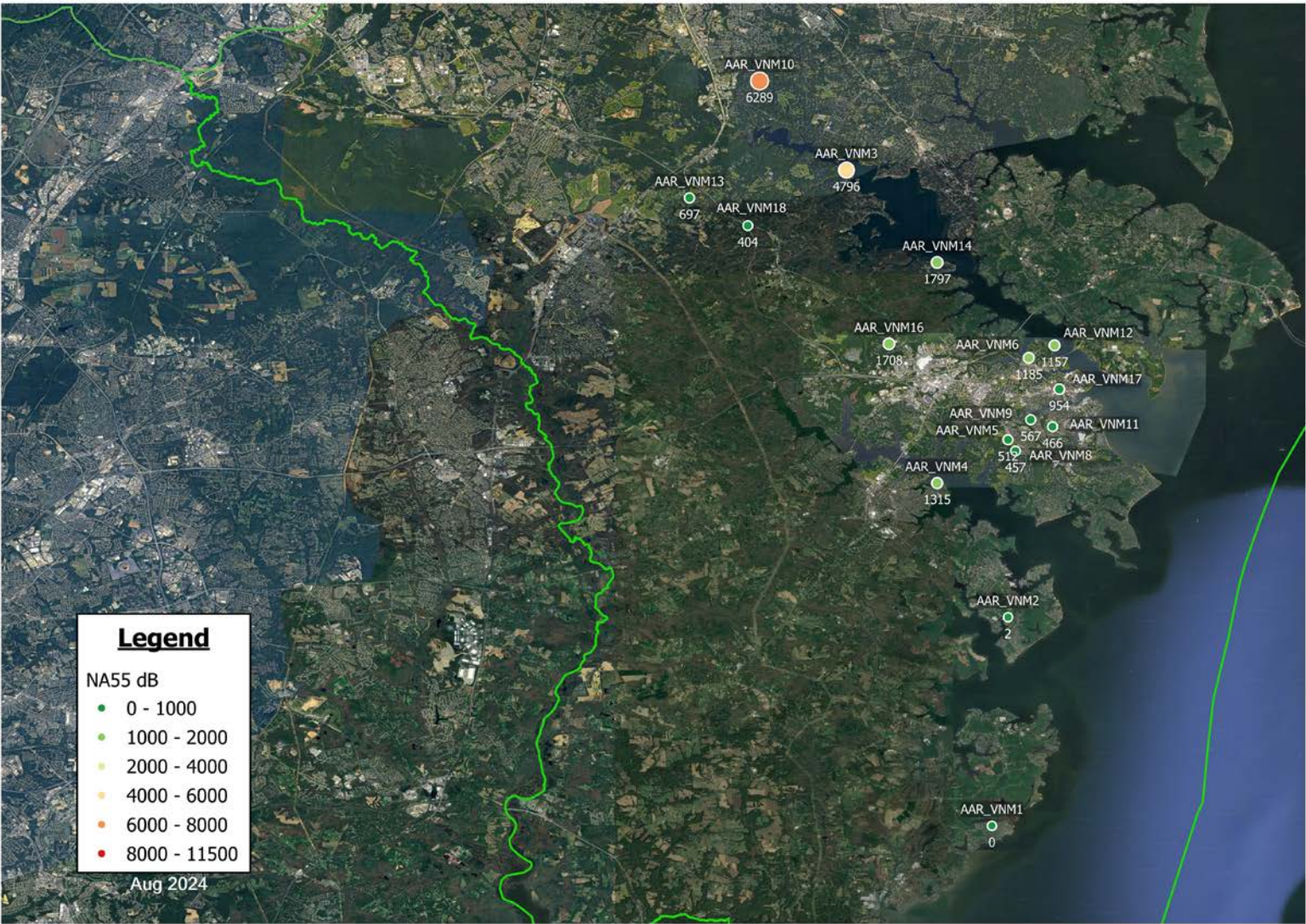
Flight Track Density – Heat Map of Anne Arundel and Howard Counties



Flight track density analyzes the concentrations of flight activity in and out of BWI. Flight track density is calculated based on reviewing all flights for the month, then analyzing the concentration of flights within the study area. Concentration (or density) is then depicted using color. Red represents the highest density, fading to white as density lowers.

Noise Exposure – Number of Events Above 55 dBA

Anne Arundel County - Landmark Locations Only



This map shows the Number of Events (single flights) at the local Landmarks during the month above the 55 decibel Threshold (NAT) for Anne Arundel County.

Note that the Annapolis peninsula and other communities along the Severn River experience many events above threshold.

Noise Exposure – Number of Events Above 55 dBA

Howard County - Landmark Locations Only

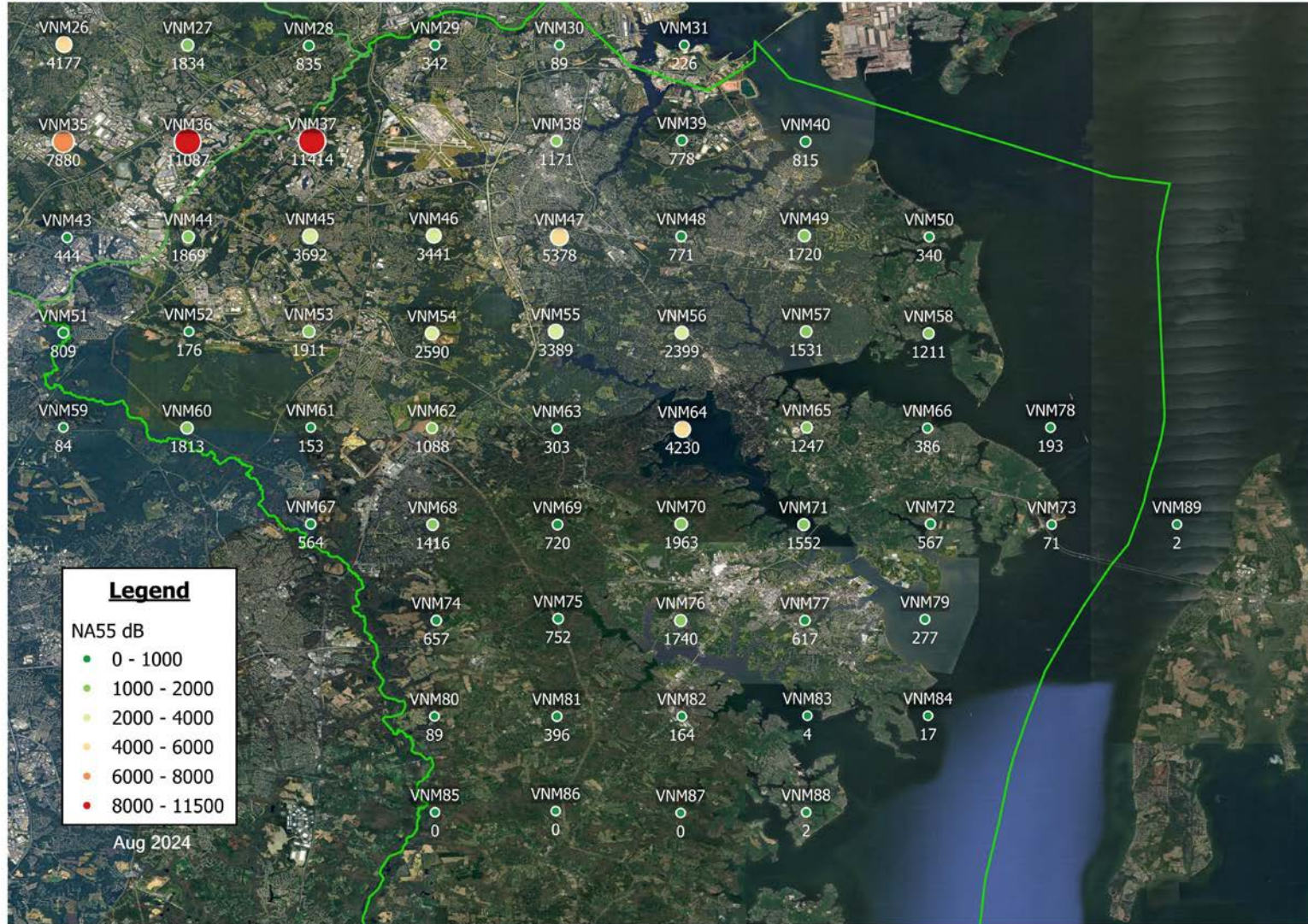
This map shows the Number of Events (single flights) at the local Landmarks during the month above the 55 decibel Threshold (NAT) for Howard County.

Note that while highly significant noise pollution extends to St. Louis Catholic School in Clarksville (HOCO_VNM18), areas as far west as Tridelphia Ridge Elementary School (HOCO_VNM11) also experienced many events above threshold.



Noise Exposure – Number of Events Above 55 dBA

Anne Arundel County – Full Virtual Noise Monitor Grid

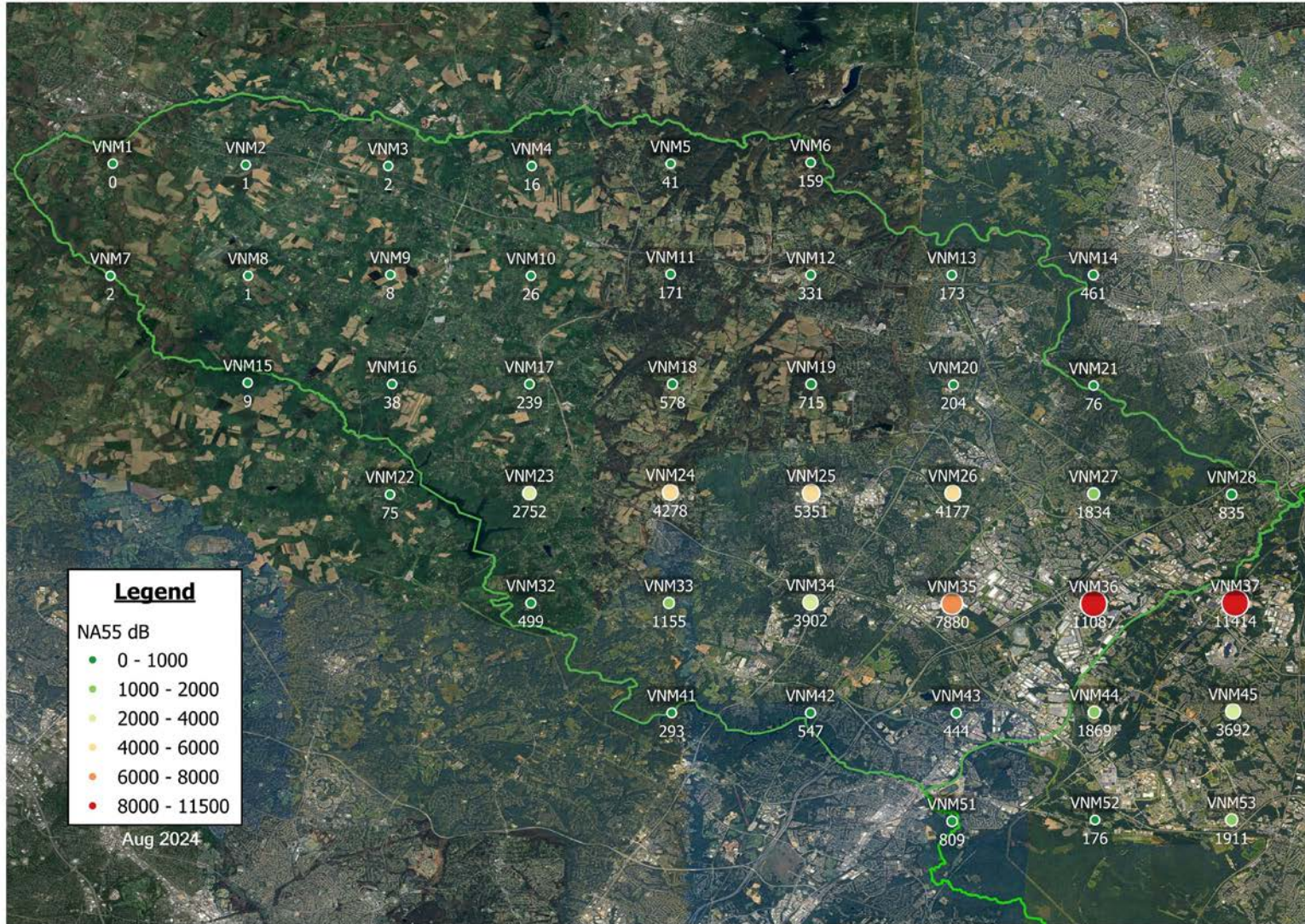


This map shows the Number of Events (single flights) during the month above the 55 decibel Threshold (NAT) for the total grid of Virtual Noise Monitors in Anne Arundel County.

For individuals who wish to use this map to gauge the NAT for their location of interest (home, school, hospital, etc.) there will be noticeable differences in noise pollution between each Virtual Noise Monitor.

Noise Exposure – Number of Events Above 55 dBA

Howard County – Full Virtual Noise Monitor Grid



This map shows the Number of Events (single flights) during the month above the 55 decibel Threshold (NAT) for the total grid of Virtual Noise Monitors in Howard County.

For individuals who wish to use this map to gauge the NAT for their location of interest (home, school, hospital, etc.) there will be noticeable differences in noise pollution between each Virtual Noise Monitor.

Noise Exposure – Full Virtual Noise Monitor Grid, All Operational Flows

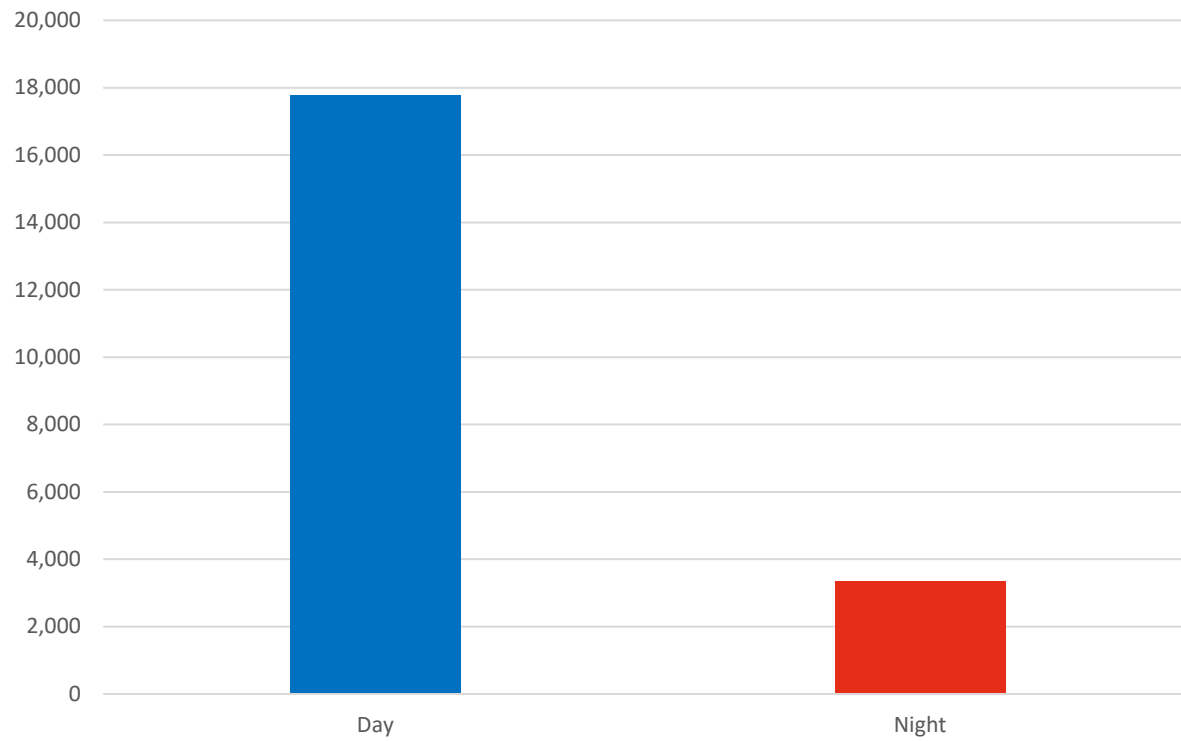
August 2024

Name	Number-of-Events-Above 55dBA (Total)	Daily Average	DNL	Name	Number-of-Events-Above 55dBA (Total)	Daily Average	DNL	Name	Number-of-Events-Above 55dBA (Total)	Daily Average	DNL
VNM1	0	0	11.18	VNM31	226	7	38.51	VNM61	153	5	40.76
VNM2	1	0	17.33	VNM32	499	16	38.77	VNM62	1,088	35	43.69
VNM3	2	0	20.92	VNM33	1,155	37	45.87	VNM63	303	10	41.09
VNM4	16	1	27.31	VNM34	3,902	126	50.7	VNM64	4,230	136	50.81
VNM5	41	1	35.14	VNM35	7,880	254	53.76	VNM65	1,247	40	45.41
VNM6	159	5	36.24	VNM36	11,087	358	59.56	VNM66	386	12	40.83
VNM7	2	0	16.58	VNM37	11,414	368	69.9	VNM67	564	18	41
VNM8	1	0	18.01	VNM38	1,171	38	50.56	VNM68	1,416	46	42.75
VNM9	8	0	24.9	VNM39	778	25	41.91	VNM69	720	23	42.01
VNM10	26	1	30.37	VNM40	815	26	42.82	VNM70	1,963	63	46.71
VNM11	171	6	39.09	VNM41	293	9	41.38	VNM71	1,552	50	44
VNM12	331	11	39.76	VNM42	547	18	43.87	VNM72	567	18	39.16
VNM13	173	6	39.85	VNM43	444	14	44.31	VNM73	71	2	31.43
VNM14	461	15	42.24	VNM44	1,869	60	49.3	VNM74	657	21	39.41
VNM15	9	0	20.81	VNM45	3,692	119	53.42	VNM75	752	24	41.17
VNM16	38	1	29.49	VNM46	3,441	111	56.3	VNM76	1,740	56	43.58
VNM17	239	8	37.45	VNM47	5,378	173	54.96	VNM77	617	20	39.2
VNM18	578	19	43.15	VNM48	771	25	47.99	VNM78	193	6	35.25
VNM19	715	23	43.27	VNM49	1,720	55	46.68	VNM79	277	9	32.58
VNM20	204	7	40.31	VNM50	340	11	40.93	VNM80	89	3	32.9
VNM21	76	2	39.15	VNM51	809	26	43.68	VNM81	396	13	34.74
VNM22	75	2	29.81	VNM52	176	6	40.41	VNM82	164	5	32.43
VNM23	2,752	89	42.84	VNM53	1,911	62	47.87	VNM83	4	0	27.57
VNM24	4,278	138	49.94	VNM54	2,590	84	47.64	VNM84	17	1	28.08
VNM25	5,351	173	50.9	VNM55	3,389	109	49.4	VNM85	0	0	21.67
VNM26	4,177	135	50.05	VNM56	2,399	77	49.75	VNM86	0	0	21.56
VNM27	1,834	59	48.01	VNM57	1,531	49	47.61	VNM87	0	0	20.81
VNM28	835	27	48.64	VNM58	1,211	39	45.27	VNM88	2	0	23.95
VNM29	342	11	42.59	VNM59	84	3	38.79	VNM89	2	0	23.26
VNM30	89	3	39.26	VNM60	1,813	58	44.81				

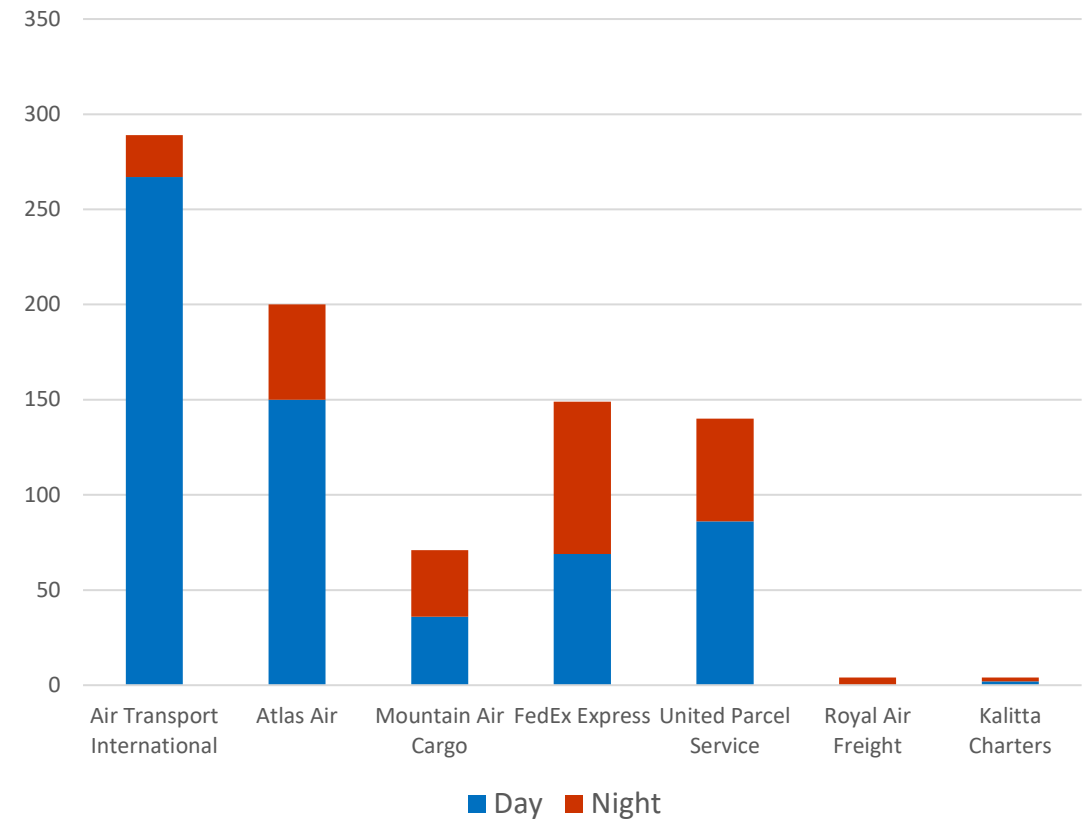
Monthly Operations – Daytime vs. Nighttime

August 2024

Monthly Operations - Day vs. Night



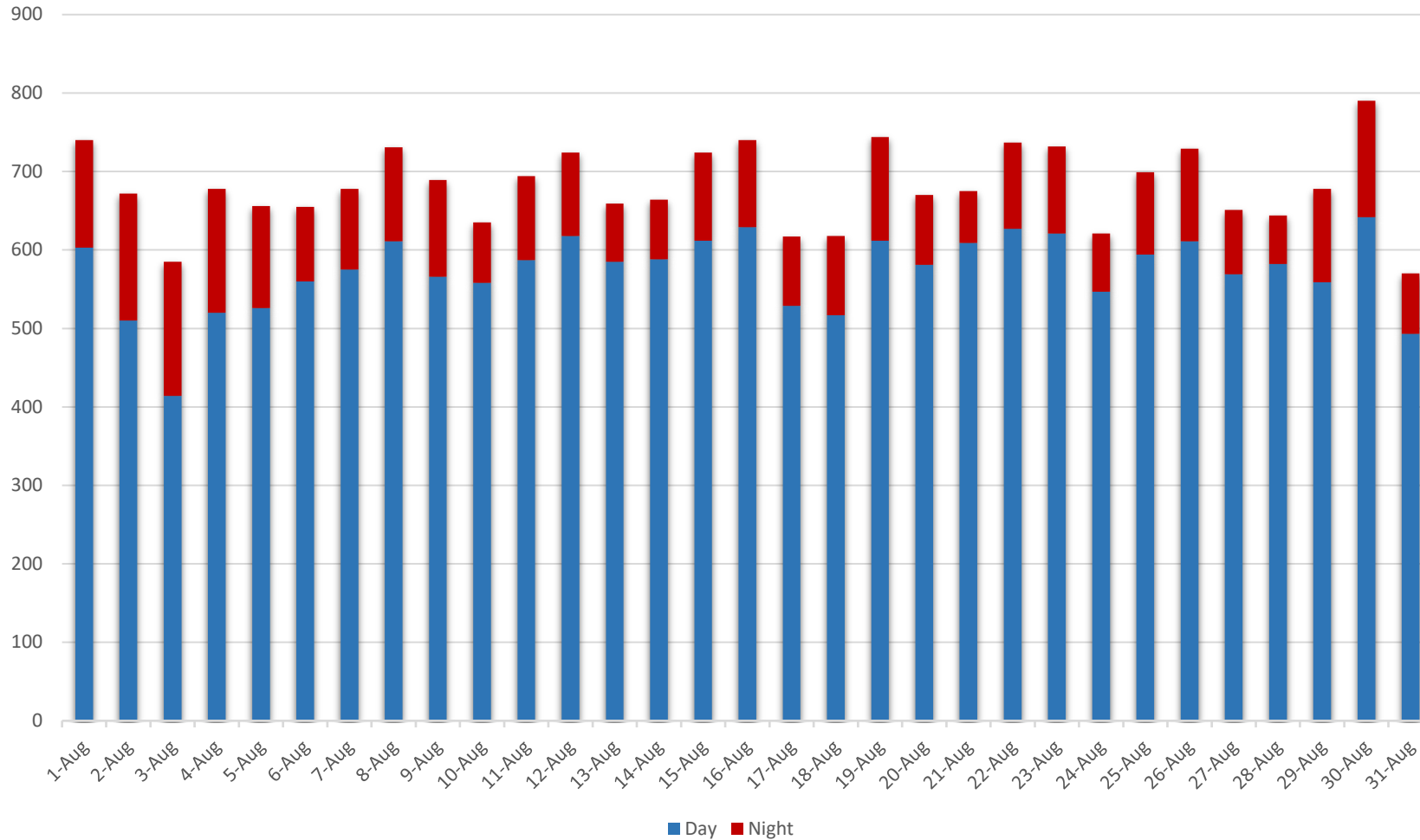
Cargo Operatons - Daytime Vs. Nighttime



Monthly Operations

August 2024

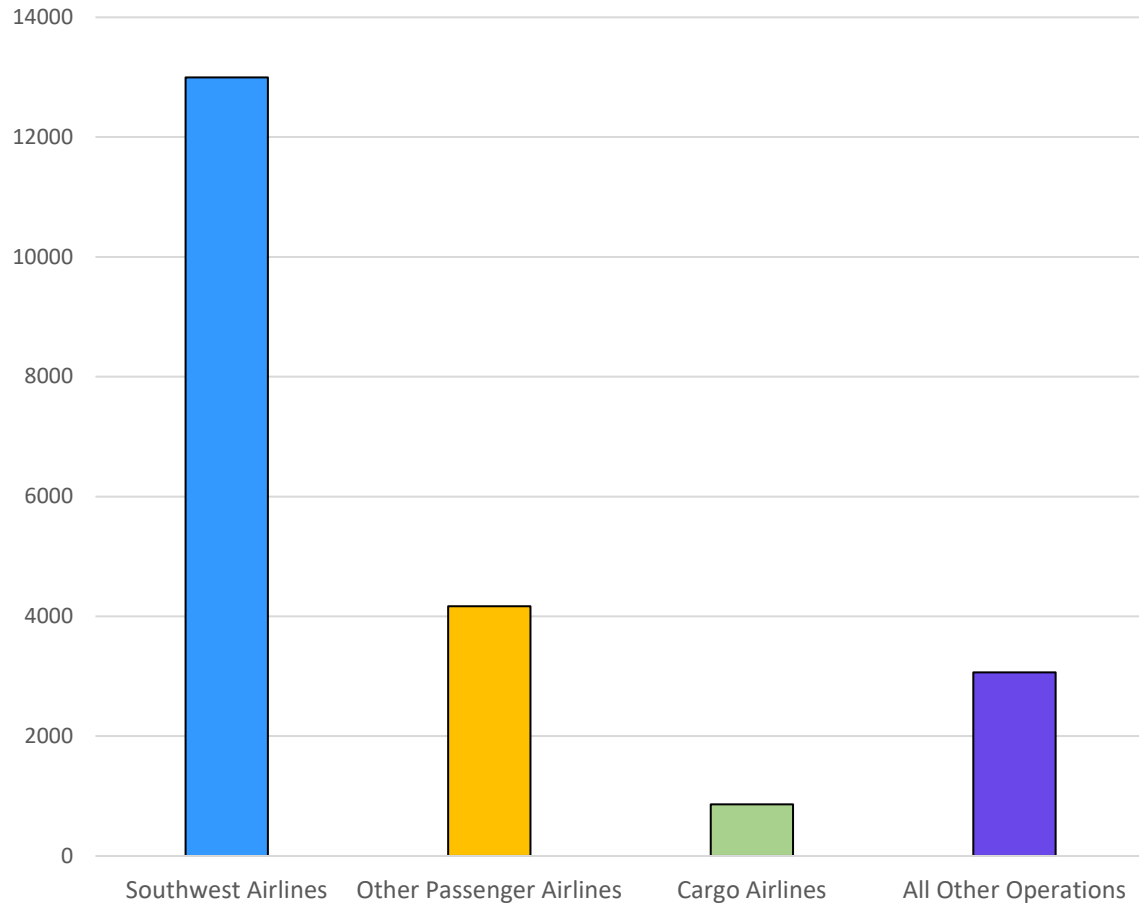
Daily Operations (Day vs. Night)



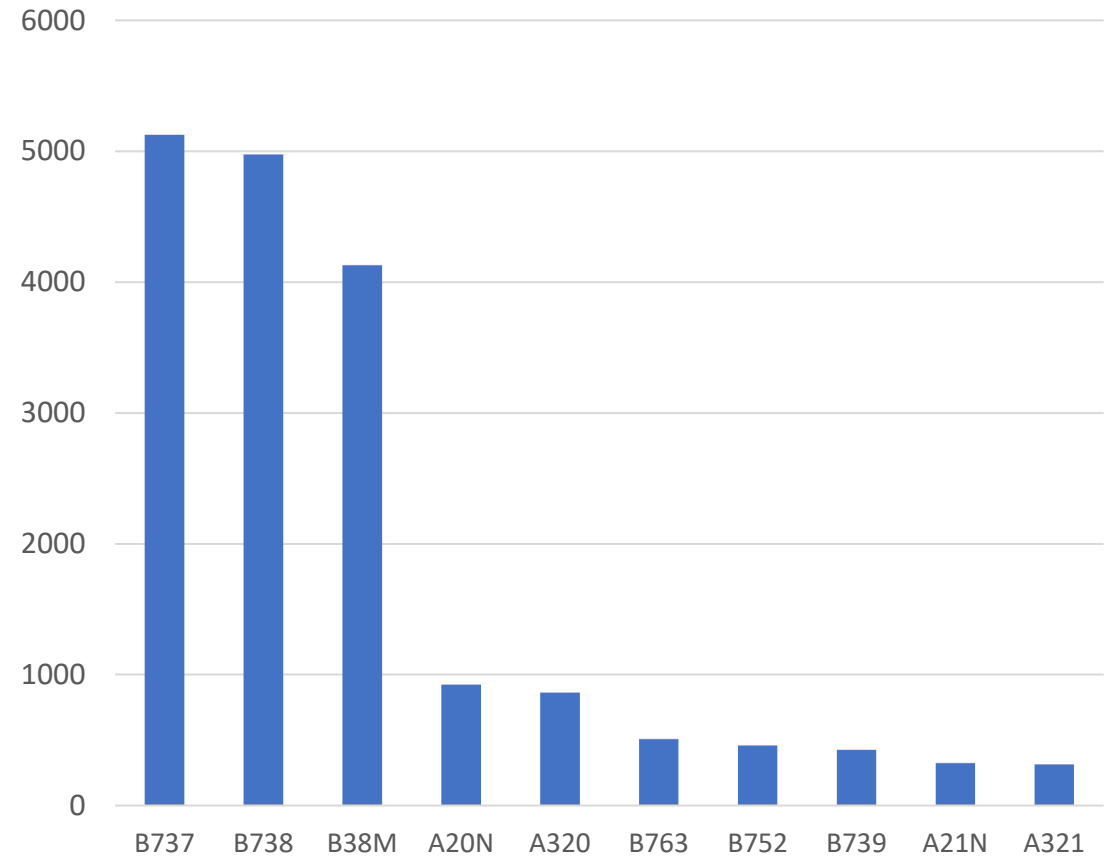
Aircraft Operations

August 2024

Southwest vs. All Other Operations



Total Operations by Aircraft Type (Top 10 Aircraft)





Aircraft Noise Basics

Noise is defined as “unwanted sound.” There are many ways to measure noise. Two common metrics will be used in these reports: Day-Night Level (DNL) and Number-of-Events-Above (NA).

DNL is the standard metric used by the Federal Aviation Administration as required by federal regulation. Federal guidelines recommend **DNL 65** as the level of aircraft noise exposure that is incompatible with noise-sensitive applications including residential development. A problem with DNL is it is difficult for the public to understand and doesn't seem to reflect what residents experience on a daily basis.

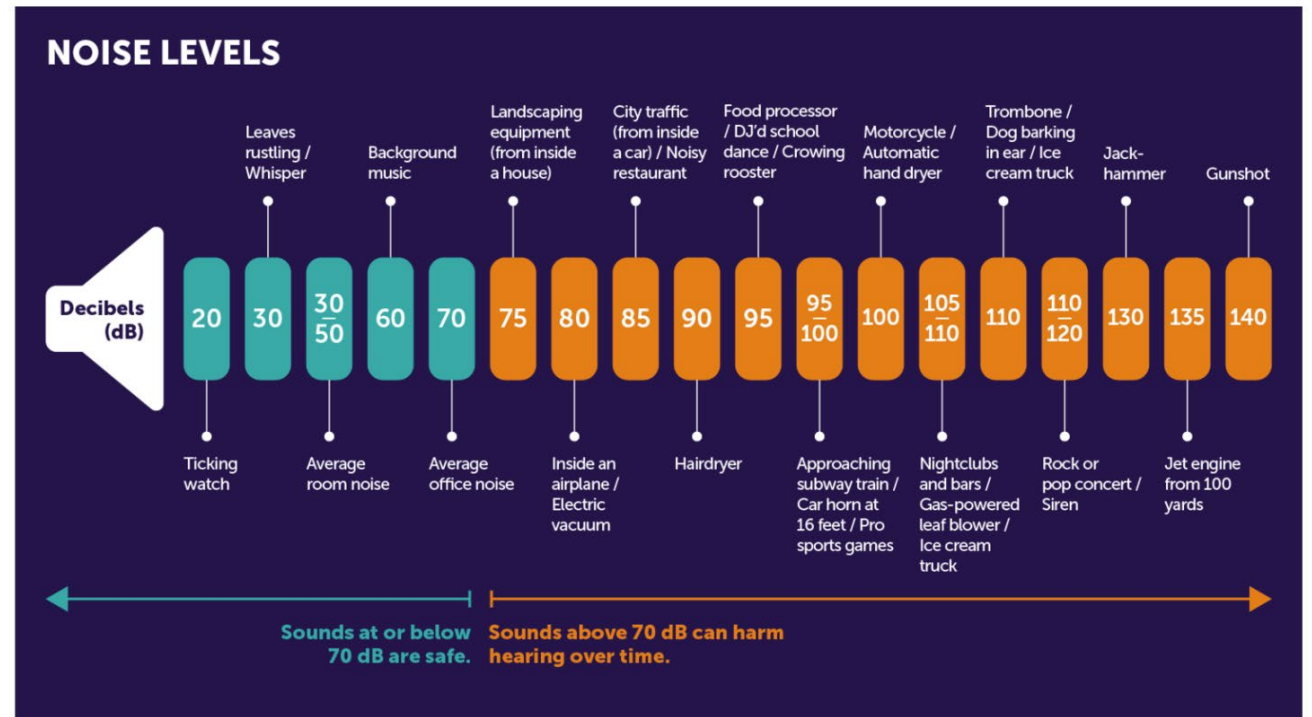
The NA noise metric counts the number of times the noise level exceeds a specific threshold. In this report, the Number-of-Events-Above 55 metric (NA55) is calculated. NA55 quantifies the number of aircraft events resulting in noise exposure of 55 decibels or higher at each location depicted.

Noise Basics

The scale below is intended to provide a basic understand of noise levels which are expressed in A-weighted decibels (dB or dBA). The purpose of the chart is to provide examples of noise/sound level associated with common events. This is intended to provide the reader with a basic understanding or context of “how loud” 55, 65, 75, etc., decibels is.



It is worth noting that noise (sound) exposure and noise annoyance are different. Noise exposure is based on acoustics and represents a measure of sound energy a person is exposed to. Sound exposure at a specific level (i.e. 65 db) may be perceived differently based on the source of the noise (i.e. music at 65 decibels vs. aircraft noise at 65 decibels). The source of the sound and the individual’s perception of the source is one of the many factors that contribute to our reaction.

Annoyance (annoyed, highly annoyed, not annoyed, etc.) is based on an individual’s multi-factored response to noise exposure and varies by individual. However, aircraft noise consistently generates greater levels of high annoyance among surveyed populations than other types of transportation noise. **Of note for this report, high noise annoyance has been scientifically associated with disease.**



Why the DNL metric is controversial

In September 2021, the General Accounting Office of the United States Government (GAO) published a review of the FAA's implementation of the precision flight path component of NextGen, which is called Performance Based Navigation (PBN). That analysis showed that because DNL combines the effects of several components of noise into a single metric, it does not provide a clear picture of the flight activity or associated noise levels at a given location. For example, 100 flights per day can yield the same DNL as one flight per day at a higher decibel level, due to the averaging effect of FAA's metric.

Flights per day, by decibel (dB) level	Day-Night Average Sound Level
1 flight per day at 114.4 dB 	65 dB
100 flights per day at 94.4 dB 	65 dB

Note: For more details, see fig. 1 in GAO-22-105844.

Source: GAO analysis of Federal Aviation Administration information. | GAO-22-105844

The GAO's analysis and other research demonstrate the limitations of FAA relying solely on DNL to identify potential noise problems. This illustrates why communities often view DNL as a "permissive" measure, designed to allow increased airplane operations.



For More Information

For more information about the contents of this report or
for questions about the DC Metroplex BWI Community Roundtable

Please Visit:

<https://marylandaviation.com/environmental/environmental-compliance-sustainability/dc-metroplex-bwi-community-roundtable>