



BWI-Thurgood Marshall Airport Operations and Noise Exposure

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

Monthly Report for March 2023

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

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

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Introduction



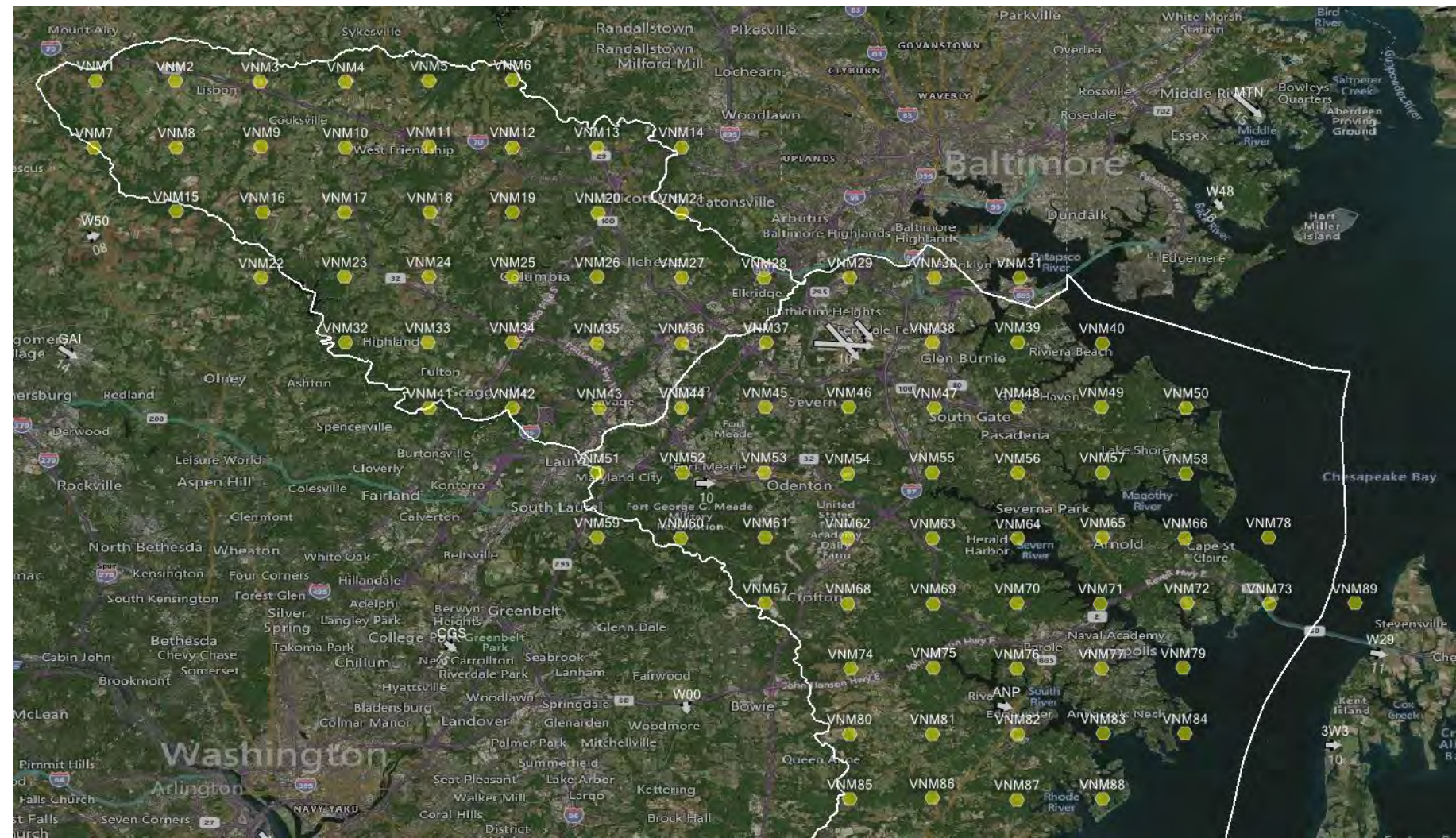
This is a summary of a larger report (the “Monthly Report”) prepared by Vianair, Inc. (“Vianair”) for the benefit of the DC Metroplex BWI Community Roundtable (the “BWI Roundtable”).

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 Marshal 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 March 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 counts the number of times the noise level exceeds a specific threshold. In this report, the Number-of-Events-Above 55 metric (NASS) is calculated. NASS 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 Marshall I 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

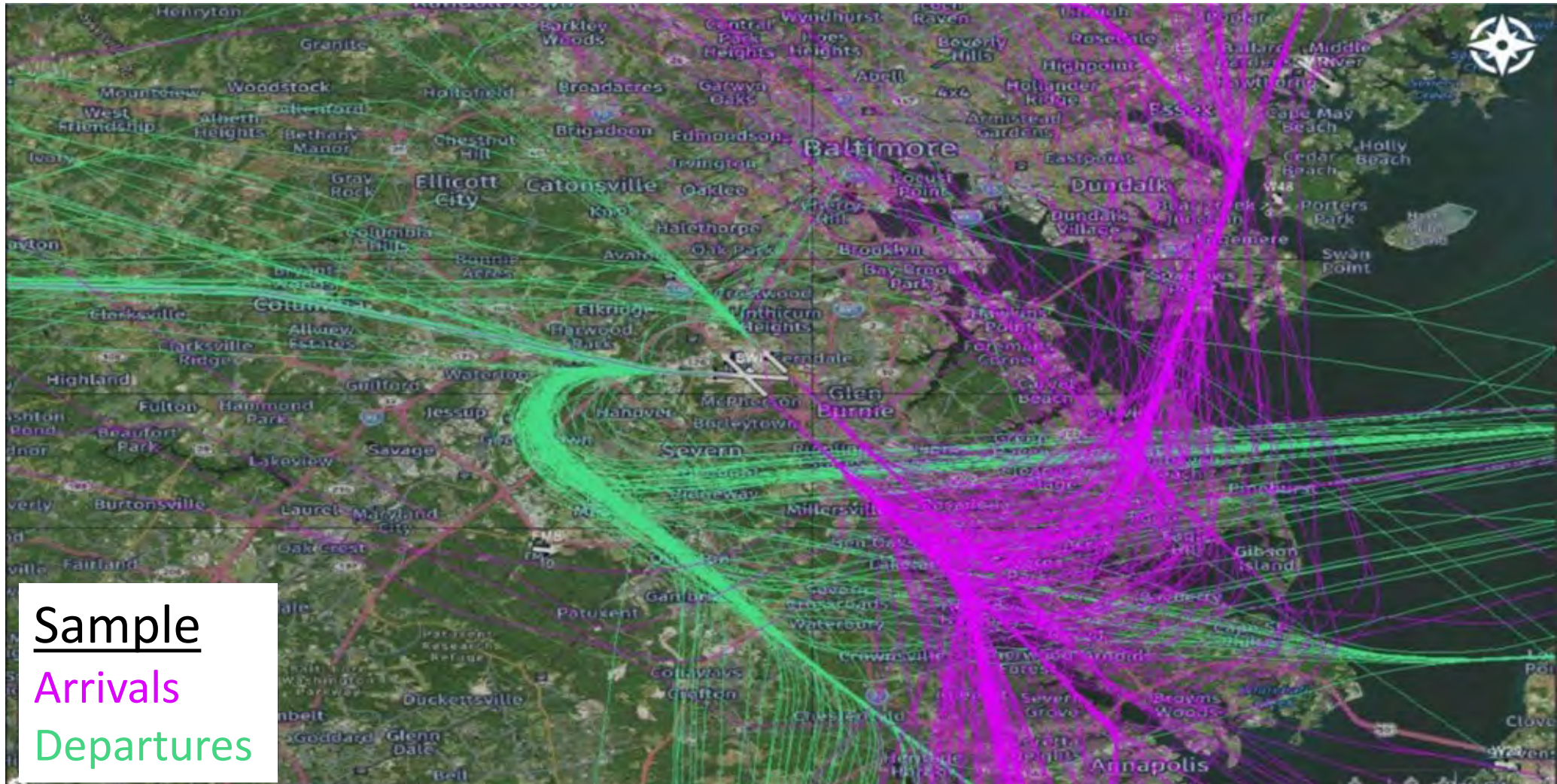
Prevailing wind speed, direction and weather factors determine the direction of air traffic flow from BWI Marshall airport. Aircraft usually take off and land into the wind to meet safety and operational requirements.

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 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.

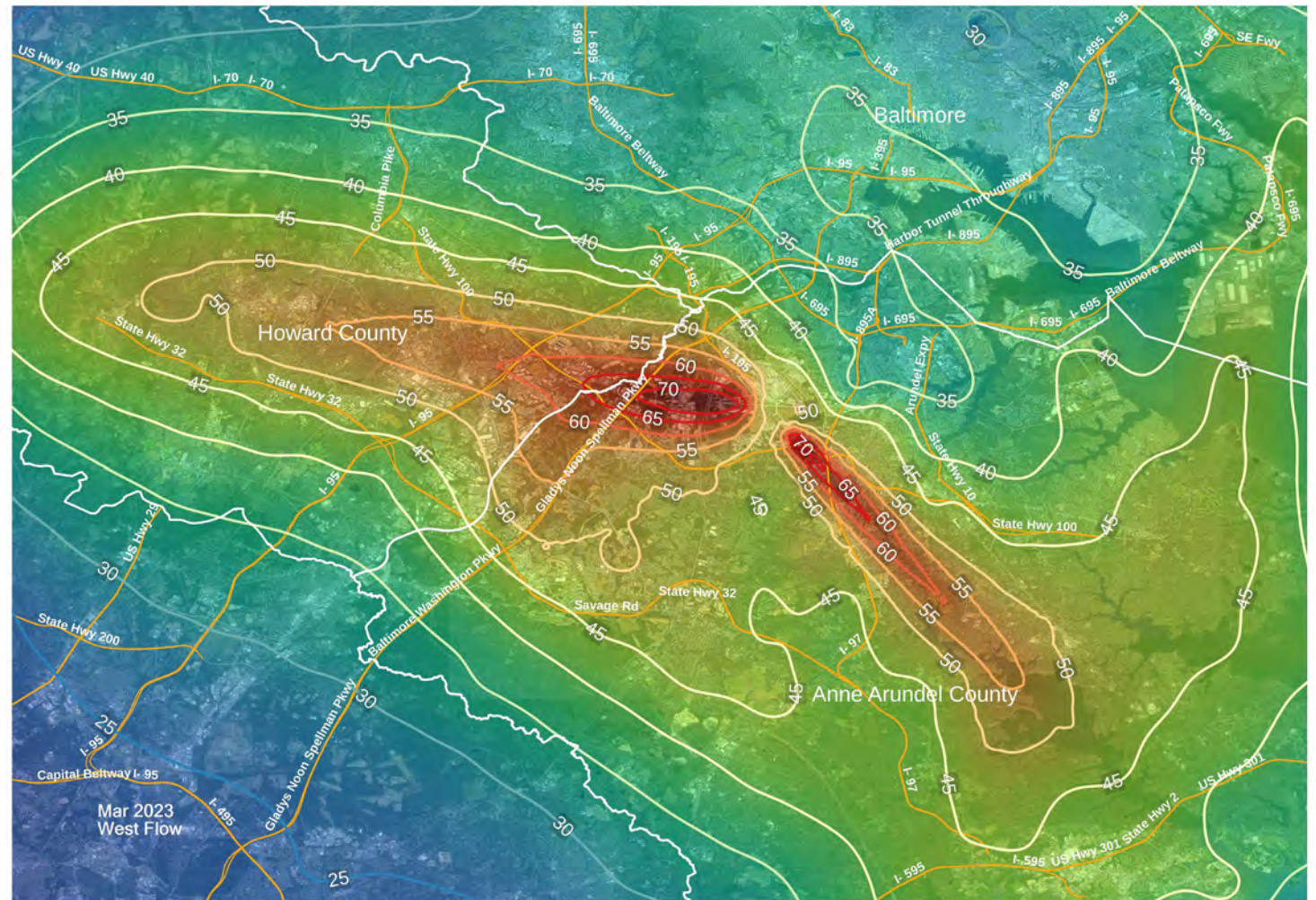
Visual representation of a typical day of traffic over the Baltimore region during West Flow operations at BWI-Marshall



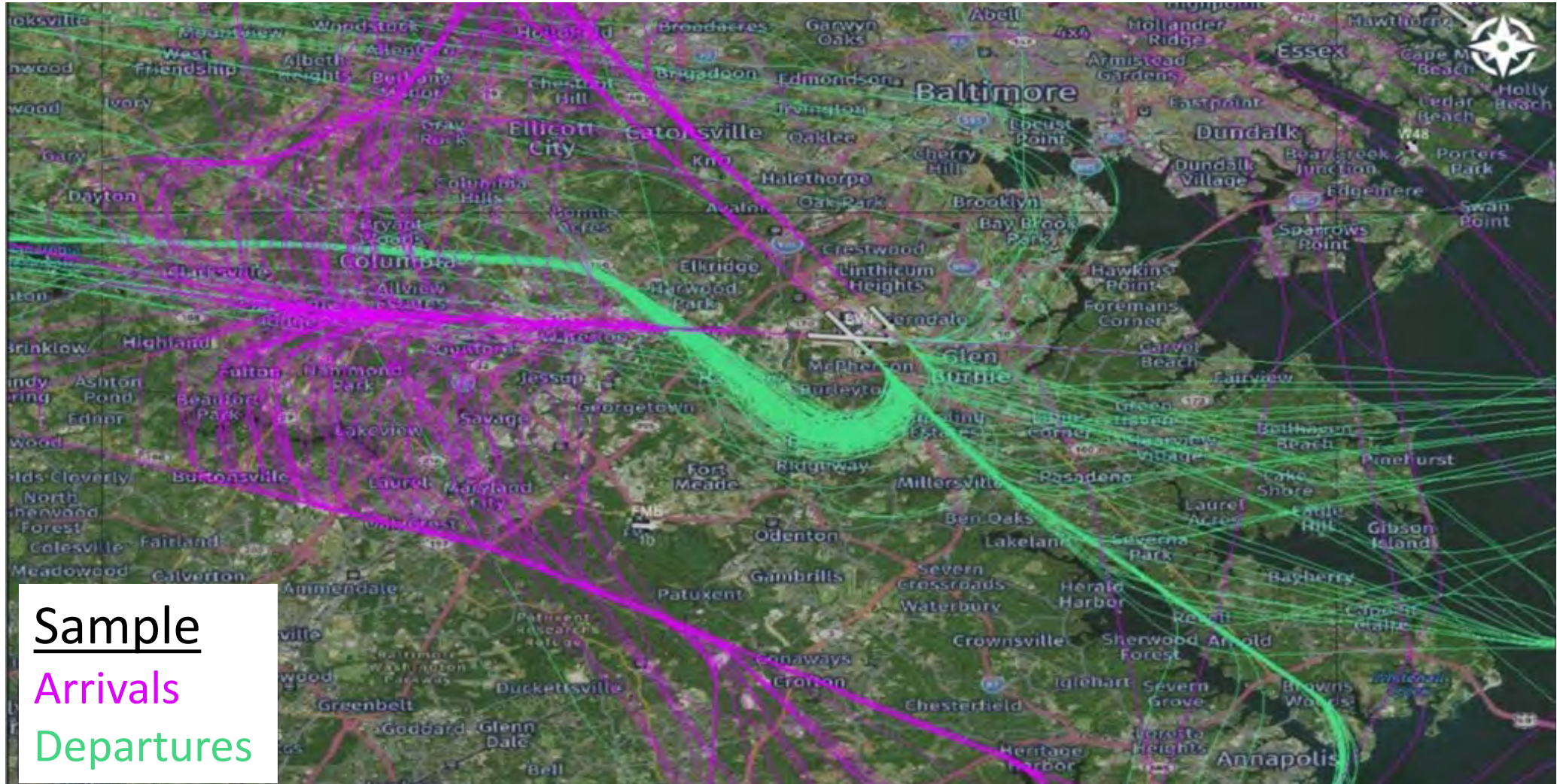
West Flow Operations – DNL Noise Exposure

West Flow: Arrivals Runway 33L & Departures Runway 28

Note: The DNL Map for KBWI East 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 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.



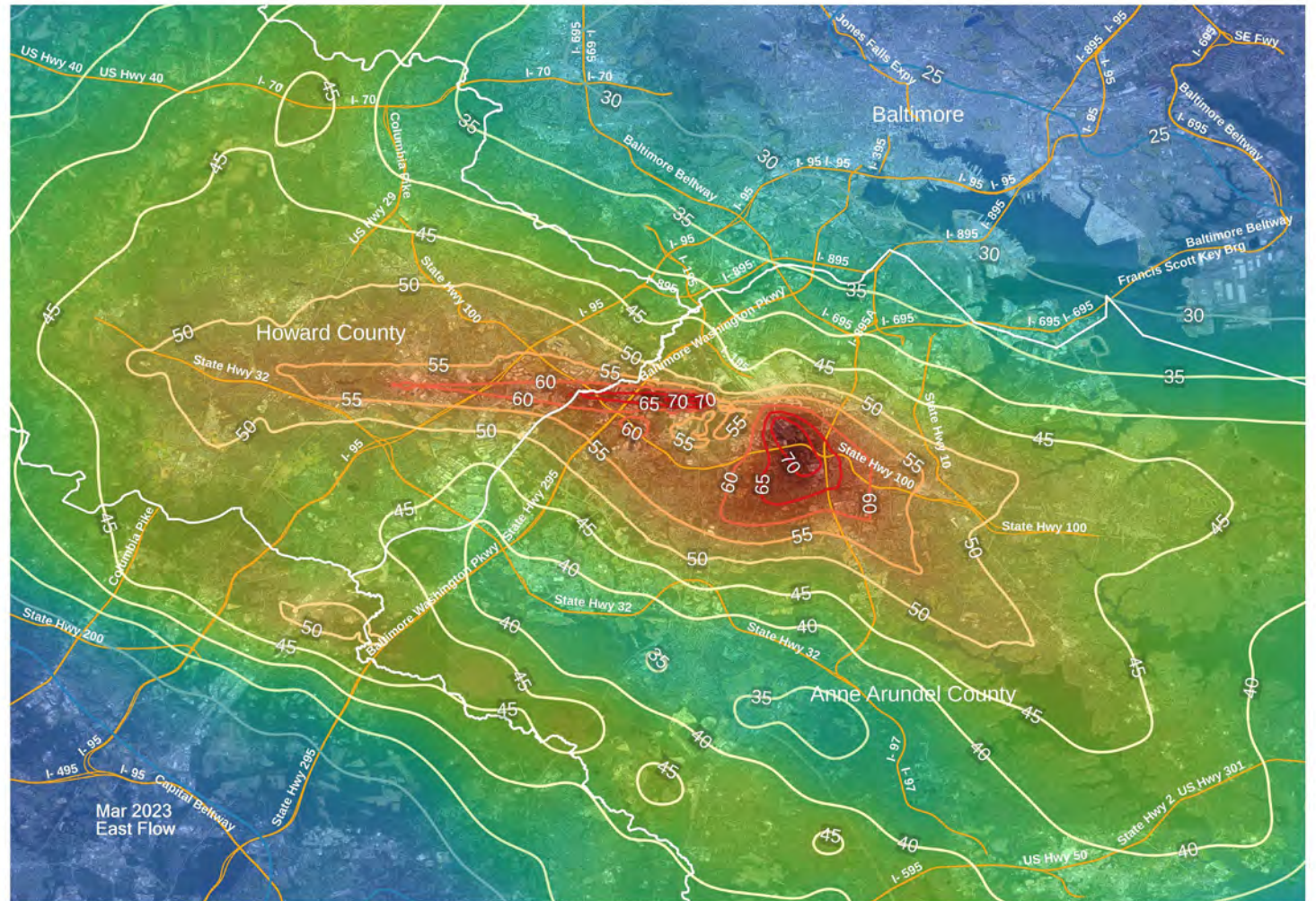
Visual representation of a typical day of traffic over the Baltimore region during East Flow operations at BWI-Marshall



East Flow Operations – DNL Noise Exposure

East Flow: Arrivals Runway 15R & Departures Runway 10

Note: The DNL Map for KBWI East Flow is calculated for Arrivals to Runway 15R only, and Departures from Runway 10 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

March 2023 – 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	17	1	132	30.63
AAR_VNM2	JETNA	27	1	232	32.23
AAR_VNM3	Arden on the Severn	5092	164	15033	57.67
AAR_VNM4	London Public House	1559	50	4472	40.02
AAR_VNM5	Annapolis Middle School	664	21	2117	39.97
AAR_VNM6	West Annapolis Elementary	1280	41	3909	45.17
AAR_VNM7	Herald Harbor	10	0	92	33.5
AAR_VNM8	Eastport Terrace	662	21	2017	41.52
AAR_VNM9	Truxton Park	781	25	2438	43.85
AAR_VNM10	Shipley's Choice Elementary	6604	213	19167	59.15
AAR_VNM11	Robinwood	590	19	1784	38.57
AAR_VNM12	Wordour Bluffs	1130	36	3465	43.48
AAR_VNM13	Millersville Elementary School	794	26	2652	43.48
AAR_VNM14	Sherwood Forest	1862	60	5755	48.79
AAR_VNM15	Brookeville, Montgomery County	35	1	35	34.63
AAR_VNM16	Rolling Knolls	2154	69	6539	47.5
AAR_VNM17	Maryland State House	974	31	974	43.4
AAR_VNM18	I-97 and MD 178 Crownsville	723	23	723	43.27

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 45, there were an average of 41 flight per day over 55 decibels (**3,909 such flights year-to-date in 2023**).

Monthly Noise Exposure – Howard County Landmark Locations

March 2023 – 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	8263	267	23148	54.96
HOCO_VNM2	HCPSS Administration Campus	4126	133	11416	49.82
HOCO_VNM3	Centennial Park	3850	124	10783	48.48
HOCO_VNM4	HoCo General Hospital	5316	171	14782	53.2
HOCO_VNM5	Merriweather Post Pavillion	5658	183	15670	54.54
HOCO_VNM6	Oakland Mills HS	5875	190	16360	55.76
HOCO_VNM7	Long Reach HS	5971	193	16721	56.72
HOCO_VNM8	Troy Park	7232	233	20757	59.82
HOCO_VNM9	Harwood Park N'hood	7288	235	21130	59.22
HOCO_VNM10	Abiding Savior Lutheran	5159	166	13960	51.96
HOCO_VNM11	Tridelphia Ridge ES	222	7	651	37.58
HOCO_VNM12	Atholton HS	4776	154	12850	53.78
HOCO_VNM13	Christ Church Episcopal	6589	213	17932	56.93
HOCO_VNM14	Mayfield Woods MS	6128	198	17231	59.44
HOCO_VNM15	Manor Woods ES	222	7	644	38.96
HOCO_VNM16	Gateway Site	6785	219	18476	56.94
HOCO_VNM17	Oxford Square Neighborhood	9912	320	27658	65.93
HOCO_VNM18	St. Louis Catholic	3003	97	8277	48.1

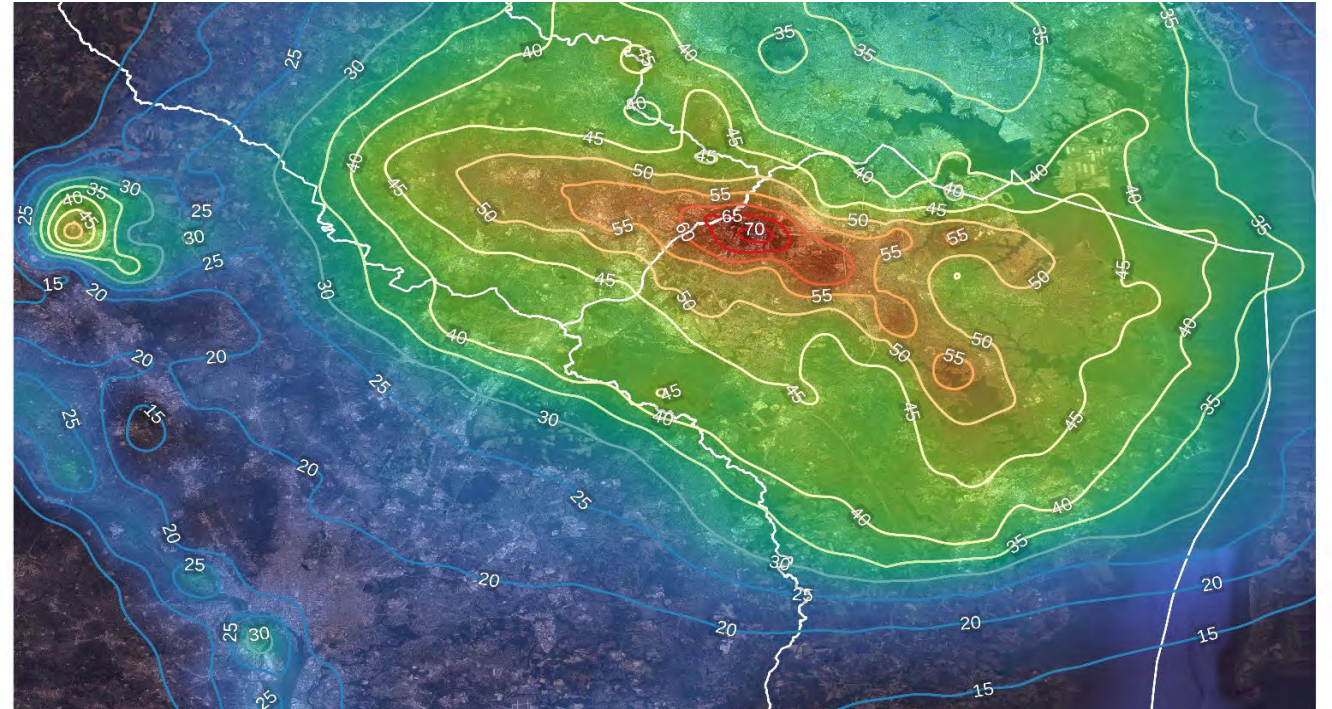
This table shows the noise pollution metrics at the “Landmark” locations identified by the Roundtable for Howard County, which primarily experiences departures from the airport.

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 55 and there were an average of 190 flight per day over 55 decibels (**16,360 such flights year-to-date in 2023**).

REGIONAL MAPS OF BWI-MARSHALL NOISE POLLUTION



MAA modeled *actual historical* flights projected for the 2020 Airport Noise Zone and updated in Aug 2022 for a report to the Maryland General Assembly

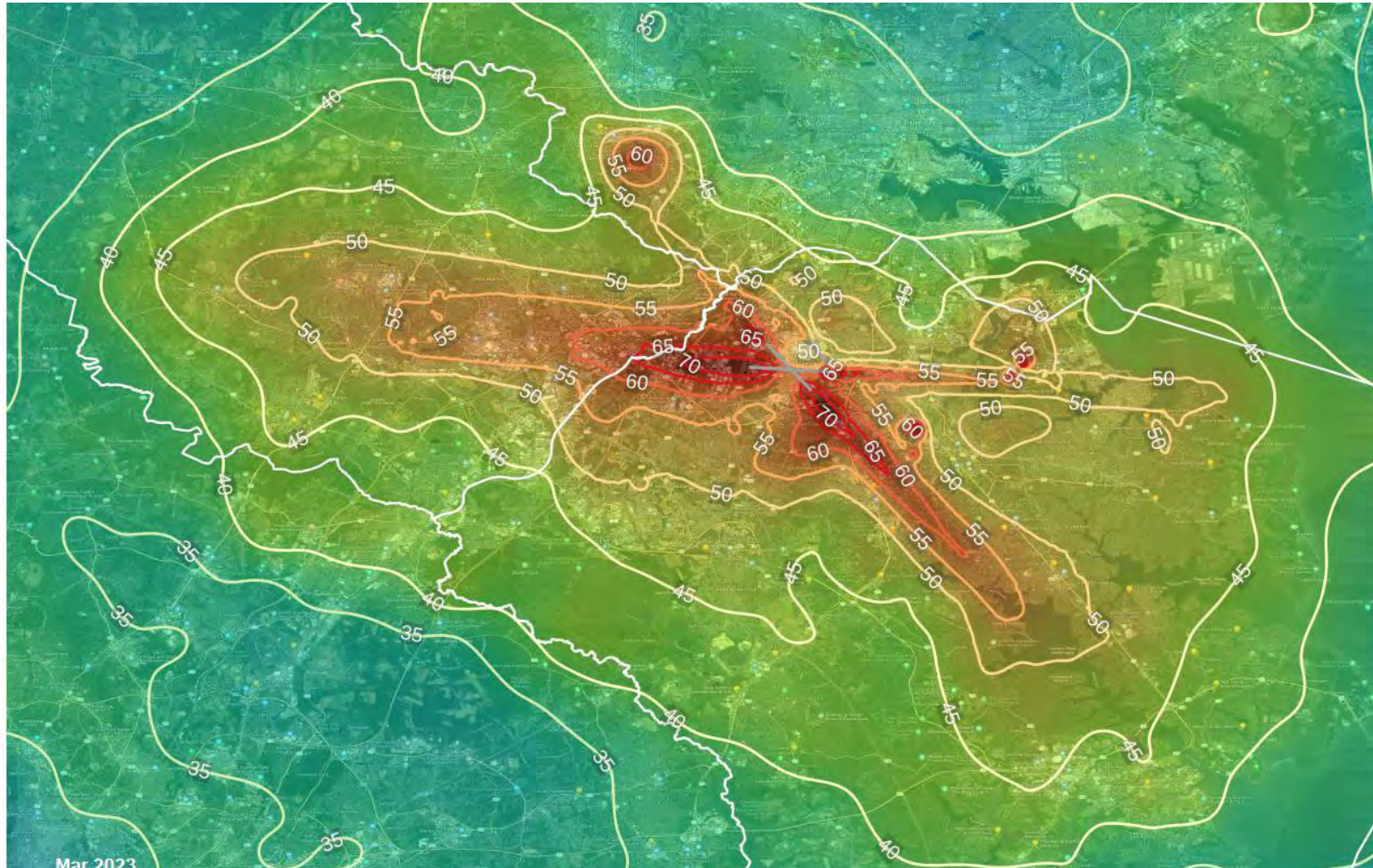


Vianair, Inc. modeled *actual daily* flights for February 2023 for the Monthly Aircraft Operations and Noise Exposure Report of the DC Metroplex BWI Community Roundtable

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

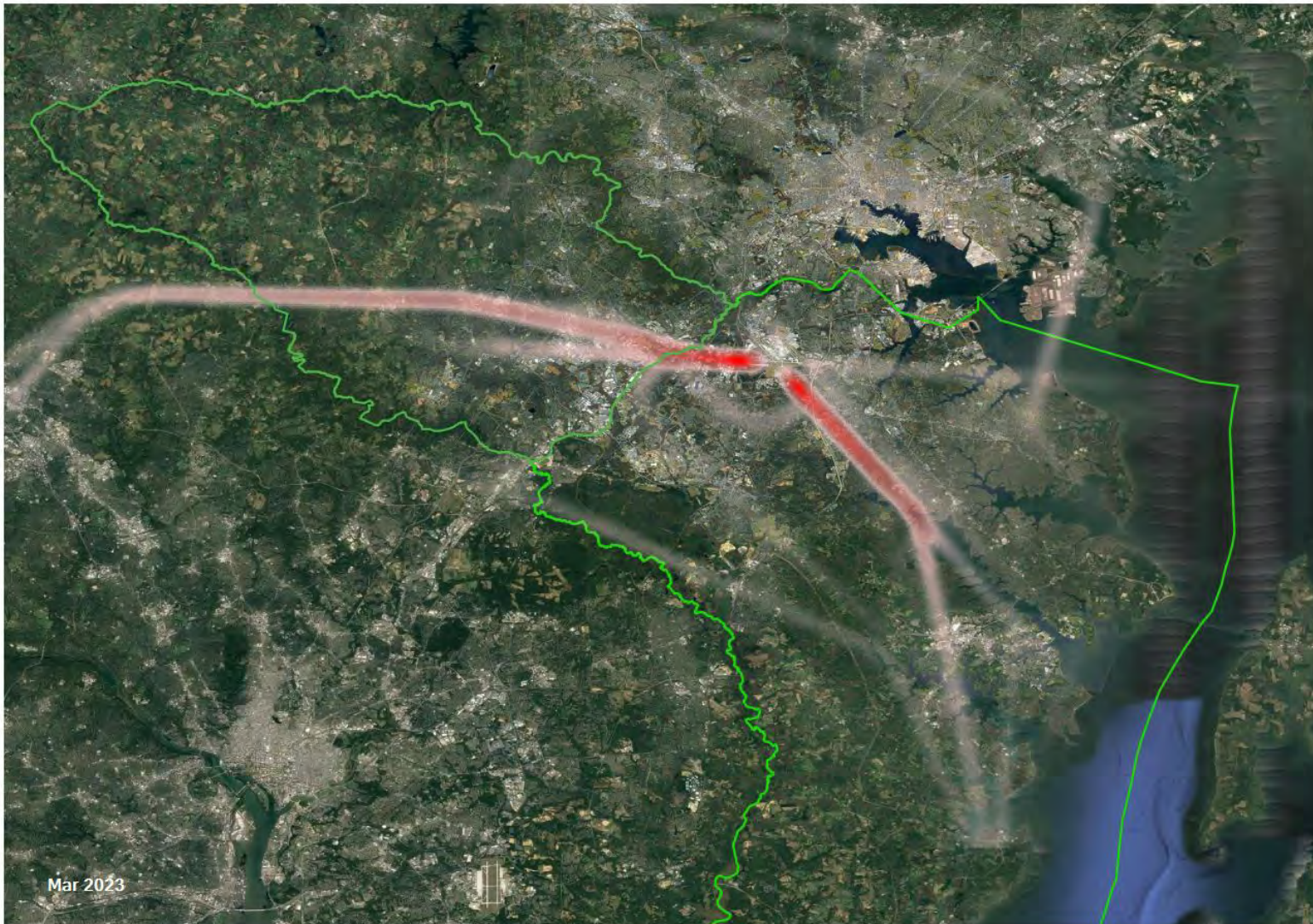
Howard and Anne Arundel Counties



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.

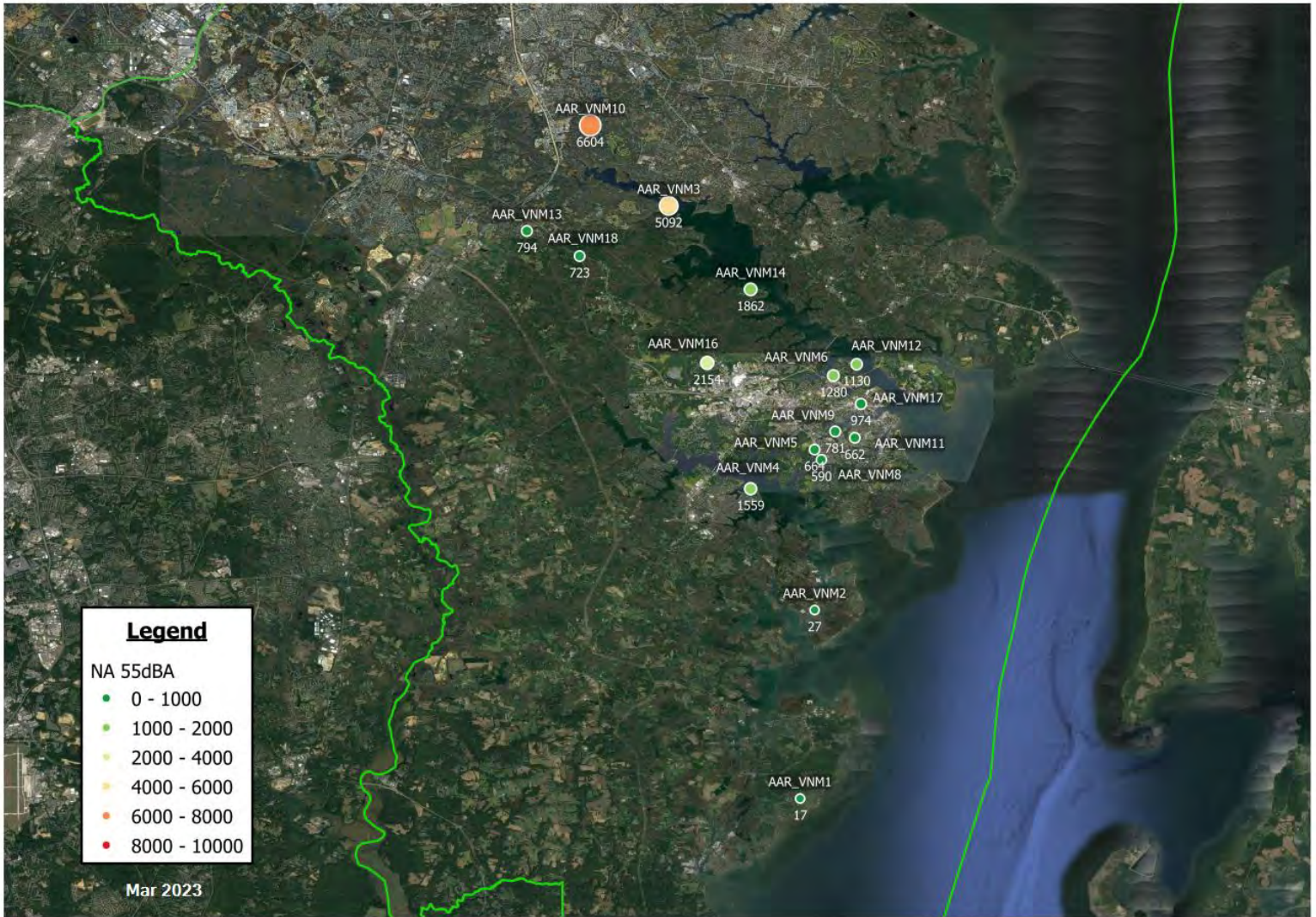
Flight Track Density – Heat Map of Anne Arundel and Howard Counties



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

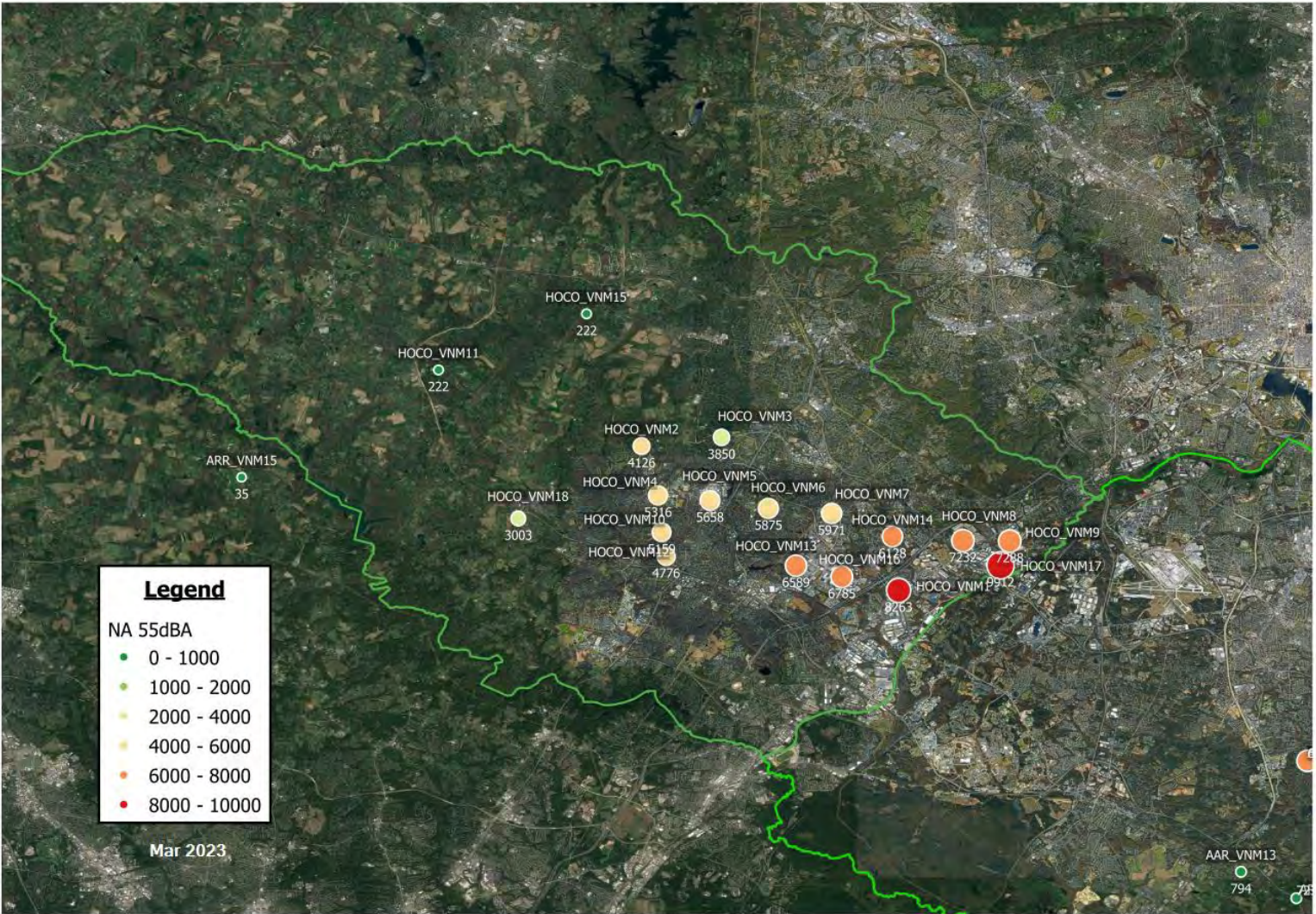


This map shows the Number of Events (single flights) at the local Landmarks during the month above the 55 decibel Threshold (NAT) for Anne Arundel County.

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

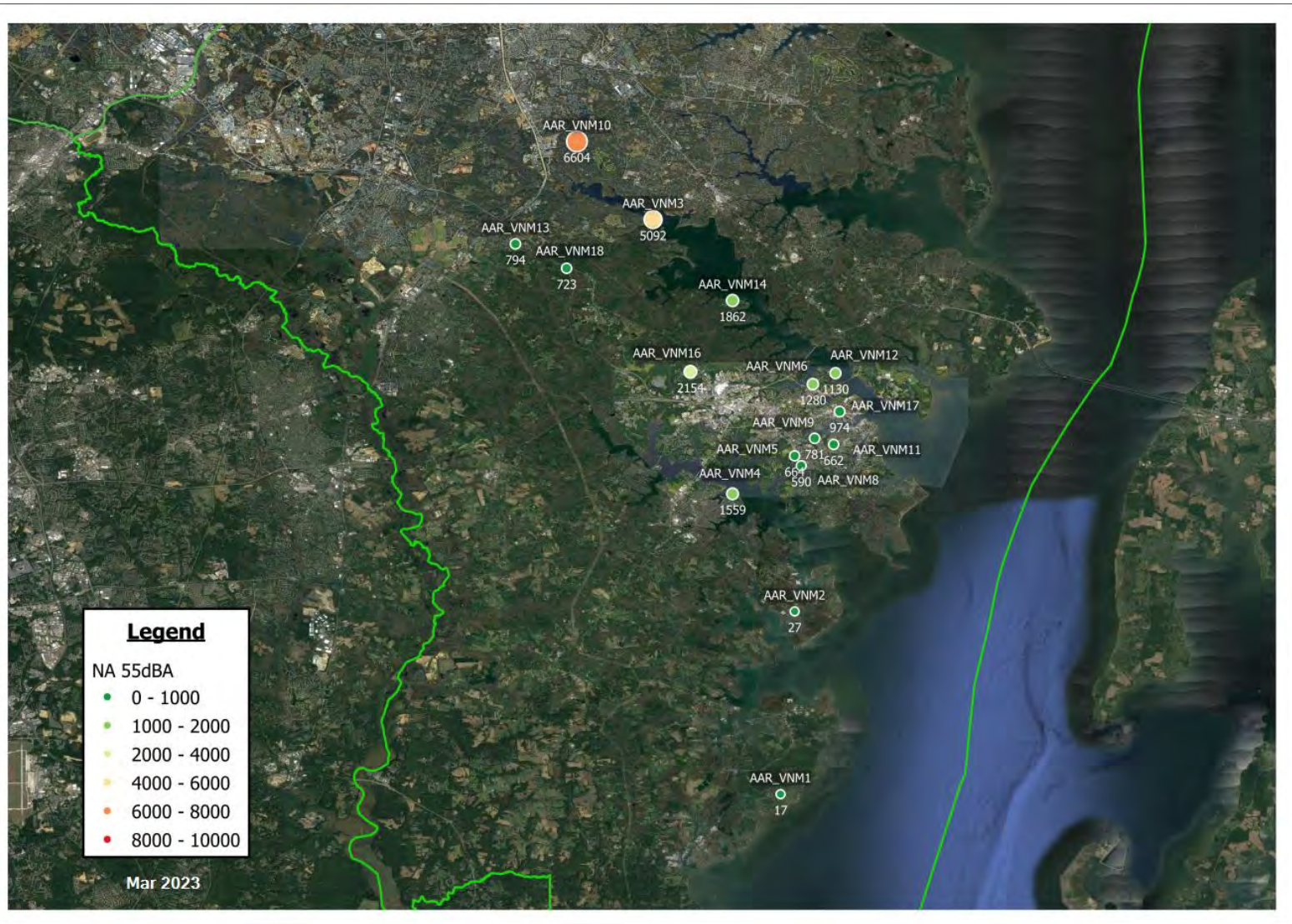


This map shows the Number of Events (single flights) at the local Landmarks during the month above the 55 decibel Threshold (NAT) for Howard County.

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

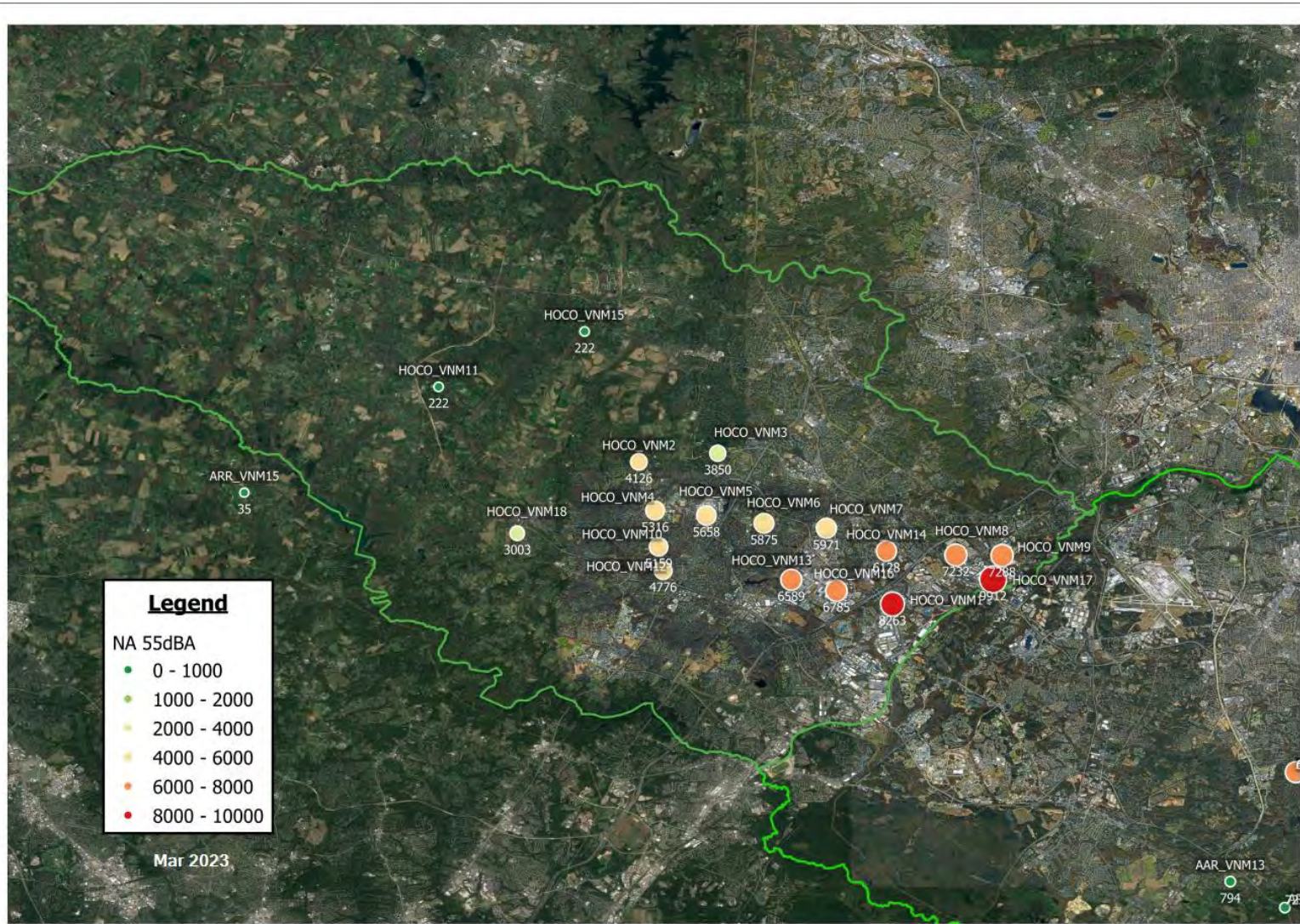


This map shows the Number of Events (single flights) during the month above the 55 decibel Threshold (NAT) for the total grid of Virtual Noise Monitors in Anne Arundel County.

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.

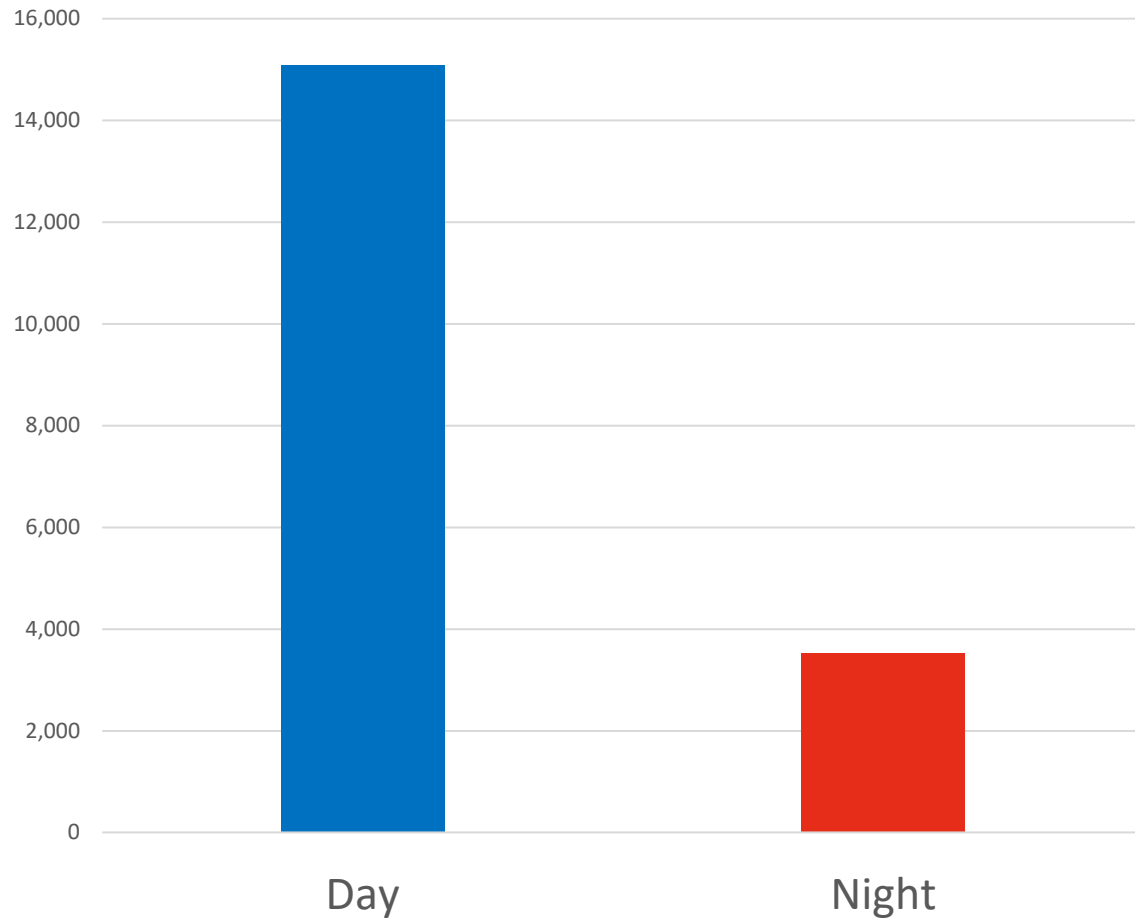
Noise Exposure – Full Virtual Noise Monitor Grid, All Operational Flows

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	13	0	27.91	VNM31	211	7	47.75	VNM61	286	9	42.73
VNM2	15	0	30.55	VNM32	145	5	37.08	VNM62	991	32	45.39
VNM3	22	1	32.96	VNM33	515	17	43.55	VNM63	519	17	43.66
VNM4	29	1	32.59	VNM34	1464	47	49.87	VNM64	4276	138	52.85
VNM5	43	1	33.12	VNM35	4773	154	51.85	VNM65	1220	39	49.67
VNM6	105	3	35.99	VNM36	8883	287	56.88	VNM66	518	17	42.35
VNM7	14	0	30.26	VNM37	9965	321	69.84	VNM67	486	16	40.4
VNM8	19	1	34.59	VNM38	1139	37	54.43	VNM68	1197	39	43.18
VNM9	24	1	33.09	VNM39	921	30	70.06	VNM69	674	22	42.77
VNM10	48	2	34.05	VNM40	1083	35	46.15	VNM70	2194	71	48.38
VNM11	129	4	36.58	VNM41	305	10	40.53	VNM71	1478	48	46.05
VNM12	280	9	40.69	VNM42	382	12	42.94	VNM72	480	15	41.2
VNM13	214	7	39.12	VNM43	324	10	42.85	VNM73	117	4	36.69
VNM14	168	5	44.26	VNM44	1673	54	50.21	VNM74	376	12	38.27
VNM15	26	1	35.25	VNM45	2860	92	52.12	VNM75	882	28	42.52
VNM16	37	1	33.71	VNM46	2688	87	60.3	VNM76	1839	59	44.49
VNM17	186	6	37.22	VNM47	4900	158	63.5	VNM77	747	24	43.56
VNM18	491	16	43.31	VNM48	842	27	48.91	VNM78	241	8	37.56
VNM19	682	22	44.96	VNM49	2024	65	49.14	VNM79	246	8	37.34
VNM20	265	9	42.93	VNM50	862	28	44.77	VNM80	70	2	35.22
VNM21	110	4	41.67	VNM51	584	19	42.5	VNM81	294	9	37.41
VNM22	61	2	34.53	VNM52	377	12	44.27	VNM82	142	5	36.05
VNM23	1395	45	41.41	VNM53	1446	47	48.28	VNM83	45	1	35.23
VNM24	3797	122	49.63	VNM54	1251	40	45.94	VNM84	40	1	34.36
VNM25	5308	171	53.29	VNM55	4438	143	51.31	VNM85	30	1	30.35
VNM26	5666	183	54.05	VNM56	1949	63	53.31	VNM86	29	1	29.86
VNM27	4567	147	50.9	VNM57	1270	41	48.28	VNM87	28	1	31.4
VNM28	1272	41	50.05	VNM58	910	29	45.56	VNM88	27	1	32.39
VNM29	525	17	50.05	VNM59	99	3	36.01	VNM89	45	1	35.78
VNM30	104	3	44.49	VNM60	1221	39	44.26				

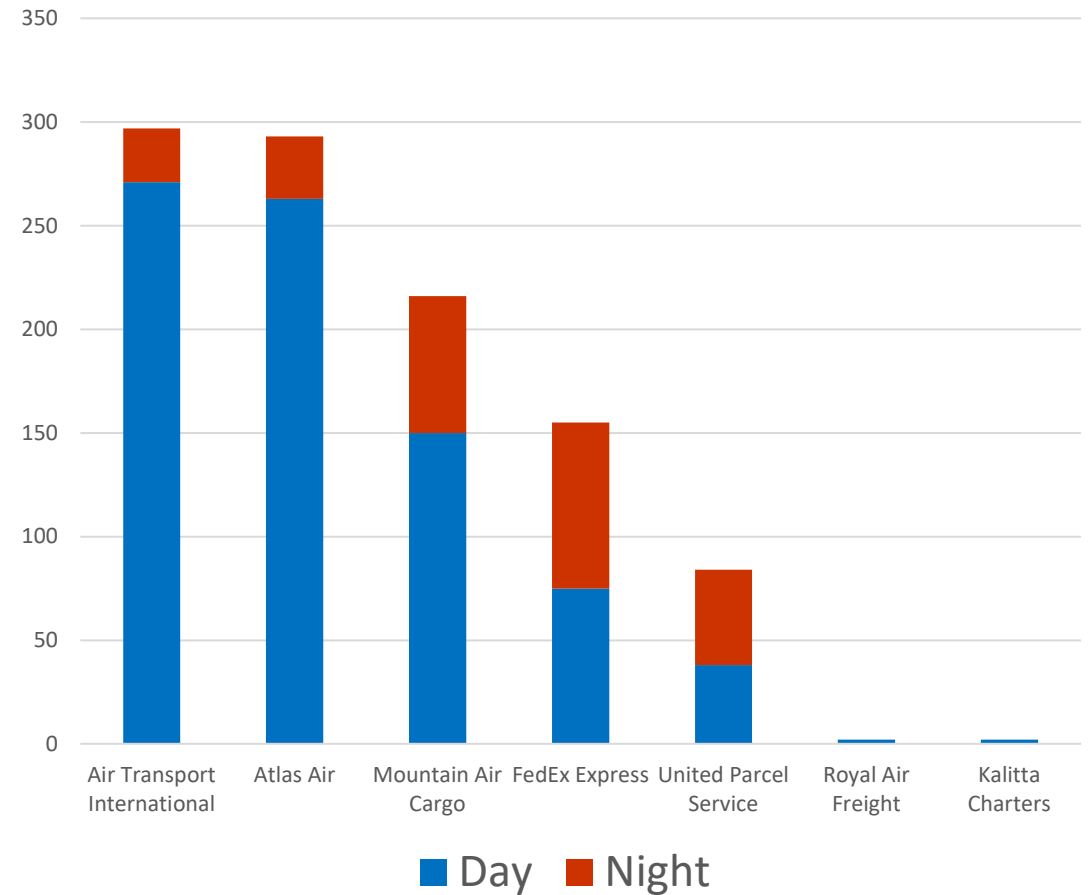
Monthly Operations – Daytime versus Nighttime

March 2023

Monthly Operations - Day vs. Night



Cargo Operations – Daytime vs. Nighttime

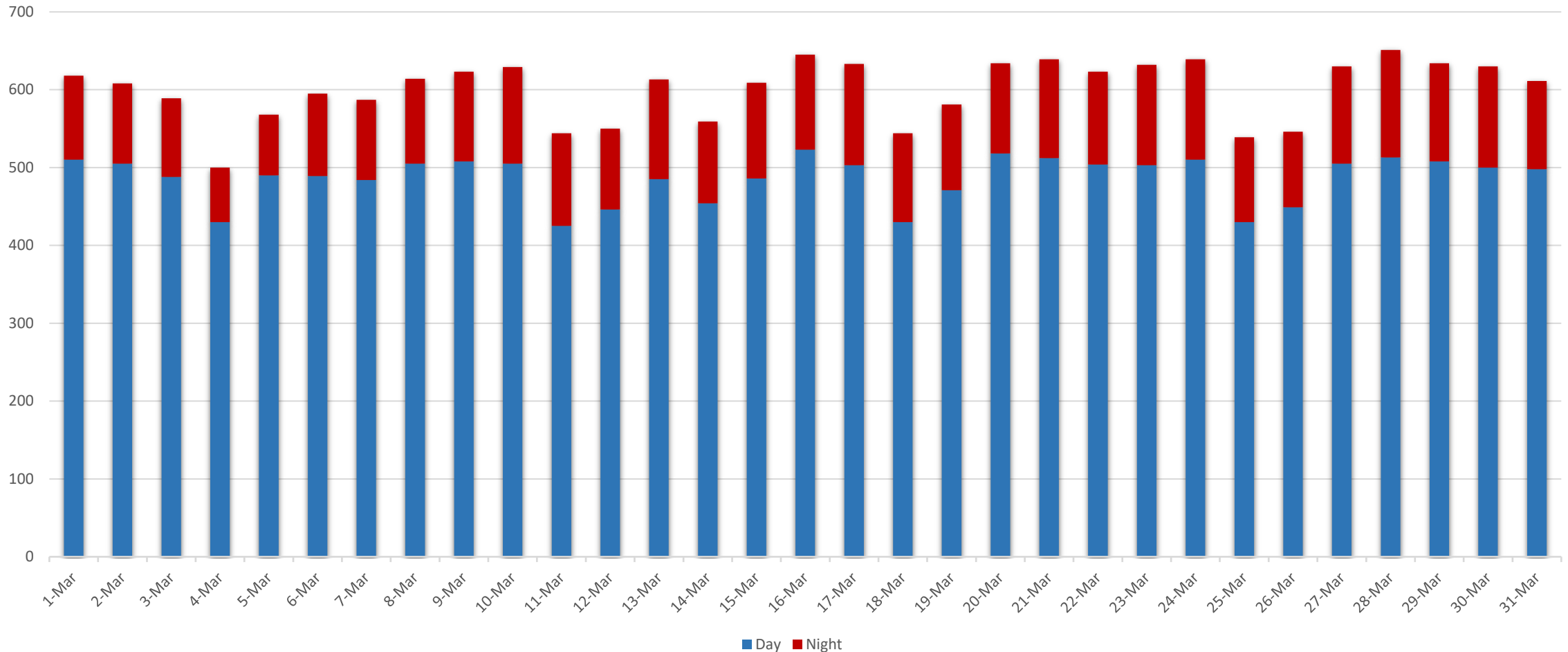


RED represents Nighttime flights. "Nighttime Hours" are from 10PM - 7AM

Monthly Operations

March 2023

Daily Operations (Day vs. Night)

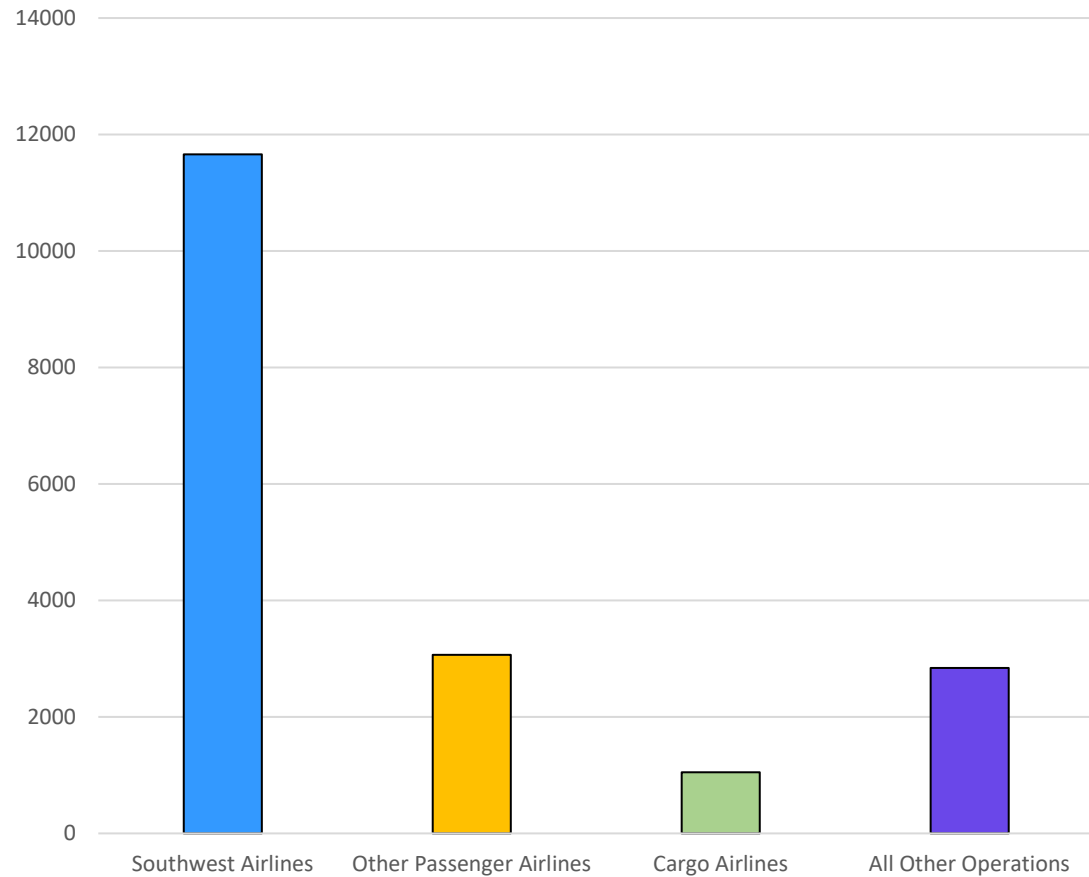


RED represents Nighttime flights. "Nighttime Hours" are from 10PM - 7AM

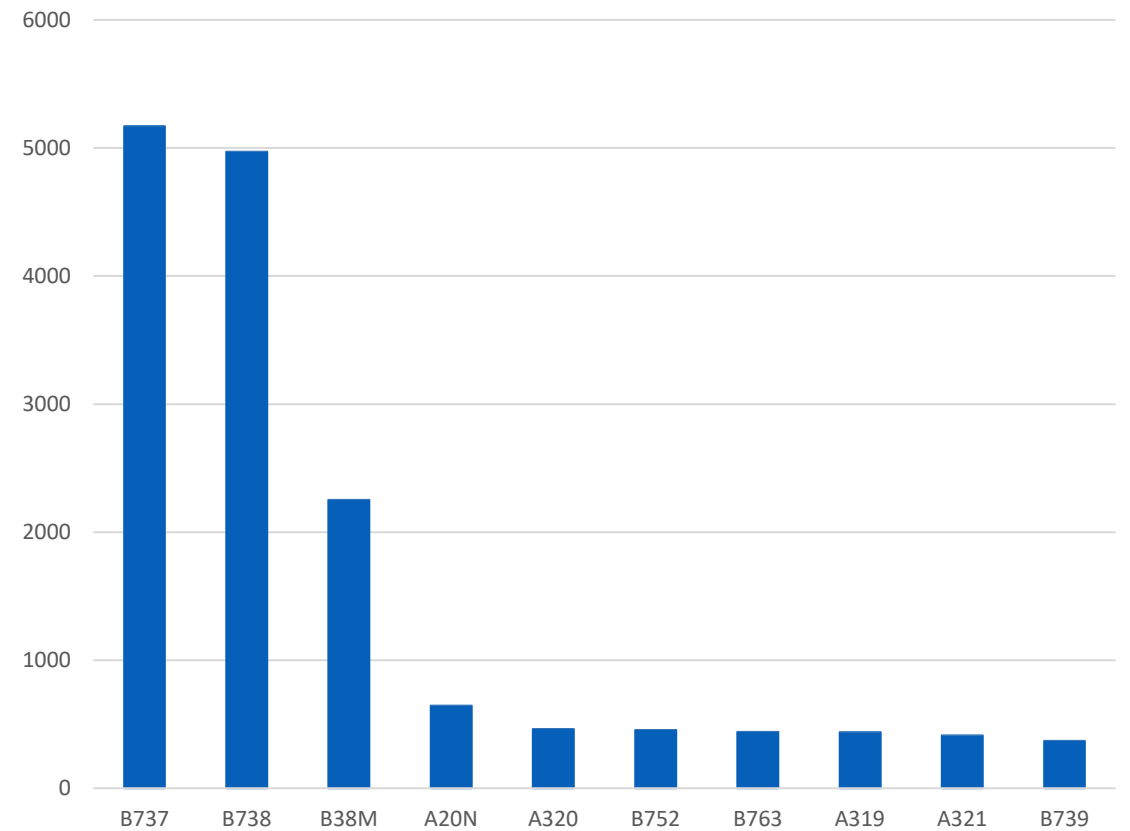
Aircraft Operations

March 2023

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:

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