BWI-Thurgood Marshall Airport Aircraft Operations and Noise Exposure

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

Monthly Report for October 2022

DC Metroplex BWI Community Roundtable link to Noise Exposure Monthly Reports below
https://marylandaviation.com/environmental/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 overflown communities in our region. The BWI Roundtable believes that the analysis of the full environmental impact of airport operations on overflown 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 Marshall 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.

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 (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 Marshall 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.

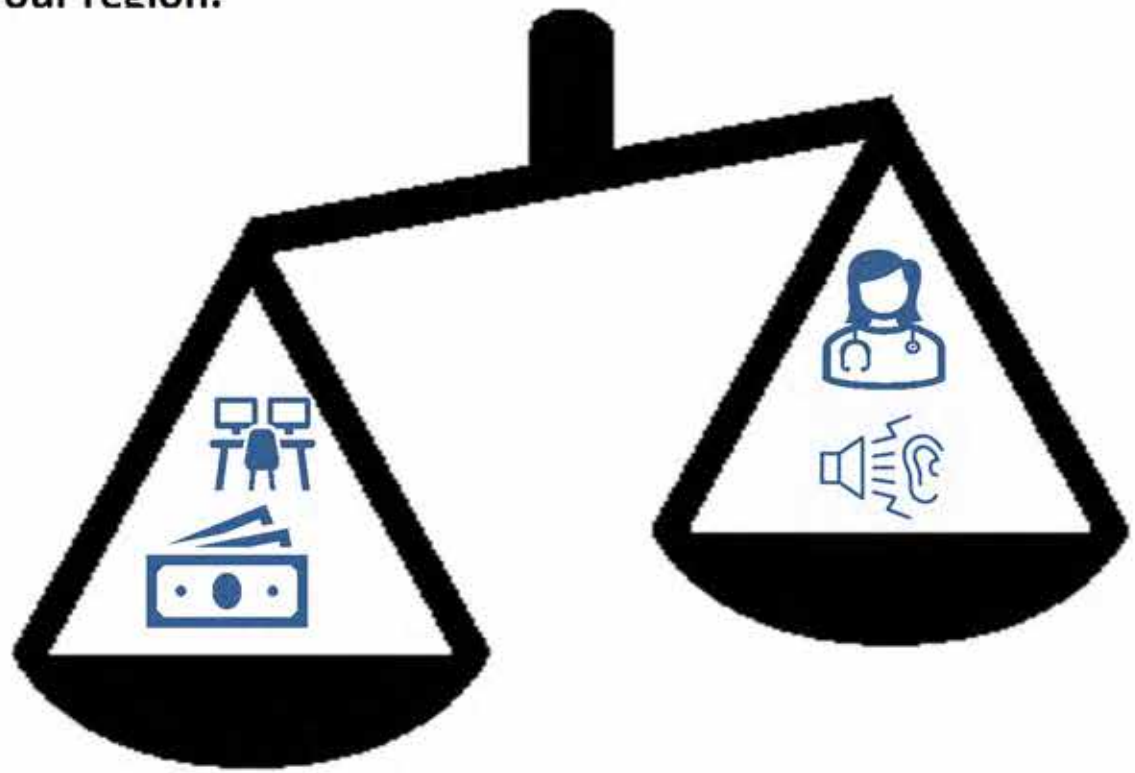
Information Sources and Disclosures:

1. 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.

2. 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/environmental-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
Total Jobs 24,211 Direct 12,753 Indirect 11,458	Total Jobs 82,277 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

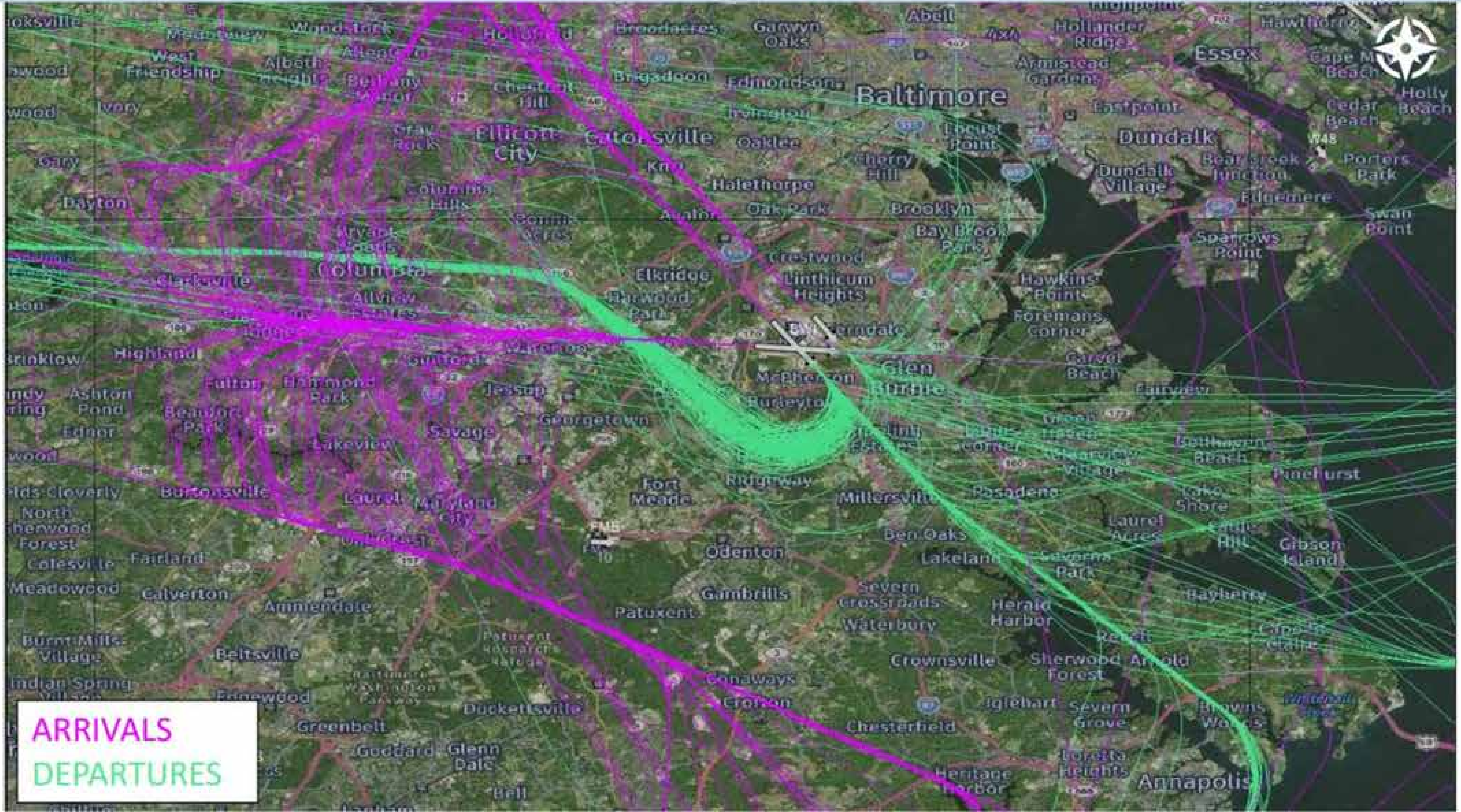
Prevailing wind speed, direction and weather factors determine the direction of air traffic flow from BWI-Marshall airport. Aircraft usually take off and land into the wind to meet safety and operational requirements.

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 daily traffic patterns over the Baltimore region during East Flow operations at BWI-Marshall



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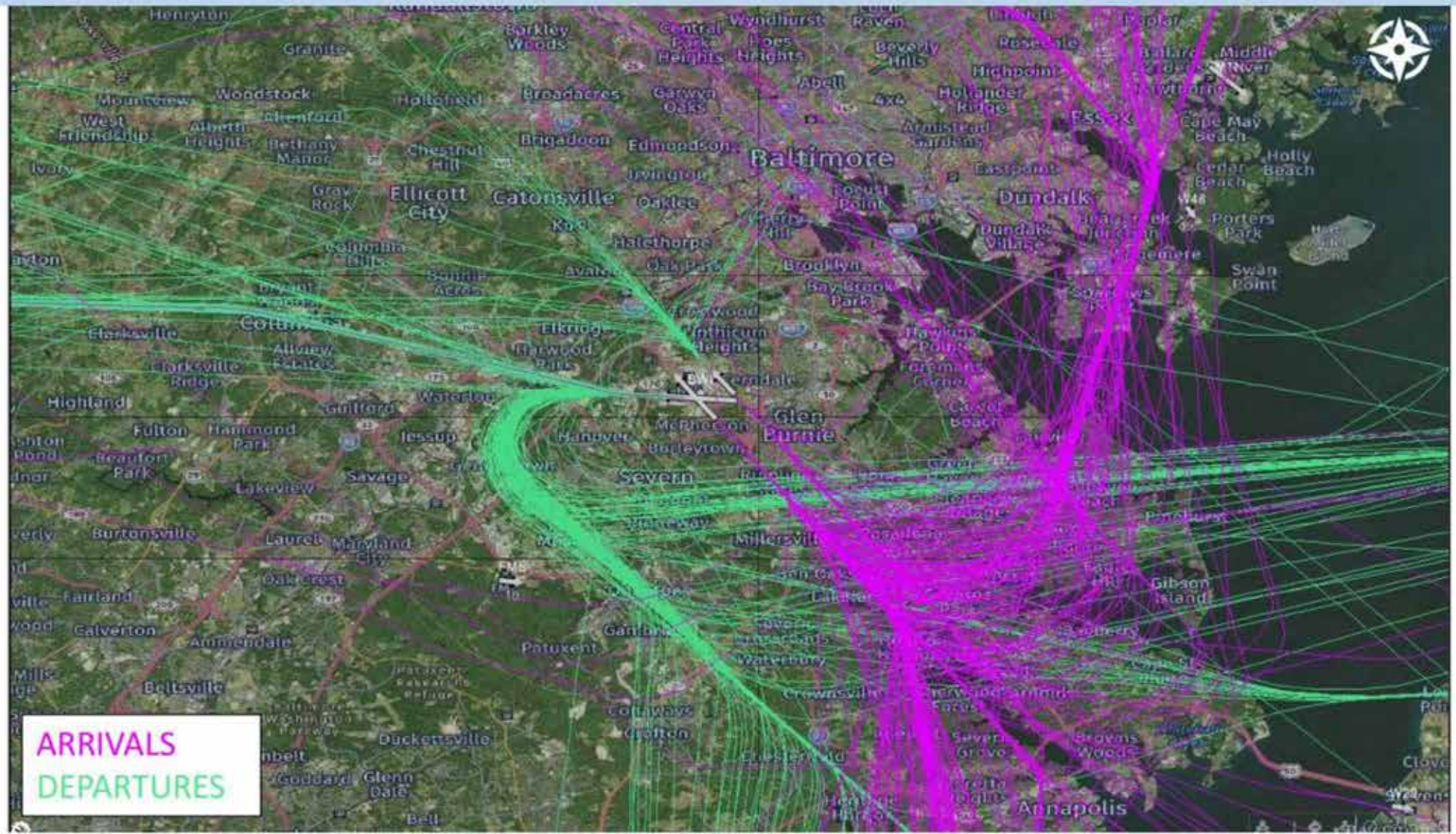
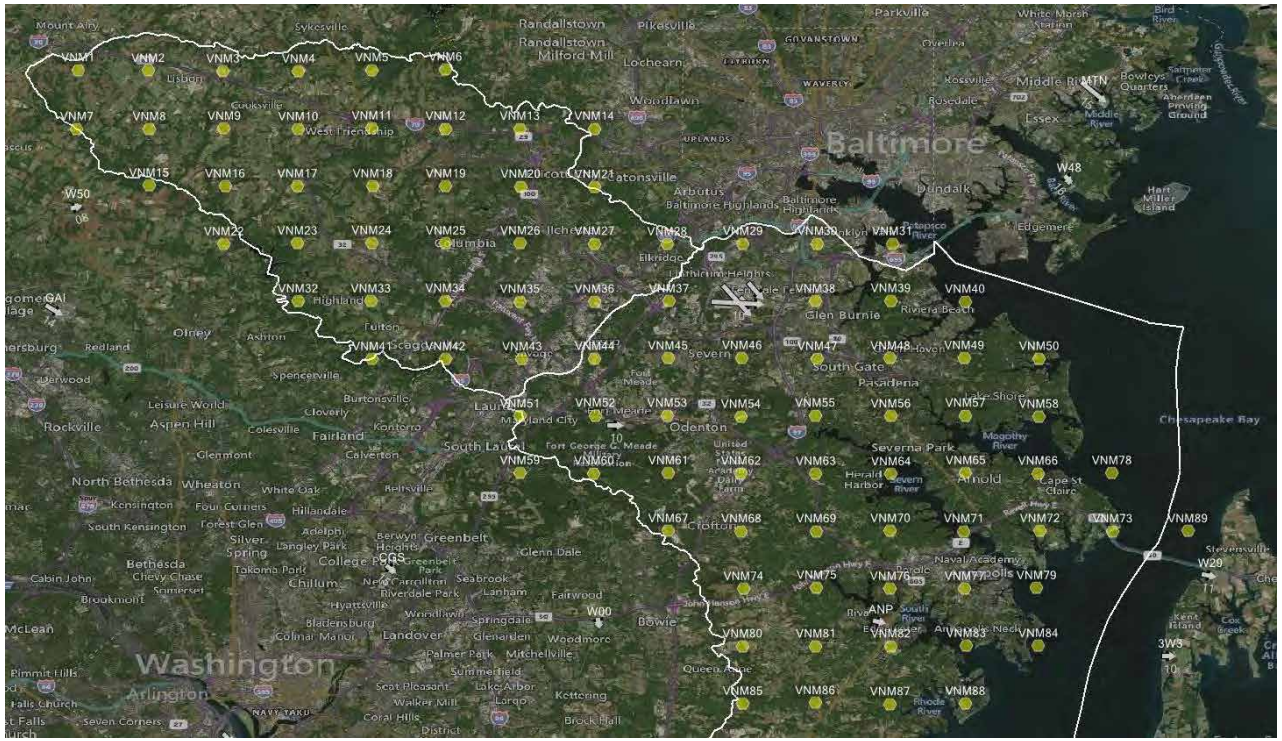
Visual representation of daily traffic patterns over the Baltimore region during West Flow operations at BWI-Marshall



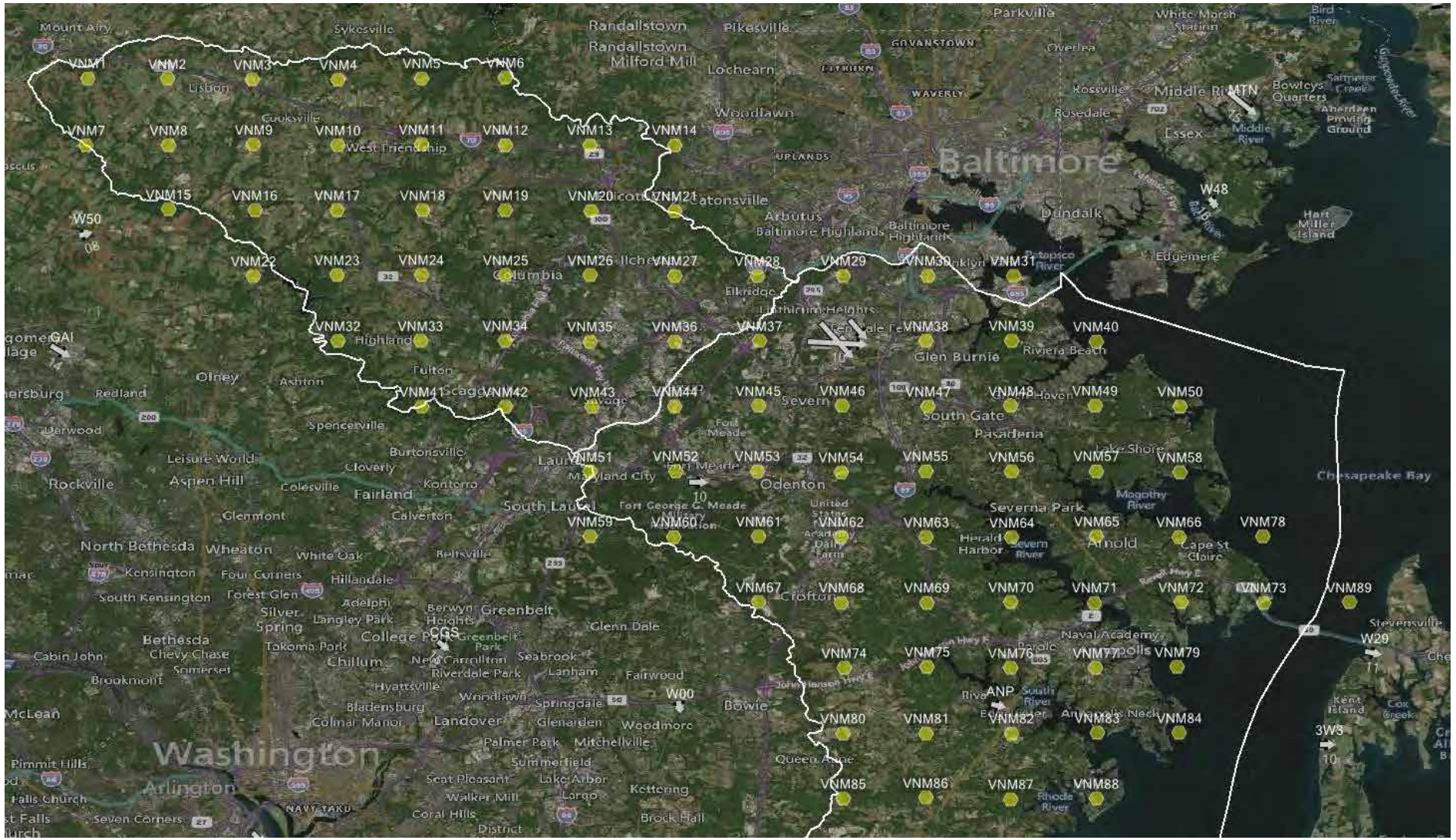
Flight Track Density – Heat Map

Noise Exposure – Virtual Noise Monitor Locations

In order to provide ample coverage of the communities in both Anne Arundel and Howard Counties, a large grid was developed and applied to the two-county area. This resulted in complete coverage of the study area. A map with the study grid, and the additional selected (landmark) locations are described in the following tables and graphics.

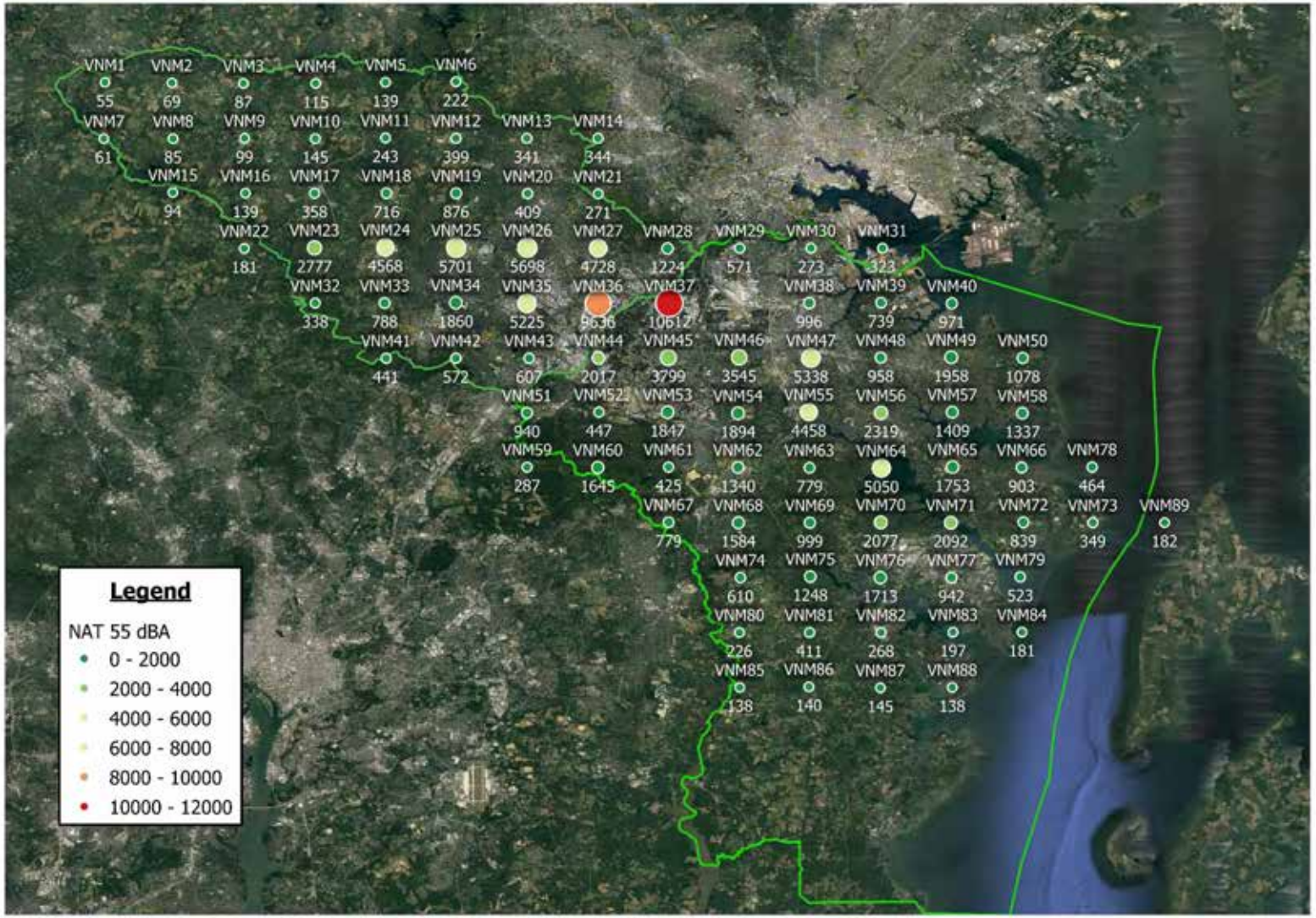


Noise Exposure – Virtual Noise Monitor Locations



Noise Exposure – Number of Events Above 55 dBA

Full VNM Grid



Noise Exposure – Full Grid, All Flows

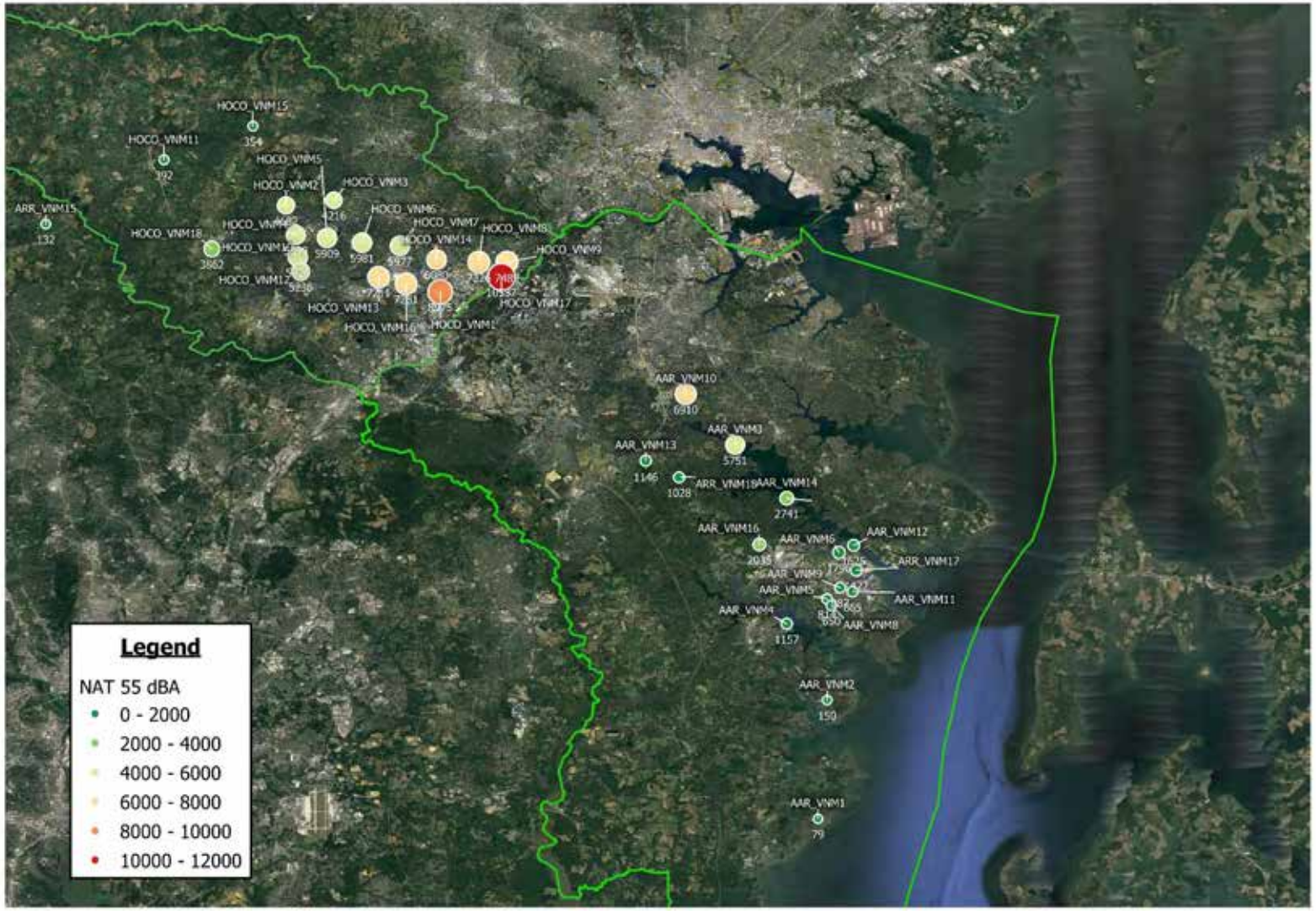
Name	Number-of-Events-Above 55 dBA (Total)	Daily Average	DNL
VNM1	55	2	20.7
VNM2	69	2	25.1
VNM3	87	3	28.8
VNM4	115	4	30.7
VNM5	139	4	32.5
VNM6	222	7	38.0
VNM7	61	2	21.7
VNM8	85	3	26.2
VNM9	99	3	28.6
VNM10	145	5	33.2
VNM11	243	8	38.4
VNM12	399	13	43.1
VNM13	341	11	42.0
VNM14	344	11	42.6
VNM15	94	3	26.9
VNM16	139	4	32.9
VNM17	358	12	40.8
VNM18	716	23	47.6
VNM19	876	28	47.8
VNM20	409	13	45.8
VNM21	271	9	43.6
VNM22	181	6	35.8
VNM23	2,777	90	46.0
VNM24	4,568	147	54.1
VNM25	5,701	184	56.8
VNM26	5,698	184	57.1
VNM27	4,728	153	54.1
VNM28	1,224	39	51.1
VNM29	571	18	48.7
VNM30	273	9	43.8

Name	Number-of-Events-Above 55 dBA (Total)	Daily Average	DNL
VNM31	323	10	40.1
VNM32	338	11	41.7
VNM33	788	25	48.0
VNM34	1,860	60	52.9
VNM35	5,225	169	55.9
VNM36	9,636	311	61.6
VNM37	10,612	342	73.4
VNM38	996	32	50.7
VNM39	739	24	45.9
VNM40	971	31	46.8
VNM41	441	14	45.0
VNM42	572	18	45.8
VNM43	607	20	48.3
VNM44	2,017	65	54.2
VNM45	3,799	123	56.4
VNM46	3,545	114	64.0
VNM47	5,338	172	58.2
VNM48	958	31	50.9
VNM49	1,958	63	52.6
VNM50	1,078	35	48.0
VNM51	940	30	46.0
VNM52	447	14	46.2
VNM53	1,847	60	52.1
VNM54	1,894	61	50.5
VNM55	4,458	144	53.9
VNM56	2,319	75	54.0
VNM57	1,409	45	50.7
VNM58	1,337	43	49.6
VNM59	287	9	39.8
VNM60	1,645	53	48.6

Name	Number-of-Events-Above 55 dBA (Total)	Daily Average	DNL
VNM61	425	14	44.4
VNM62	1,340	43	49.2
VNM63	779	25	48.6
VNM64	5,050	163	57.8
VNM65	1,753	57	51.9
VNM66	903	29	47.3
VNM67	779	25	44.4
VNM68	1,584	51	47.5
VNM69	999	32	46.5
VNM70	2,077	67	51.5
VNM71	2,092	67	51.7
VNM72	839	27	46.4
VNM73	349	11	42.0
VNM74	610	20	42.7
VNM75	1,248	40	45.2
VNM76	1,713	55	47.4
VNM77	942	30	45.5
VNM78	464	15	42.5
VNM79	523	17	43.3
VNM80	226	7	35.4
VNM81	411	13	37.0
VNM82	268	9	36.0
VNM83	197	6	33.9
VNM84	181	6	36.3
VNM85	138	4	30.4
VNM86	140	5	30.2
VNM87	145	5	30.6
VNM88	138	4	30.1
VNM89	182	6	34.1

Noise Exposure – Number of Events Above 55 dBA

Landmark Locations



Monthly Noise Exposure – Landmark Monitors

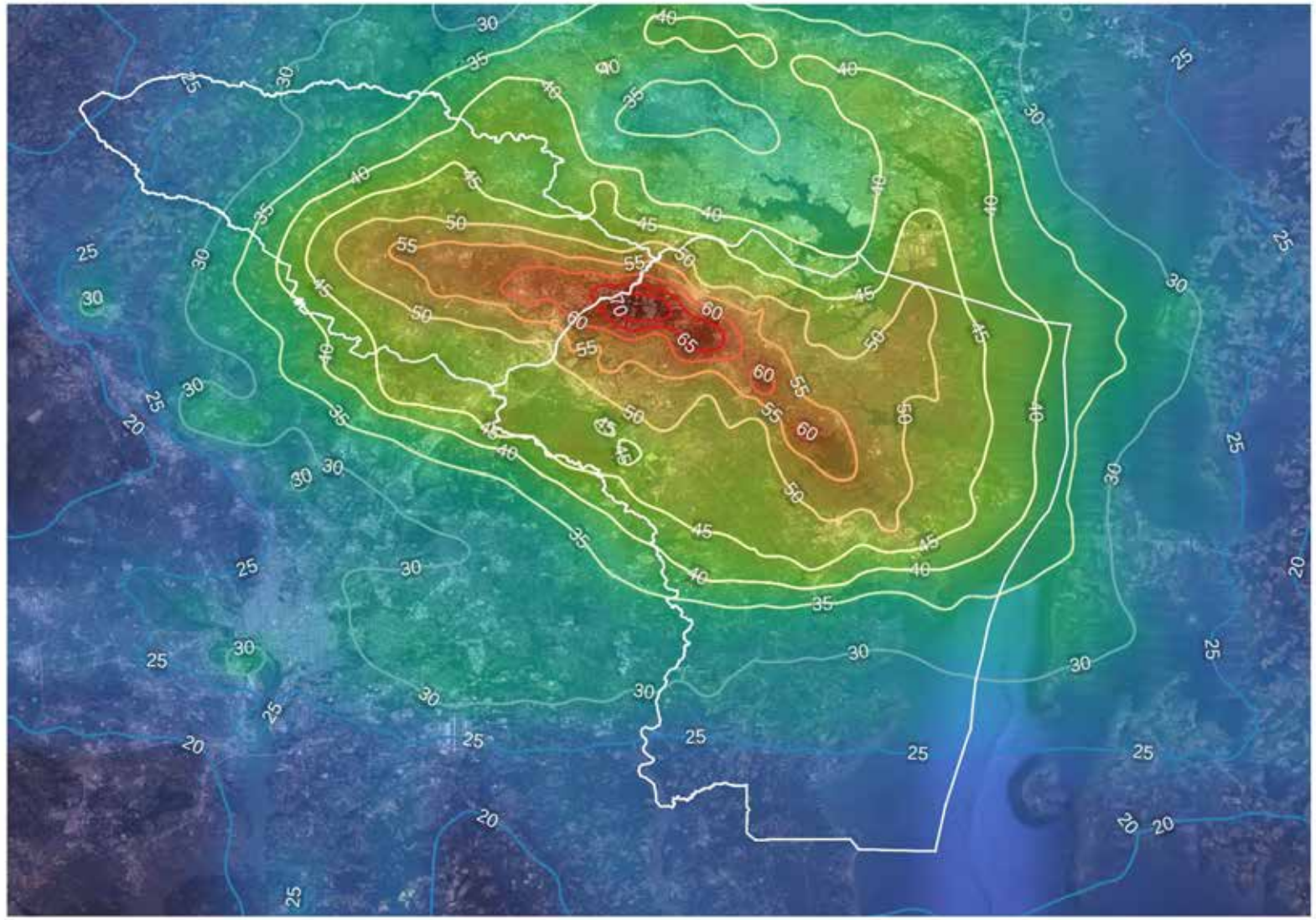
All Flows

Name	Number-of-Events-Above 55 dBA (Total)	Daily Average	DNL
AAR_VNM1	79	3	25.6
AAR_VNM2	150	5	30.3
AAR_VNM3	5,751	186	61.1
AAR_VNM4	1,157	37	41.0
AAR_VNM5	814	26	42.6
AAR_VNM6	1,796	58	51.5
AAR_VNM7	51	2	21.6
AAR_VNM8	865	28	44.3
AAR_VNM9	987	32	45.7
AAR_VNM10	6,910	223	62.1
AAR_VNM11	650	21	40.9
AAR_VNM12	1,625	52	49.3
AAR_VNM13	1,146	37	49.8
AAR_VNM14	2,741	88	55.4
ARR_VNM15	132	4	32.5
AAR_VNM16	2,035	66	50.7
ARR_VNM17	1,422	46	49.0
ARR_VNM18	1,028	33	49.3

Name	Number-of-Events-Above 55 dBA (Total)	Daily Average	DNL
HOCO_VNM1	8,975	290	60.1
HOCO_VNM2	4,682	151	52.9
HOCO_VNM3	4,216	136	51.0
HOCO_VNM4	5,699	184	56.7
HOCO_VNM5	5,909	191	58.0
HOCO_VNM6	5,981	193	59.1
HOCO_VNM7	5,977	193	59.8
HOCO_VNM8	7,326	236	62.7
HOCO_VNM9	7,489	242	61.5
HOCO_VNM10	5,926	191	55.1
HOCO_VNM11	392	13	40.5
HOCO_VNM12	5,236	169	57.3
HOCO_VNM13	7,211	233	60.7
HOCO_VNM14	6,080	196	62.6
HOCO_VNM15	354	11	41.0
HOCO_VNM16	7,281	235	60.7
HOCO_VNM17	10,587	342	69.2
HOCO_VNM18	3,862	125	52.0

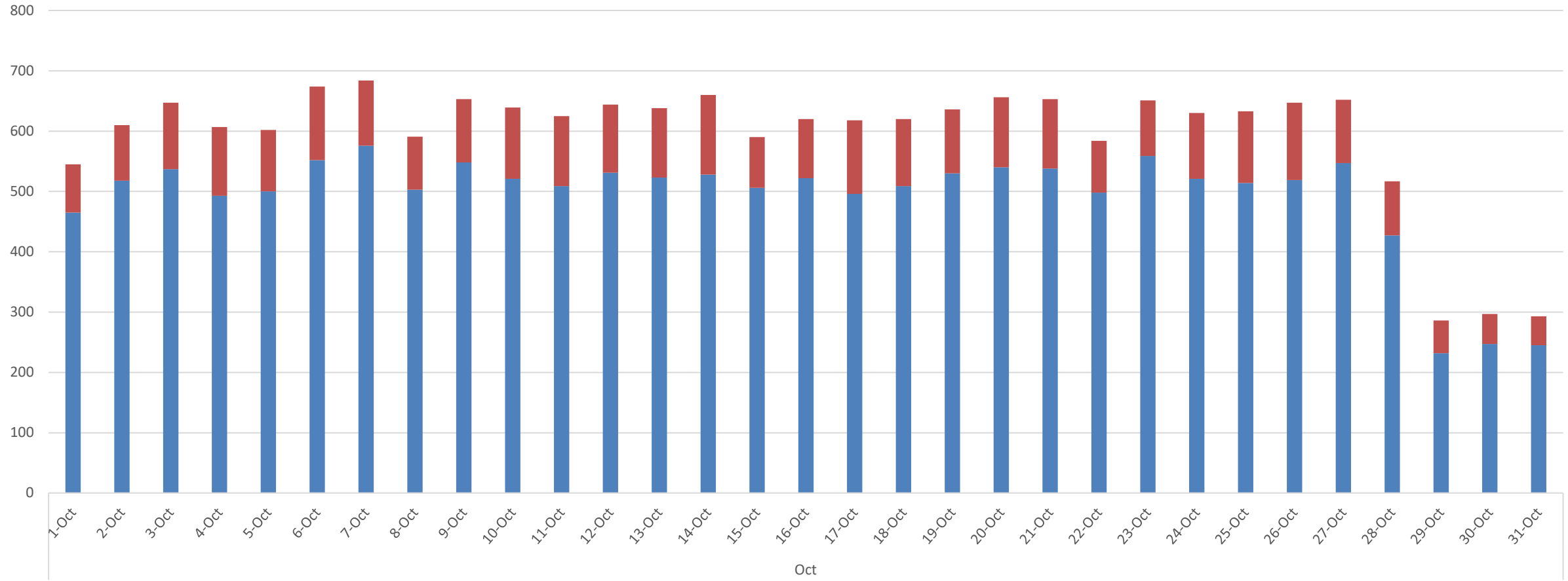
Noise Exposure – DNL Contours

Howard and Anne Arundel Counties



Monthly Operations

October 2022

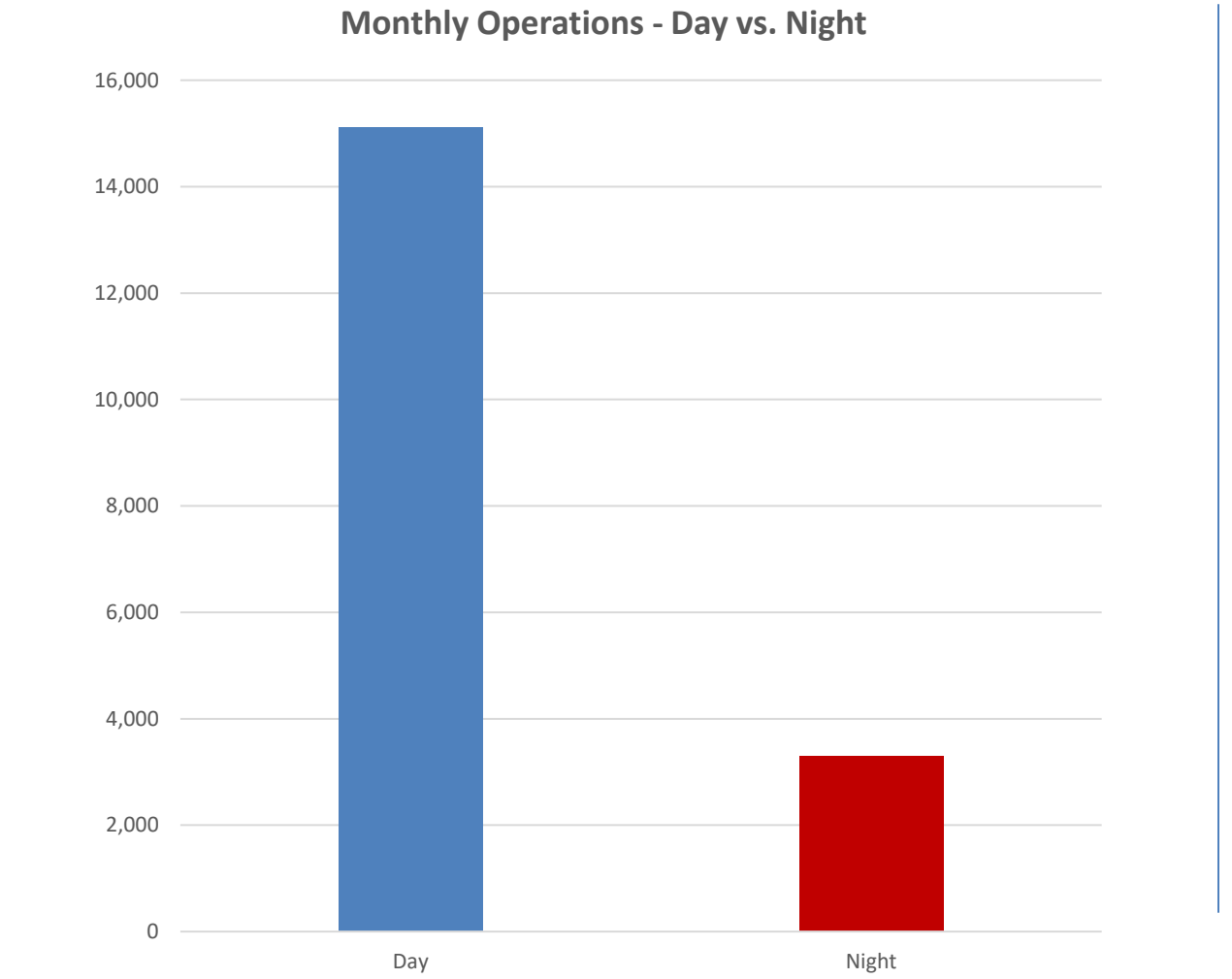


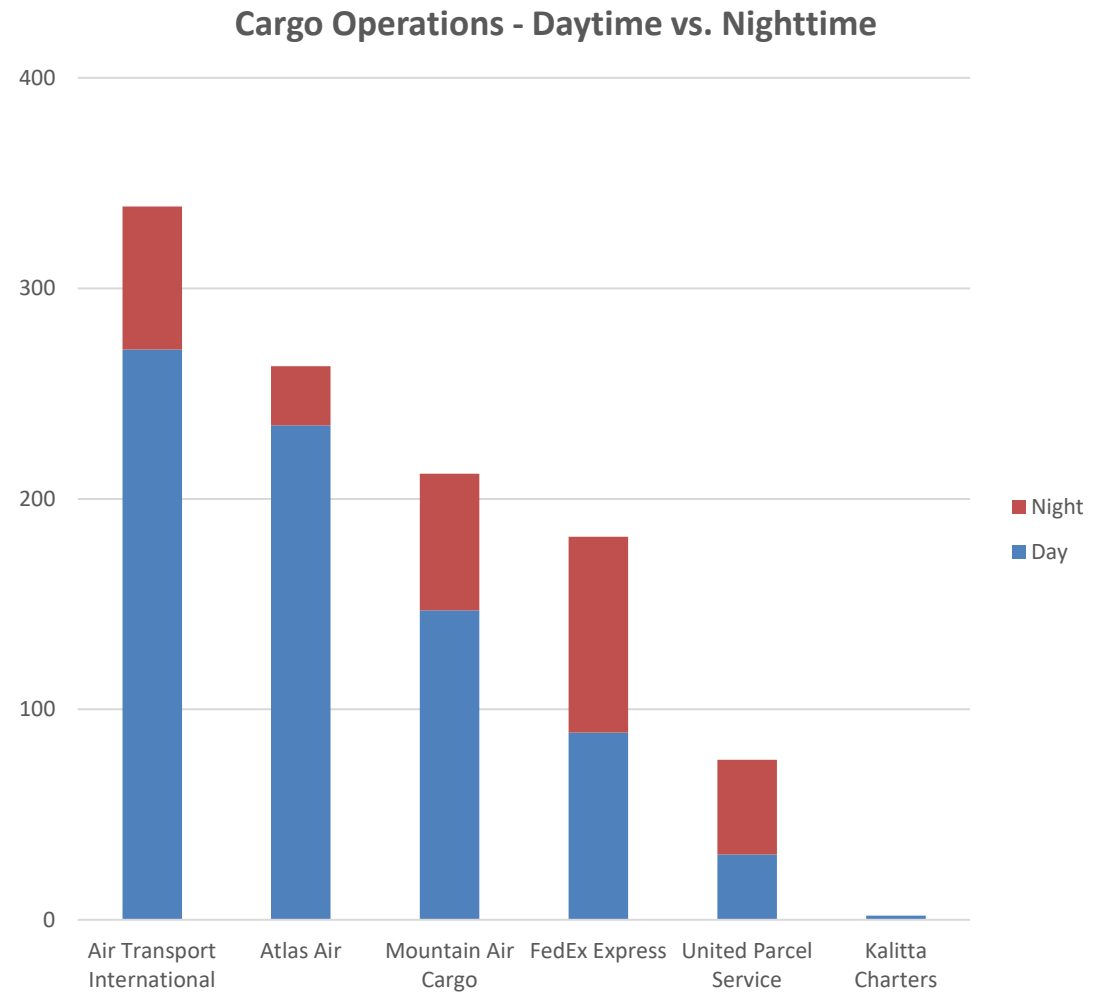
Total Monthly Operations	18,402
Average Daily Operations	594
YTD Cumulative Operations (March - October)	142,979

"Nighttime Hours" are from 10PM - 7AM

Monthly Operations – Daytime versus Nighttime

October 2022

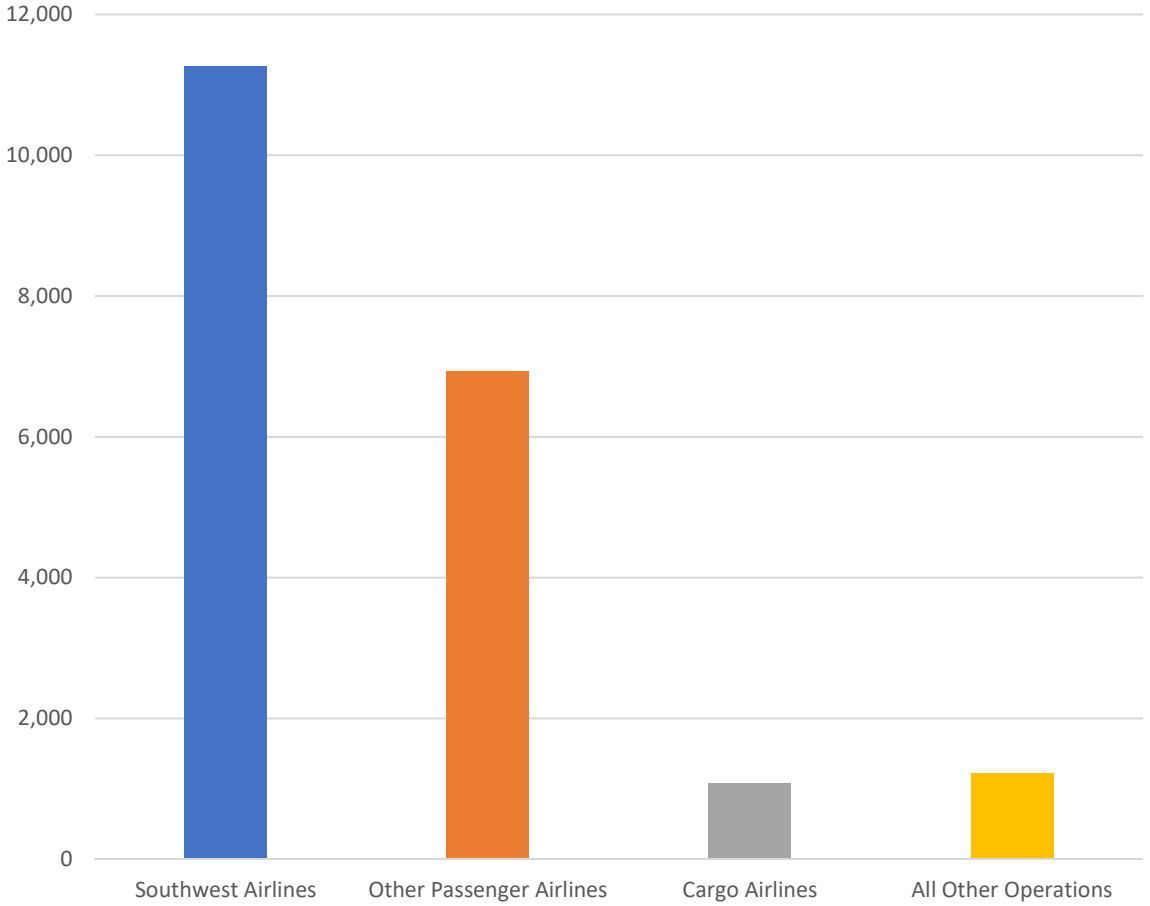




Aircraft Operations

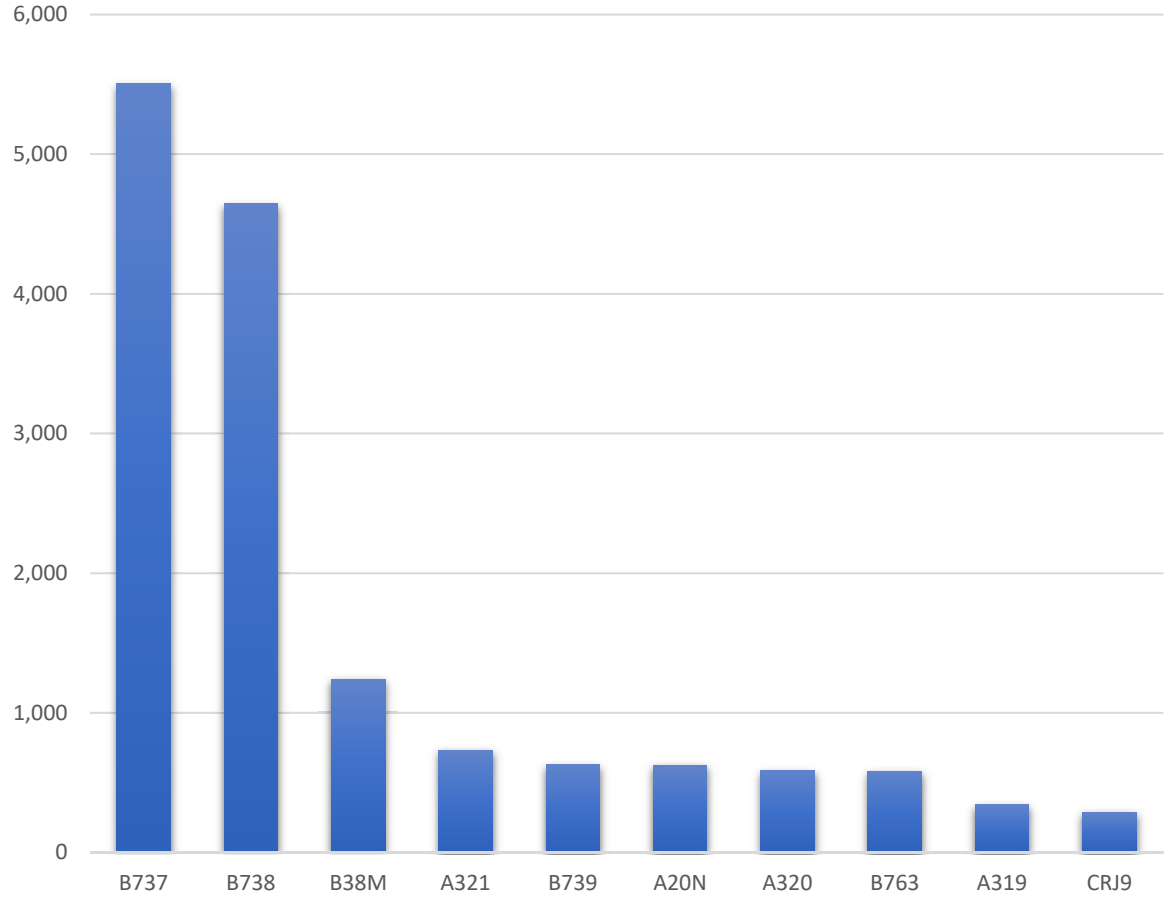
October 2022

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.

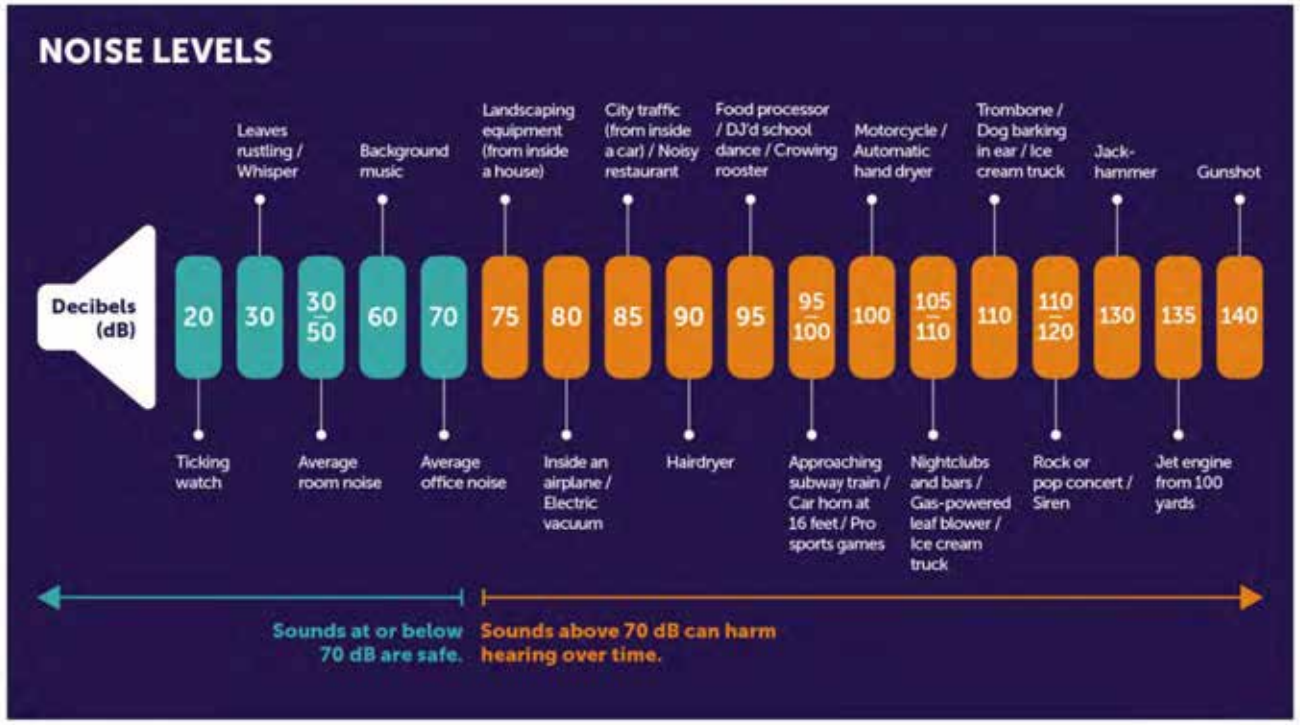
The NA noise metric counts the number of times the noise level exceeds a specific threshold. In this report, the Number-of-Events-Above 55 metric (NA55) is calculated. NA55 quantifies the number of aircraft events resulting in noise exposure of 55 decibels or higher at each location depicted.

Noise Basics

The scale below is intended to provide a basic understand of noise levels which are expressed in 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, 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. Annoyance is based on an individual's response to the noise exposure.

An Individual's response (annoyed, highly annoyed, not annoyed, etc.), vary based many factors. Furthermore, 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.



Source: Hearing Health Foundation, http://hearinghealthfoundation.org/

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 call 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/