Aircraft Noise Measurement Report

Neath Lane

Glen Burnie, MD 21061

Prepared by Harris Miller Miller & Hanson, Inc.

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1. INTRODUCTION

This memorandum presents the measured aircraft noise levels for the period of July 31 to August 21, 2017 at Neath Lane Glen Burnie, MD 21061. This residence is located approximately 2.5 miles southeast of the southeastern end of Runway 15R/33L of Baltimore/Washington International Thurgood Marshall (BWI Marshall) Airport. Figure 1 shows the location of the measurement site (marked as BW251) relative to BWI Marshall. Measurement data were collected and analyzed on behalf of the Maryland Department of Transportation Aviation Administration (MAA) by Harris Miller Miller & Hanson (HMMH) and Straughan Environmental (SE). The equipment was regularly checked for function and calibrated during the measurements. With the exception of brief periods during calibration, and from the morning of August 4th to the afternoon of August 7th when the meter was not operational, noise levels were monitored continuously throughout the measurement period.

At the conclusion of the measurement period, data were uploaded to the MAA's Noise and Operations Monitoring System (NOMS). The NOMS compared the times of loud noise events to its database of aircraft radar flight paths. Loud noise events which occurred while aircraft were passing within the vicinity were identified as aircraft noise. This matching of noise events to individual aircraft flights makes possible the calculation of the total aircraft noise exposure over a particular hour or day as well as the full measurement period. Additionally, the relative contribution of different aircraft types (e.g. jet aircraft, propeller aircraft, helicopters) or operations (e.g. arrivals, departures) to the total noise exposure can be computed.

Section 2 of this memorandum describes the measurement location. Section 3 presents information about the aircraft operations during the measurement period. Section 4 summarizes the measured noise levels. Section 5 provides conclusions. The appendix titled "How Do We Describe Aircraft Noise" provides background information on acoustical terms used in this memorandum.

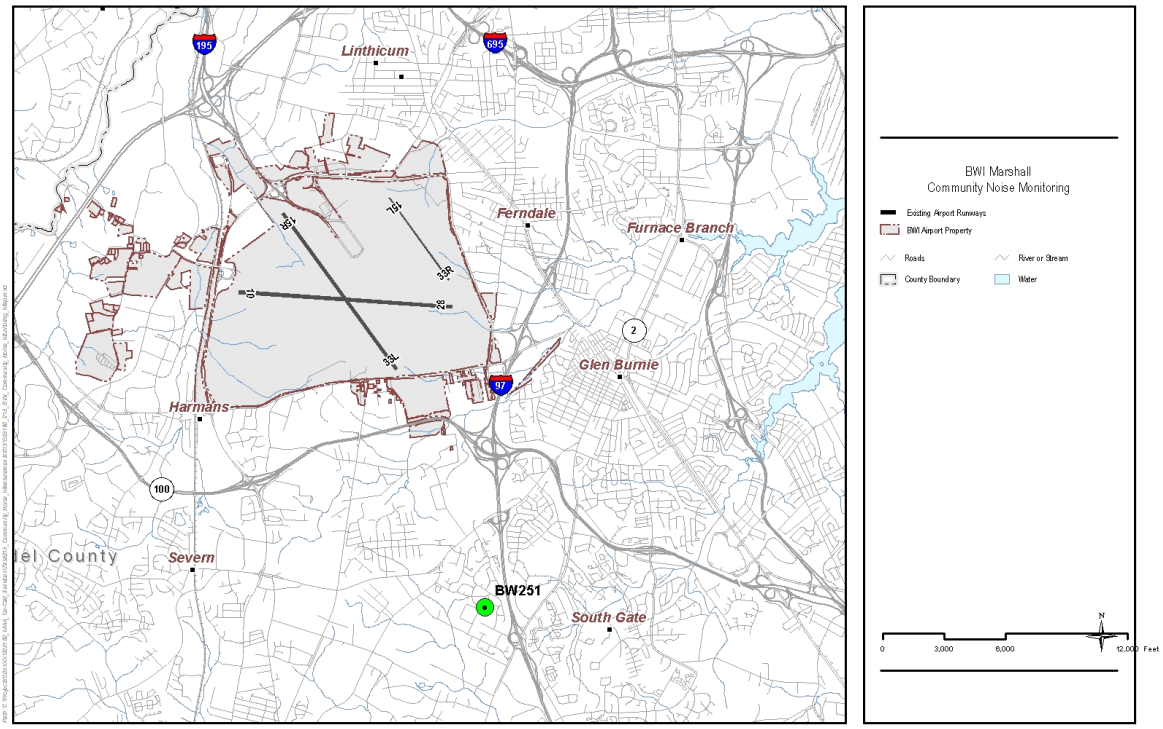

Figure 1. Noise Monitoring Location Map

2. MEASUREMENT SITE

Aircraft noise levels were measured from midday on July 31 through the early afternoon of August 21, 2017 at Neath Lane in Glen Burnie. The noise monitor was placed in the side yard of the residence. Figure 2 shows the placement of the noise monitoring equipment.

The noise monitor is a Type I sound level meter and is regularly calibrated. Additionally, the system was calibrated every two to four days during the measurements during equipment checks. These checks typically show small variances in the calibrated level of up to 1 dB. The meter ran normally throughout the measurement period with the exception of the morning of August 4th through the afternoon of August 7th when the monitor was left off in error following an equipment check. The measurement period was extended to compensate for this period of missed data.

Notable noise sources at this site include aircraft overflights to BWI Marshall, and typical suburban sounds including landscaping equipment, barking dogs, and vehicle traffic.

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Figure 2. Noise Measurement Microphone

3. AIRCRAFT OPERATIONS

The measurement site is located to the southeast of BWI Marshall and the primary aircraft noise events for this site are due to arrivals on BWI Marshall Runway 33L and departures on BWI Marshall Runway 15R.

During the measurement period, BWI Marshall operated in two configurations:

- departures on Runway 28 and arrivals on Runway 33L (west flow) and
- departures on Runway 15R and arrivals on Runway 10 (east flow).

The most common configuration on an annual basis at BWI Marshall, departures on Runway 28 and arrivals on Runway 33L, was active for eight days during the measurement period. On five days, BWI Marshall operated in east flow, or departures on Runway 15R and arrivals on Runway 10. On seven days, BWI Marshall operated on a combination of the two configurations above. Table 1 in the Measured Noise Levels section includes a description of the primary arrival and departure runways for each day.

Figure 3 displays all BWI Marshall flight tracks for a typical day during the measurement period in west flow, which primarily utilizes Runway 28 for departures and Runway 33L for arrivals. The red flight tracks are arrivals and the blue flight tracks are departures. The location of the measurement site is marked with its unique identifier in the NOMS, “BW251”. Figure 4 displays the same west flow flight tracks at a larger scale. Again, the text “BW251” shows the location of the measurement site. In west flow, the primary BWI Marshall overflights were arrivals on Runway 33L. Arrivals on Runway 33L were 600 to 700 ft. above ground level at their point of closest approach to the measurement site, with the most common altitude being 700 ft. Less commonly, departures from Runway 28 cause noise events at the measurement site. These departures were generally 3,900 to 8,500 ft. above ground level at their point of closest approach to the measurement site, with the most common altitude being 7,000 ft. .

Figure 5 displays all BWI Marshall flight tracks for a typical day during the measurement period in east flow, which primarily utilizes Runway 15R for departures and Runway 10 for arrivals. Figure 6 displays the same flight tracks at a larger scale. In east flow, the primary BWI Marshall overflights were departures on Runway 15R. Departures on Runway 15R were 1,300 to 2,200 ft. above ground level at their point of closest approach to the measurement site, with the most common altitude being 1,600 ft.

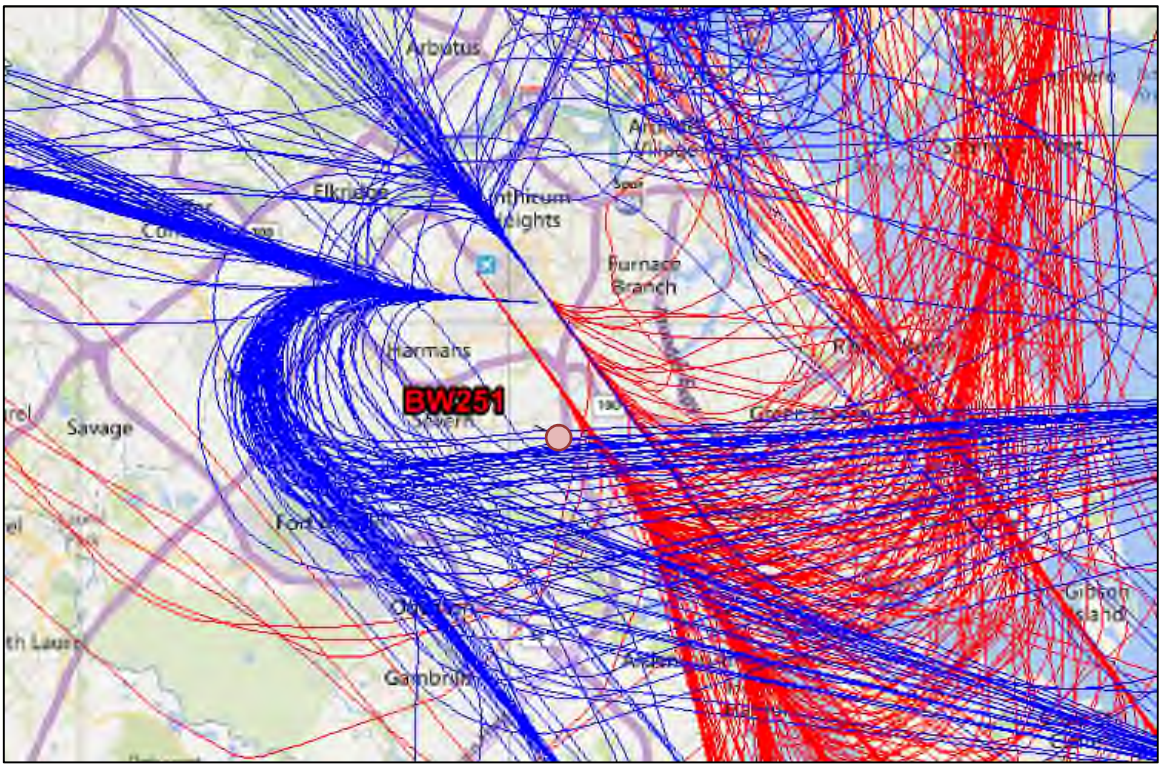

Figure 3. All Flight Tracks for a West Flow Day – August 8, 2017
(red = arrivals, blue = departures)

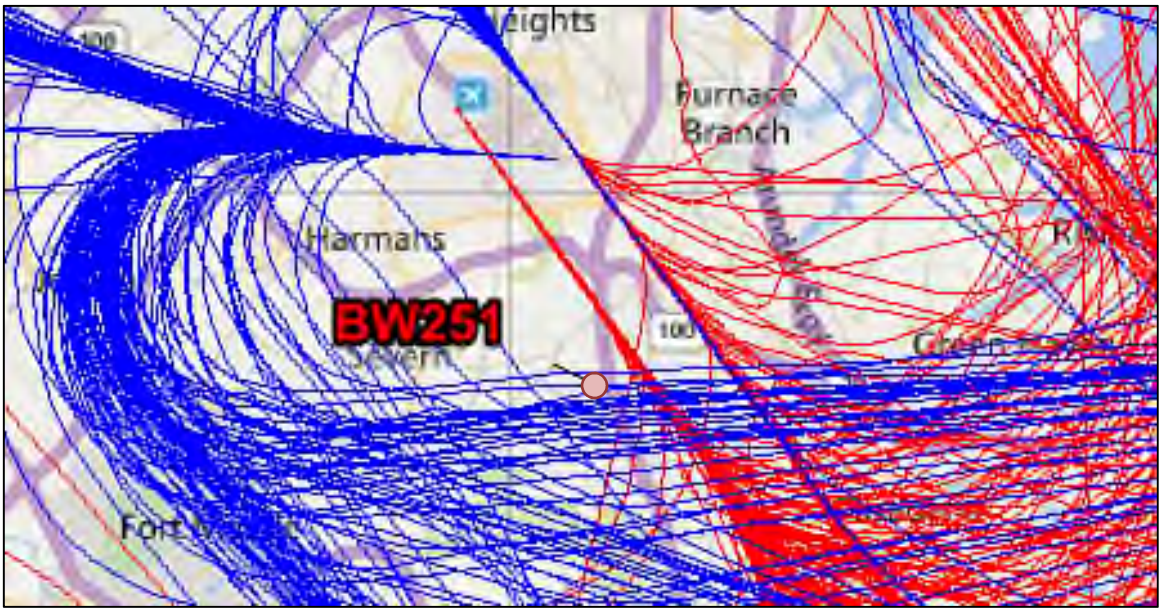

Figure 4. All Flight Tracks for a West Flow Day – August 8, 2017
(red = arrivals, blue = departures)

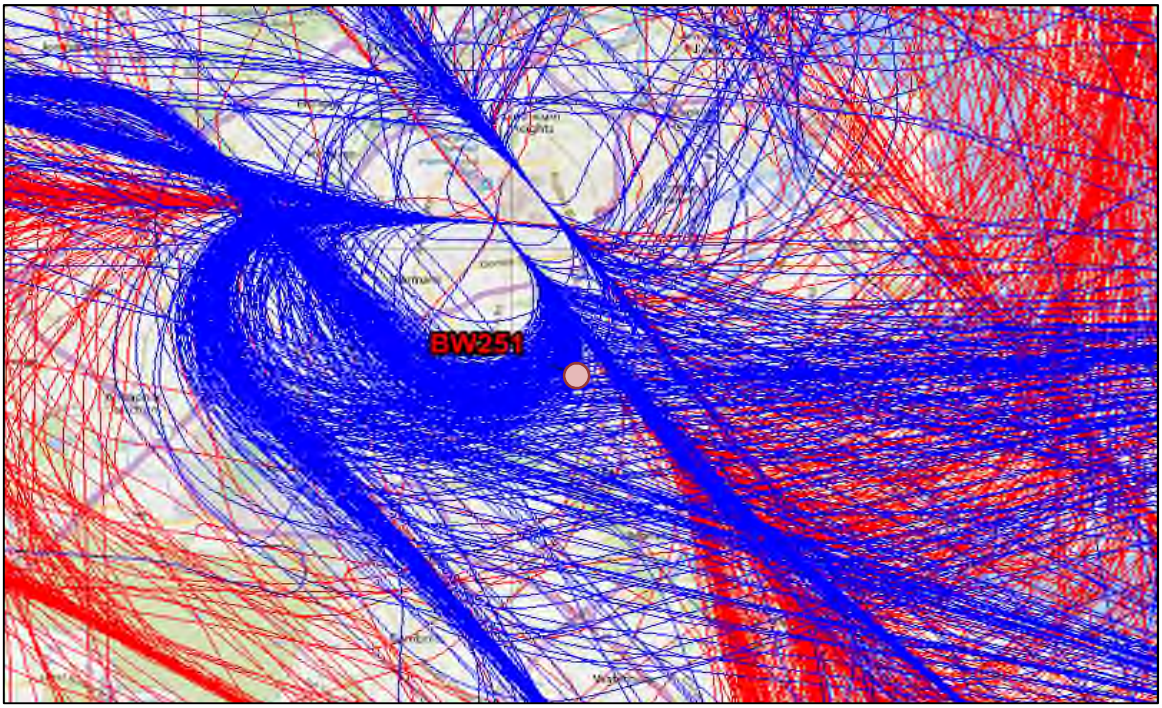

Figure 5. All Flight Tracks for an East Flow Day – August 3, 2017 (red = arrivals, blue = departures)

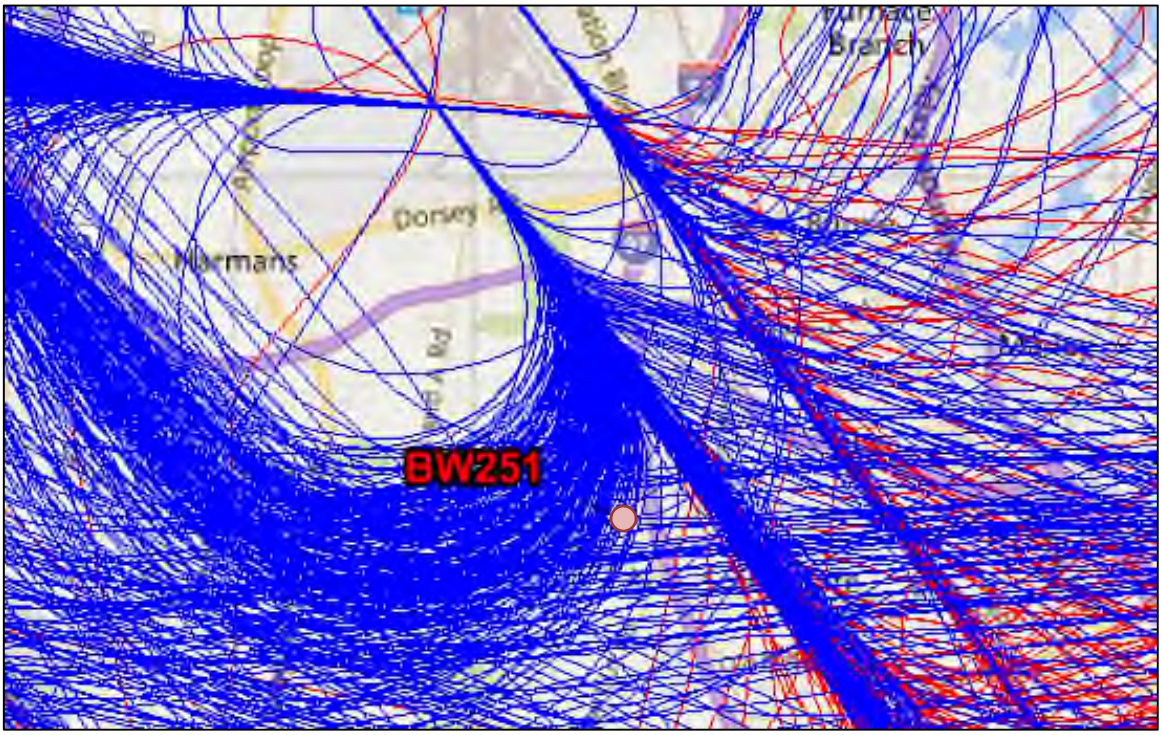

Figure 6. All Flight Tracks for an East Flow Day – August 3, 2017 (red = arrivals, blue = departures)

4. MEASURED NOISE LEVELS

This section provides an introduction to noise terminology, discusses the noise levels from individual aircraft noise events, and summarizes the cumulative noise exposure over the measurement period.

4.1 Aircraft Noise Terminology

There are several key metrics which are used to describe aircraft noise on a single-event and cumulative basis. The appendix titled "How Do We Describe Aircraft Noise" provides a more detailed overview of the metrics which are discussed in this section.

In brief, noise can be described by A-Weighted Sound Level[1] and is expressed in decibels (noted as dB or dBA). This noise level rises and falls from second to second as noise becomes louder or quieter. The average noise level over some time period, such as an hour, is called the Equivalent Sound Level (Leq). For a particular noise event, such as an aircraft overflight, the loudest level at any instant during the event is the Maximum A-Weighted Sound Level (Lmax). The Lmax tends to correlate poorly to people's perception of the total "noisiness" of an event because it neglects the duration. The Sound Exposure Level (SEL) accounts for both the level and duration of the noise and is the best measure of the "noisiness" of a single event. Finally, the noise exposure over a complete day is represented by the Day-Night Average Sound Level (DNL). This metric sums all of the noise exposure over the day with a ten decibel weighting for any noise which occurs during the nighttime (10 pm to 7 am) to account for the intrusive nature of these noise events.

4.2 Single Event Noise Levels

Figure 7 presents a count of noise events due to arrivals on Runways 33L and departures on Runway 15R at various Lmax values for the complete measurement period. For example, the tallest blue bar in the figure shows that 404 arrivals on Runway 33L had an Lmax of 60 dB. For typical conversational speech at a distance of approximately three feet, speech is interrupted by noise levels at or above 65 dB. Any noise events shown in this figure with a maximum level at or above 65 dB would, briefly for quieter events and longer for louder events, interrupt typical conversations outdoors.

Figure 8 tells a similar story using the SEL metric which corresponds better to people's judgment of the noisiness of an event. Departures on Runway 15R produced a similar number of loud noise events as arrivals on Runway 33L, but the departures on Runway 15R were generally louder.

Note that the noise events measured and presented in this report are those which can be clearly detected by the noise measurement equipment. Aircraft noise events with maximum levels at, near, or below the ambient noise levels from community noise sources are difficult, and sometimes impossible, to quantify and in most cases contribute little to the total noise exposure.

[1] A-Weighting simply refers to a method of computing the noise level which accounts for the particular response of the human ear. It is the standard for the vast majority of environmental noise analyses.

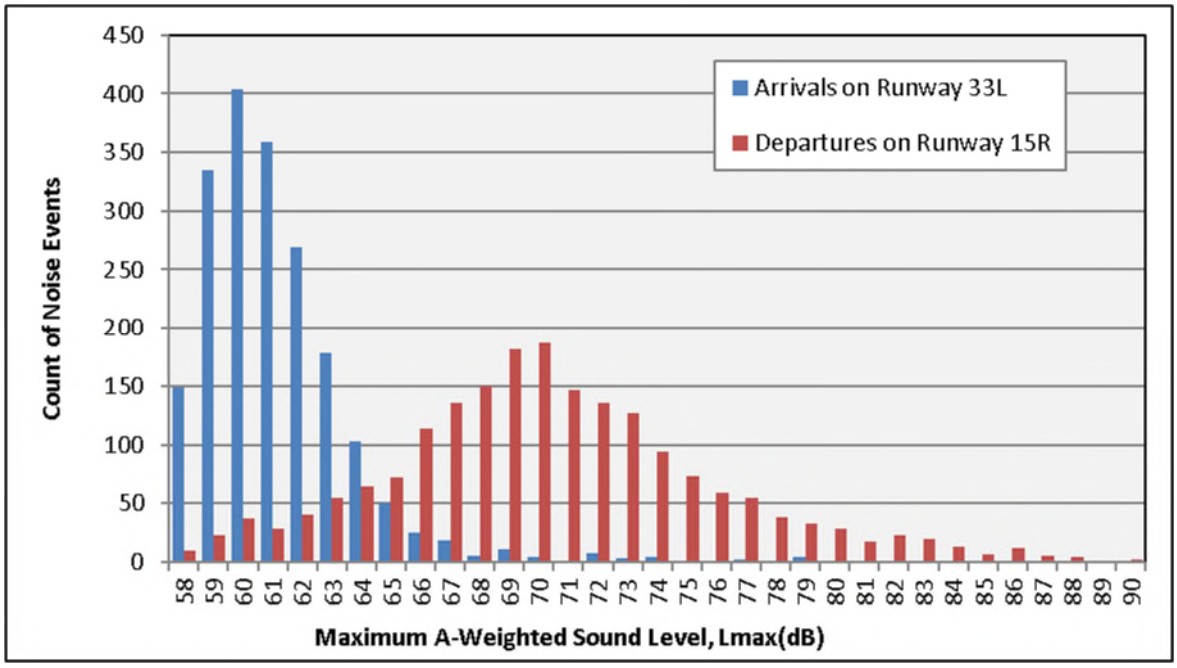

Figure 7. Counts of Maximum Noise Levels from Aircraft Overflights over the Full Measurement Period – Arrivals on Runway 33L and Departures on Runway 15R

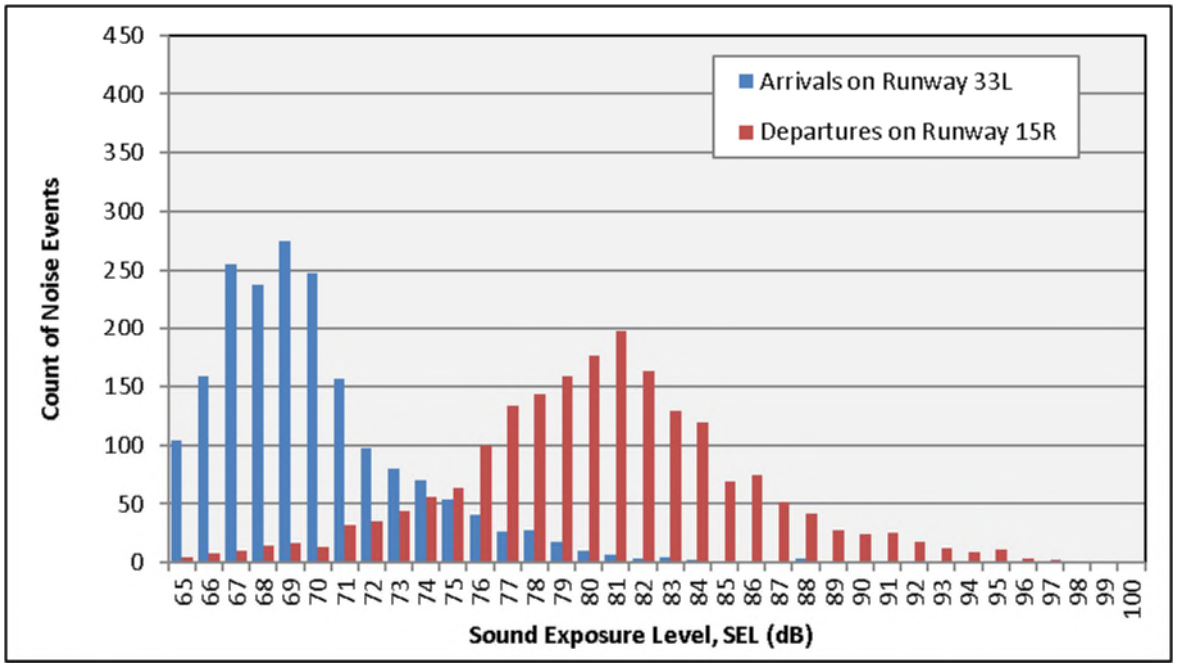

Figure 8. Counts of Sound Exposure Levels from Aircraft Overflights over the Full Measurement Period – Arrivals on Runway 33L and Departures on Runway 15R

4.3 Cumulative Noise Levels

Figure 9 provides a way to visualize the changes in aircraft noise levels over the measurement period. The average aircraft noise level (Leq) is presented on an hourly basis. Hours with louder or more aircraft events will show higher Leq values. Regions where the bars are absent simply indicate periods where no loud aircraft noise events occurred. Note that the cumulative noise level for each day incorporates these hourly noise levels with an additional ten decibel weighting for nighttime noise levels. This cumulative daily noise level, called DNL, is discussed next.

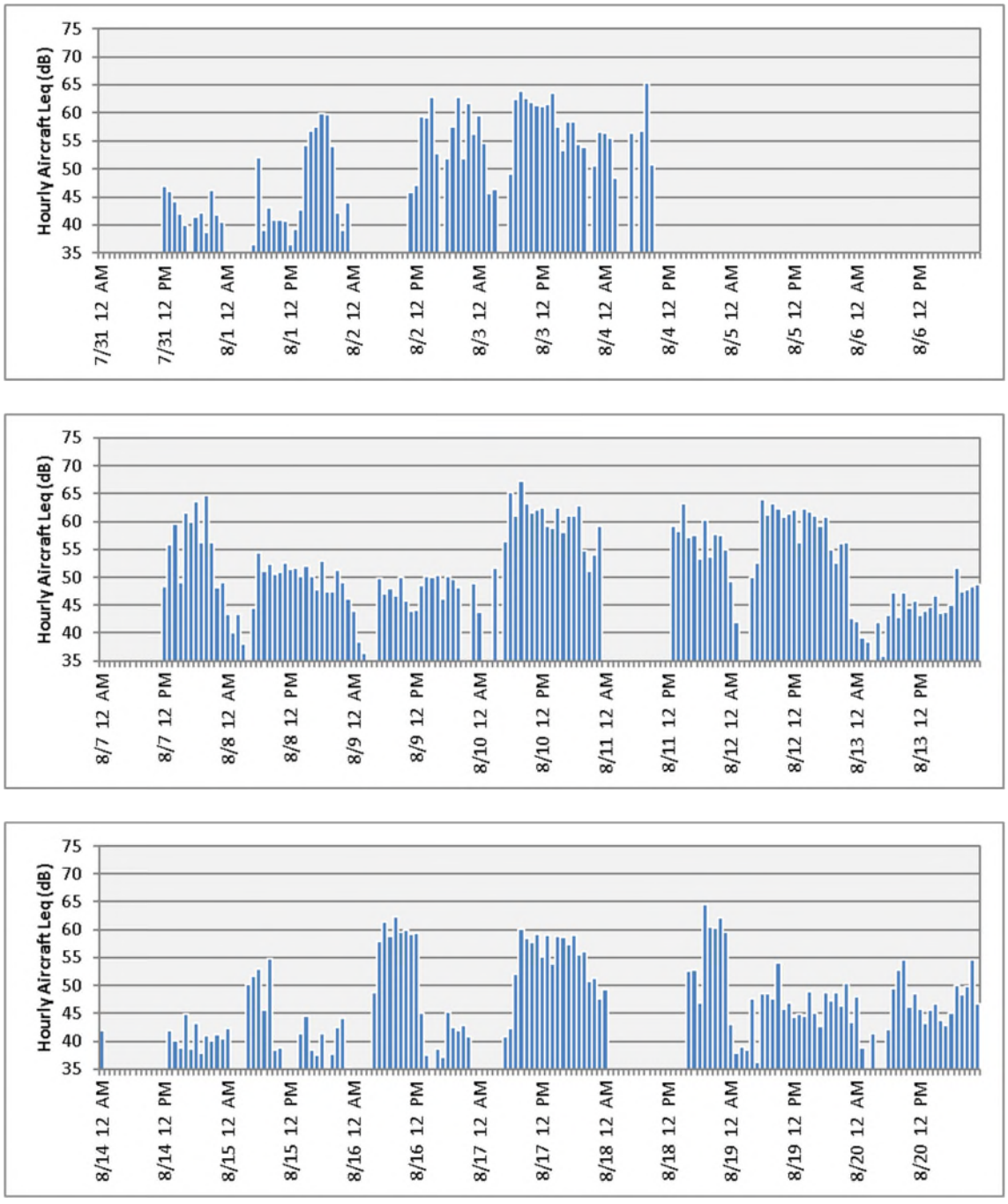

Figure 9 Average Hourly Aircraft Noise Levels

Table 1 summarizes the cumulative noise exposure over each of the twenty-two days of recorded data within the measurement period using the DNL metric. DNL sums the noise from every aircraft noise event over the day. The formula for DNL gives an extra ten decibel weighting to nighttime noise events to account for the intrusive nature of these events. The DNL for the sixteen complete days, as shown in Table 1, ranged from 44 dB to 65 dB.

Table 1. Measured Daily Aircraft Noise Levels

Date	Day-Night Average Sound Level, DNL (dB)	Hours Measured	Primary Aircraft Operations
7/31/2017	46*	12	33L Arr/28 Dep
8/1/2017	54	24	33L Arr/28 Dep until 3 PM and then after 10 PM 15R Dep/10 Arr between 3 PM and 10 PM
8/2/2017	60	23	33L Arr/28 Dep until 12 PM 15R Dep/10 Arr after 12 PM
8/3/2017	62	24	15R Dep/10 Arr
8/4/2017**	63*	9	15R Dep/10 Arr
8/5/2017**	-	0	33L Arr/28 Dep
8/6/2017**	-	0	33L Arr/28 Dep until 12 PM 15R Dep/10 Arr after 12 PM
8/7/2017	60*	11	15R Dep/ 10 Arr until 9 PM 33L Arr/28 Dep after 9 PM
8/8/2017	55	24	33L Arr/28 Dep
8/9/2017	52	24	33L Arr/28 Dep
8/10/2017	65	24	15R Dep/10 Arr
8/11/2017	58	23	15R Dep/10 Arr
8/12/2017	63	24	15R Dep/10 Arr until 3 PM 33L Arr/28 Dep after 3 PM
8/13/2017	51	24	33L Arr/28 Dep
8/14/2017	44	23	33L Arr/28 Dep
8/15/2017	54	24	33L Arr/28 Dep until 12 PM 15R Dep/10 Arr after 12 PM
8/16/2017	61	24	33L Arr/28 Dep until 12 PM 15R Dep/10 Arr after 12 PM
8/17/2017	56	24	15R Dep/10 Arr
8/18/2017	61	24	15R Dep/10 Arr until 9 AM 33L Arr/28 Dep after 9 AM
8/19/2017	52	24	33L Arr/28 Dep
8/20/2017	54	24	33L Arr/28 Dep
8/21/2017	58*	14	-
Total	**59**	**411**	-

Notes:
* Measurements for a partial day may not represent the average noise level for the complete day.
** The meter was not operational on August 5 or August 6.

As shown in the single event figures, Figure 7 through Figure 8, most of the loudest noise events at this site are from departures on Runway 15R. Departures on 15R accounted for about ninety percent of the DNL over the measurement period. Arrivals to Runway 33L contributed approximately eight percent of the DNL over the period. Departures on Runway 28 contributed approximately one percent of the DNL over the period. The small remainder of the DNL was due to arrivals and departures on other BWI Marshall runways and other overflights not associated with BWI Marshall.

5. CONCLUSION

The composite aircraft DNL over the full measurement period was 59 dB. The precise DNL over a full year will depend on the type and number of aircraft utilizing BWI Marshall and the percentage of time the airport spends in various operational configurations. Approximately fifty percent of operations during the measurement period were in west flow and fifty percent were in east flow, which is less than the typical annual average of seventy percent west flow operations. Noise levels at this site are higher in east flow than in west flow. Based only on the measurements and a seventy percent annual west flow assumption, the annual DNL at the measurement site is likely lower than the 59 dB that was measured for this period. Table 1 shows the primary runways in use each day of the measurement period.

In Appendix A of 14 CFR Part 150, the Federal Aviation Administration provides guidelines for the compatibility of land uses with various annual DNL values. These guidelines consider residential land use to be incompatible when the DNL is 75 dB or greater. For noise levels between 65 dB and 75 dB DNL, residential land use is considered incompatible, but where the community determines that this land use must be allowed, measures to achieve greater than typical outdoor to indoor noise level reduction should be incorporated into building codes. The guidelines designate all land uses, including residential, as compatible for DNL values below 65 dB.