airservices
australia

Short Term Noise Monitoring Program, *Upper Brookfield*

02 August 2023 – 18 November 2023

Version Control

Version	Date	Comments	Sections
1.0	10 April 2024	Initial Version	All

Summary

Deployment Purpose

This deployment aims to capture noise levels of arrival and departure operations south of the airport in the Upper Brookfield area.

Deployment monitoring Period

02 August 2023– 18 November 2023

Monitoring Details

Capture zone: 2.5km radius x 13,123ft (4,000m) altitude.

Threshold settings: 00:00-05:59 = Threshold 40dB(A), 06:00-11:59 = Threshold 49dB(A),

11:00-16:59 = Threshold 48dB(A), 18:00-23:59 = Threshold 40dB(A)

Key Findings

- Noise Correlation

  The purpose was to determine the number of aircraft correlated noise events (CNEs) captured by the noise monitor during the deployment. 77.7% of the aircraft from Brisbane airport, as per the focus group, generated noise events that correlated to the aircraft.

- Noise Daily Distribution

  The purpose was to establish the number of aircraft where the maximum noise level (LaMax) of the noise event created by the aircraft exceeded a specific threshold. 72% of the maximum noise level generated by aircraft fall within the range of 55dB(A) to 65dB(A).

- Most Common aircraft

  The purpose was to identify the most prevalent aircraft during the deployment period, which was the B738 aircraft.

- Top loudest noise events

  The purpose was to verify the accuracy of the top 100 loudest (LaMax) noise events. The top 10 noise events for this deployment originated from community sources. Additionally, the top 10 correlated noise events were associated with community sources in addition to aircraft noise.

- Busiest Day

  The purpose was to analyze the day that had the most significant impact on the community. The busiest day during the deployment period occurred on 16 November 2023.

Glossary of Terms

A	Arrivals
Background noise Level (L90)	The noise level in dB(A) that is exceeded 90% of the time. It is considered the background noise level of an environment.
Capture Zone	The region relative to the noise monitor that an aircraft can be within and be able to be correlated to a noise event.
Correlated Noise Event (CNE)	A noise event matched to an aircraft movement that flew through the capture zone.
D	Departures
Data Availability	The degree of data completeness achieved during the deployment period. The data availability percentage factors in any monitor outages that occur.
Day	6:00am-10:00pm
dB(A)	A-weighted decibel. It is an expression of the relative loudness of sounds as perceived by the human ear.
General Aviation	Movements other than scheduled commercial airline operations. This includes private, sports, charter and training operations.
LaMax	Each noise event will have a peak noise level which is referred to as the maximum sound level in dB(A) or LaMax
Local	Movement that departs and arrives at the same airport, including circuits and training flights.
Movement	An aircraft operation, such as an arrival or departure
Night	10:00 pm to 6:00 am
NMT	Noise Monitoring Terminal also referred to as the noise monitor.
Noise Event	A noise event is created when the noise level exceeds the threshold settings for a specified period.
O	Overflight i.e. an aircraft movement that flew over the area but did not arrive or depart from the airport of concern.
Overall Correlation Percentage	The total number of correlated noise events (CNE) is divided by the total number of aircraft movements through the capture zone to calculate the overall correlation percentage.
RWY	Runway
T	An operation by an aircraft that arrives and departs on a runway without stopping or exiting the runway. It is also known as Touch and Go.
Threshold	The threshold represents the value that the noise level must surpass for a specified period to create a noise event.
YBBN	Brisbane Airport, Queensland

Table of Contents

1 Purpose

The short-term noise monitoring program target's locations in suburbs chosen by Airservices Australia with consideration for community feedback. This deployment aims to capture noise levels of arrival and departure operations south of the airport in the Upper Brookfield area. Furthermore, we will conduct an extensive analysis on a selected day, specifically the busiest day of the deployment period. This day has been chosen due to its potential to offer significant statistical data and insight into a day that has the greatest impact on the community during the deployment. The analysis will provide details of the loudest noise events experienced and the most prevalent aircraft operations observed.

To adequately depict the variation in flight paths, weather conditions and operational patterns from Brisbane airport movements, a monitoring period between 02 August 2023– 18 November 2023 was deemed sufficient.

This short-term monitor was deployed in Upper Brookfield, QLD. The noise monitoring terminal (NMT) was positioned to capture aircraft within a three-dimensional cylinder capture zone. The zone spans a radius of 2.5km and extends to 13,123ft (4,000m) above the NMT from the noise monitors centre as depicted in Figure 1. Considering that the focus group of aircraft operate below 12,000ft (3,657m), a ceiling of 13,123ft (4,000m) was adopted to accommodate potential variations.

The Focus Group for this deployment consists of aircraft operating to the south Brisbane airport which include:

- Fixed-wing aircraft arriving at runway 01L and 01R of YBBN.
- Fixed-wing aircraft departing from runway 19R and 19L of YBBN.
- All touch-and-go and helicopter YBBN operations flying into the correlation zone.
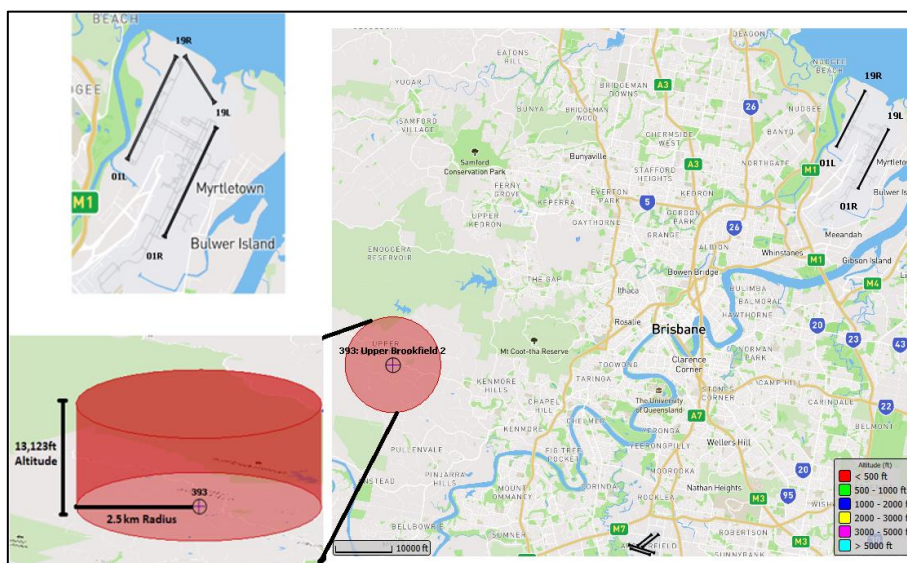

Figure 1: NMT Correlation Zone of 2.5km radius x 13,123ft altitude zone of the monitor

The focus group excludes fixed-wing aircraft departures from runway 01R and 01L, as these few turboprops aircraft that do fly over the monitor are travelling over 13,000 ft. These aircraft are unable to generate a noise level significant enough to be detected by the noise monitor and trigger a noise event. The focus group also excludes fixed aircraft arrivals on runway 19R and 19L. These operations pass on the border of the correlation zone hence are unlikely to produce noise levels to create events.

2 Deployment Details

The Upper Brookfield monitor was installed on 1 August 2023 and removed on 19 November 2023. Complete data is available from 2 August 2023 to 18 November 2023.

NMT ID	393
Deployment Period	02/08/2023 - 18/11/2023
Location	Carbine Rd, Upper Brookfield, QLD 4069
NMT Altitude	315ft (96m)
Capture Zone	2.5km radius x 13,123ft (4,000m) altitude
Data Availability	99.9%
Threshold Settings[1]	The noise detection thresholds which have been selected: • 00:00-05:59 = Threshold 40dB(A) • 06:00-11:59 = Threshold 49dB(A) • 12:00-16:59 = Threshold 48dB(A) • 17:00-23:59 = Threshold 40dB(A)

Table 1: NMT Details

3 Findings

3.1. Noise Correlation Summary

The total number of aircraft correlated noise events (CNEs) that were captured by the noise monitor during the three-month deployment period is shown in Table 2 below.

	All Movements[2]	Brisbane Airport Movements	Brisbane Airport Focus Group
Number of Movements through capture zone	5610	5026	4872
Number of CNE	4151	3793	3786
Correlation Summary	74.0%	75.5%	77.7%

Table 2: Aircraft correlation rate

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1 Threshold setting procedures are explained in section 6.1.1.
2 All-movement tab accounts for operations to and from other airports (E.g. Amberley, Archerfield and Wellcamp) as well as YBBN operations.

89.6% of all operations that passed through the capture zone were Brisbane airport movements. A one-week sample of these movements is shown in Figure 2, below. Other operations included traffic from other airports, such as Amberley, Archerfield, and Wellcamp Airports. A correlation of 77.7% was achieved for the focus group of Brisbane airport movements.
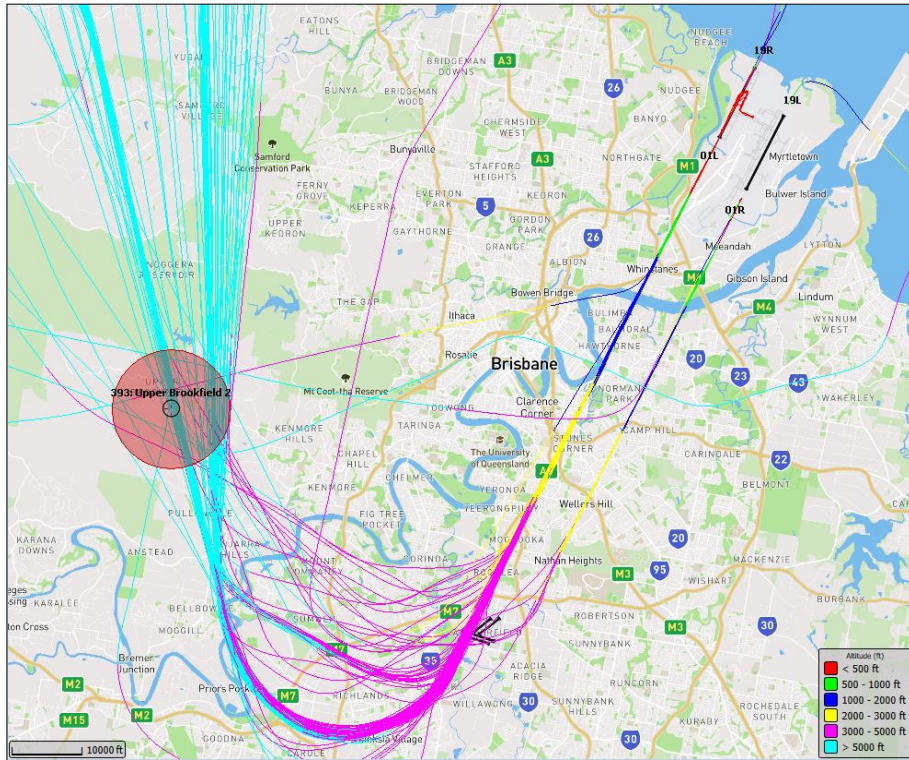

Figure 2: One week of Brisbane airport flight tracks passing through the correlation zone

The findings obtained during the short-term deployment at Upper Brookfield are as follows:

- Departure runway 19R and 19L less than 1% of the operations from Brisbane airport over the noise monitor.

- Arrival runway 01L and 01R account for 94% and 1% of the operations respectively from Brisbane airport over the noise monitor.

- The average LaMax and highest LaMax for arrival and departure runways are detailed in Table 3, below.

Operation Type	Runway	Average LaMax noise dB(A)	Highest LaMax dB(A)
Brisbane Airport Departure	19R	60.4	65.7
Brisbane Airport Arrival	01L	58.7	78.1
Brisbane Airport Departure	19L	56.2	59.0
Brisbane Airport Arrival	01R	59.2	67.7

Table 3: Average LaMax and highest LaMax noise levels corresponding to each runway.

3.2. Daily Distribution of Correlated Noise Events

A summary of the total number of correlated noise events by time of day, and the minimum to maximum number of CNE on any day, are summarized below in Table 4.

Correlated Noise Event (CNE)	Day Time Count (6:00am-10:00pm)	Night-time Count (10:00pm-6:00am)	Min number of CNE per day	Max number of CNE per day
N- Above[3] 50 dB(A) (N50+[4])	3779	13	1	85
N- Above 60 dB(A) (N60+[4])	589	2	0	18
N- Above 70 dB(A) (N70+[4])	13	0	0	2

Table 4: Total correlated noise events during deployment period by time

Examination of the N-above distribution values in Figure 3 and Figure 4 (below) show that the highest daytime noise levels (N70+) were recorded on 29 September. 72% of the maximum noise level generated by aircraft falls within a range of 55dB(A) to 65dB(A), with only 0.3% exceeding 70dB(A).

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[3] N-above (or Number-above) is defined as the number of noise event with a LaMax above the specified (eg.N50+) value.
[4] N50+, N60+, N70+ are expressed as number of noise events with a LaMax above 50dB(A), 60 dB(A) and 70 dB(A), respectively.
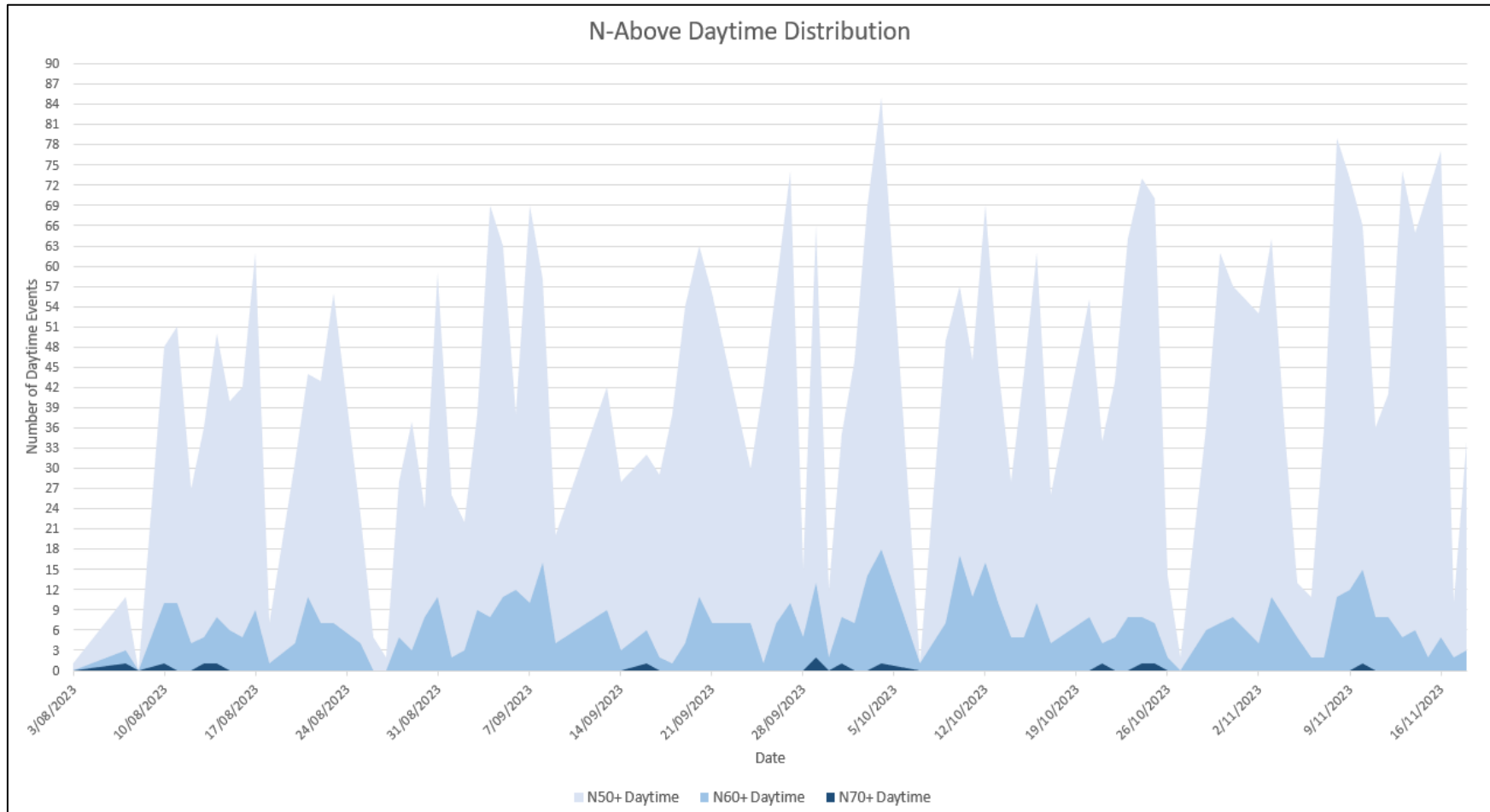
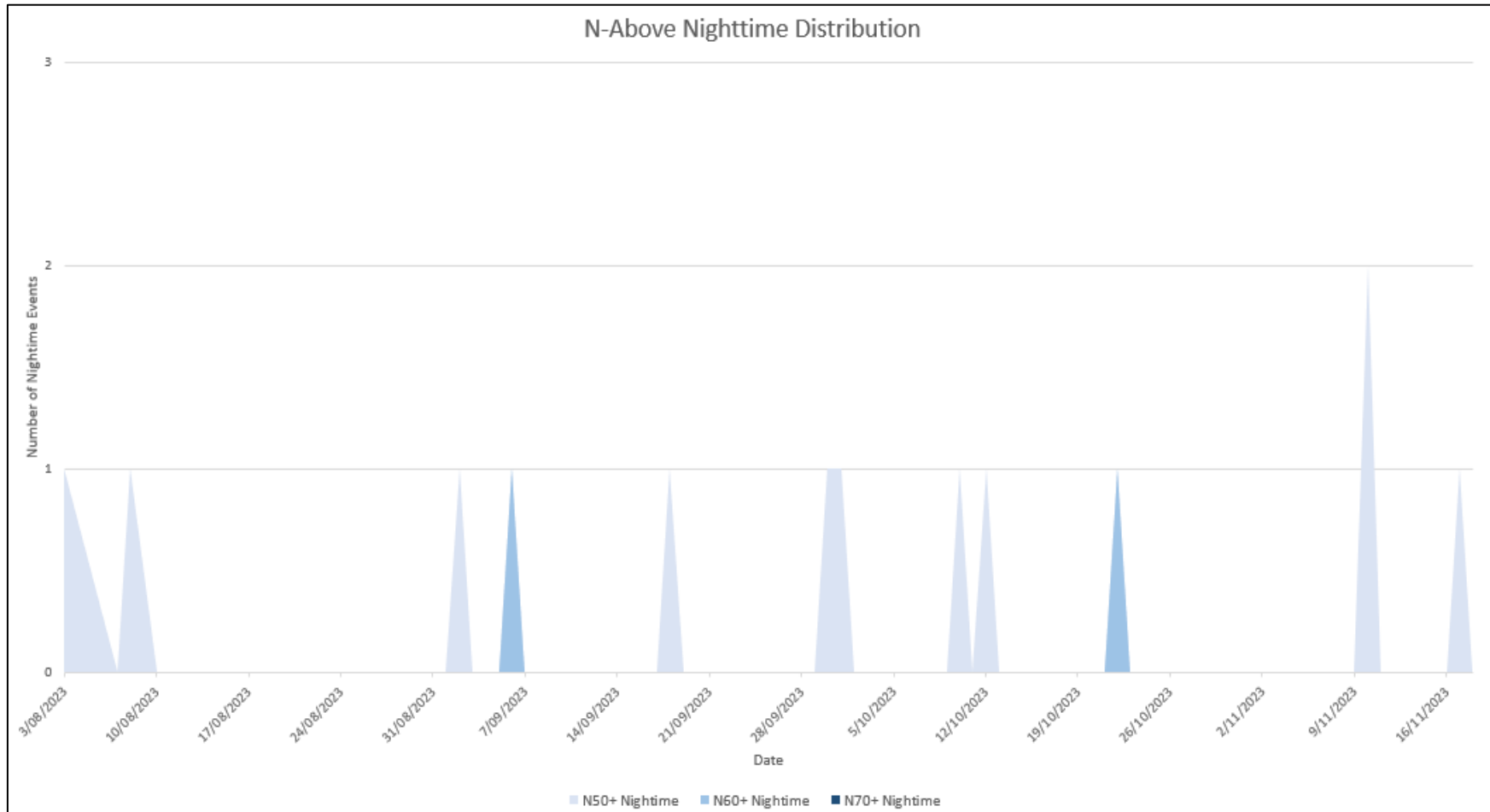**Figure 3:** Daytime Daily N-Above Distribution Graph

Figure 4: Night-time Daily N-Above Distribution Graph

3.3. Most Common Aircraft

The most common aircraft type that flew through the zone during the deployment period is a B738 aircraft as shown in Table 5, below.

Brisbane Airport Operation Type	Operations	Correlated %
Arrival	911	86%
Departure	12	33%
Touch and Go	-	-
Overflight	-	-

Table 5: B738 correlation percentage across the deployment period

3.4. Top 10 Correlated Aircraft

The following table shows the top 10 average and maximum noise levels of correlated noise events (CNEs) for the deployment period from 02 August to 18 November. The highest average LaMax of 61.2dB(A) is attributed to B737 jet aircraft arriving to runway 01L, shown in Table 6.

Aircraft Type	Aircraft Category	Airport Code	Operation Type	Runway	Total CNE	Average LaMax dB(A)	Max dB(A)
B738	J	YBBN	A	01L	795	59.5	76.2
E190	J	YBBN	A	01L	529	57.9	71.8
F100	J	YBBN	A	01L	487	58.7	77.5
F70	J	YBBN	A	01L	461	58.0	71.6
DH8D	T	YBBN	A	01L	231	55.7	66.1
A320	J	YBBN	A	01L	191	58.6	69.0
SF34	T	YBBN	A	01L	191	59.8	76.0
A359	J	YBBN	A	01L	152	59.9	72.3
B737	J	YBBN	A	01L	127	61.2	78.1
B763	J	YBBN	A	01L	55	59.9	65.0

Table 6: Top 10 aircraft in the deployment period by total CNE

Aircraft Type: J = Jets, T = Turboprop. Operation Type: A = Arrival

3.5.   Noise Event Analysis

The audio verification process involved listening to and confirming the accuracy of the top 100 loudest (LaMax) noise events.

Table 7 outlines the top 10 noise events from all sources. The maximum noise levels (LaMax) of the noise events for this deployment were all from community sources such as birds, strong winds or rain and thunder.

Table 8 outlines the top 10 correlated noise events (that is, aircraft noise). The maximum noise levels (LaMax) of correlated noise events for this deployment originated from other nearby local airport movements as well as Brisbane Airport movements.

Some correlated noise events were associated with community sources in addition to aircraft. This can be seen in the 'noise source' details in Table 8 and Figure 5. Consequently, there may be a benefit in conducting further noise monitoring in this location to explore and confirm the spectrum of noise levels attributed to aircraft, with the exclusion of any impact from community noise contamination.

Future aircraft noise monitoring in the Upper Brookfield area can achieve more precision by:

- Choosing a location with fewer trees will minimise the contamination of the noise events by wildlife.
- Selecting autumn and winter periods, typically between May and August, for deployment. During these seasons, bird activity tends to decrease, thereby reducing the amount of bird noise captured in the noise events.

Start Date/Time	Correlated to Aircraft?	LaMax dB(A)	Noise Source	Aircraft Type	Operation Type	Runway
28/09/2023 15:11	No	91.60	Rain and Thunder	-	-	-
26/09/2023 15:04	No	88.50	Birds	-	-	-
31/08/2023 08:20	No	88.10	Birds	-	-	-
05/10/2023 09:35	No	87.80	Birds	-	-	-
08/08/2023 07:58	No	87.40	Birds	-	-	-
17/11/2023 15:17	No	86.60	Birds	-	-	-
11/08/2023 17:06	No	84.90	Birds	-	-	-
02/10/2023 05:49	No	84.40	Birds	-	-	-
15/10/2023 09:02	No	84.30	Birds	-	-	-
21/08/2023 10:35	No	84.10	Birds	-	-	-

Table 7: Top 10 loudest noise events during the deployment period by LaMax

Start Date/Time	Movement Airport[5]	LaMax dB(A)	Noise Source	Aircraft Type[6]	Operation Type[7]	Runway
14/08/2023 16:21	Brisbane	78.1	Aircraft and Birds	B737	A	01L
25/10/2023 11:37	Overflight	77.9	Aircraft and Door Closing	AS50	O	-
16/09/2023 13:31	Brisbane	77.5	Aircraft and Birds	F100	A	01L
07/08/2023 14:59	Brisbane	76.2	Aircraft and Birds	B738	A	01L
29/09/2023 15:30	Brisbane	76.0	Aircraft and Birds	SF34	A	01L
14/10/2023 14:46	Overflight	75.2	Helicopter	B214	O	-
18/09/2023 08:26	Overflight	73.1	Aircraft	C210	O	-
26/08/2023 14:43	Overflight	72.6	Aircraft	R44	O	-
04/10/2023 06:44	Brisbane	72.3	Aircraft and Birds	A359	A	01L
28/10/2023 10:10	Overflight	72.1	Helicopter	A139	O	-

Table 8: Top 10 loudest aircraft correlated noise events during the deployment period by LaMax

[5] Overflights refers to movements from Amberly airport, Archerfield airport, Toowoomba airport, etc.
[6] Dash (-) indicates unknown aircraft types
[7] Operation types A = Arrival, D = Departure, O = Overflight, T = Touch and Go
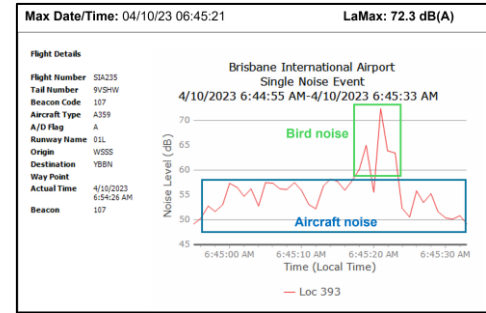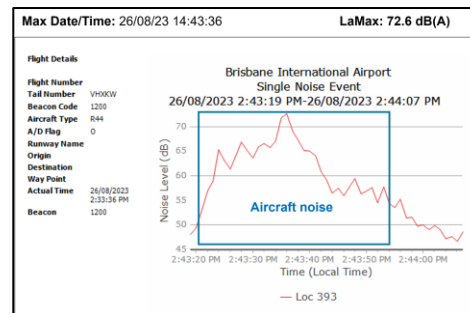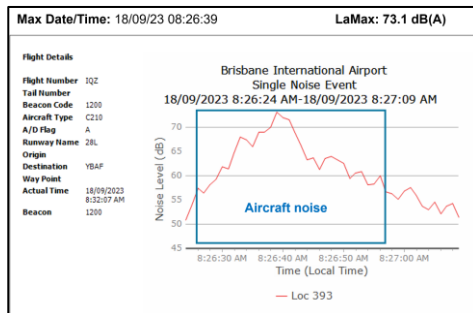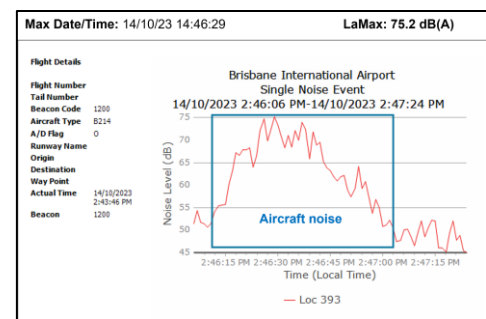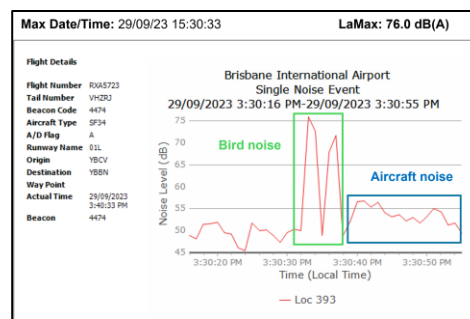
Figure 5: Top 9 correlated noise event from Table 8 graphed and analysed.
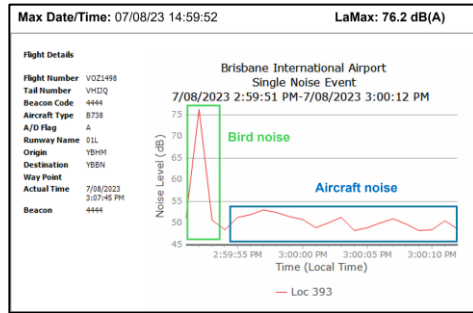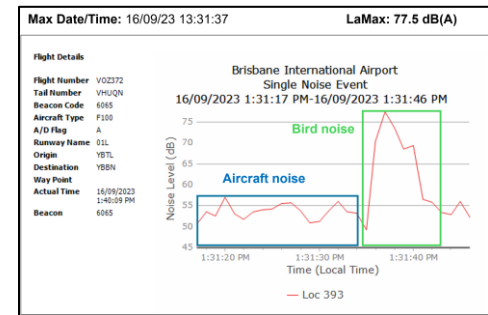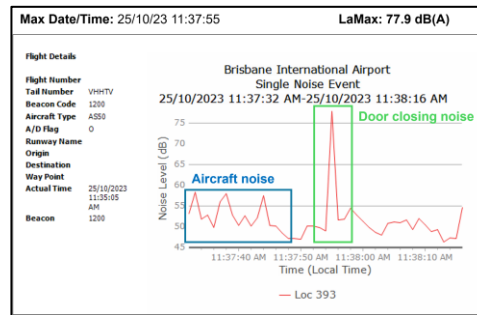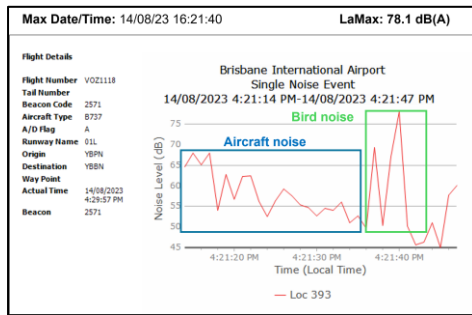
4 Busiest Day Analysis

4.1. Discussion

The busiest day during the deployment period occurred on 16 November, with a total of 410 noise events. The noise events consisted of jet, turboprop, machinery, rain, and bird noise. There were 107 aircraft captured passing through the zone from Brisbane airport movements, 106 which were from the focus group. The predominant movement over the capture zone was from jet operations (74%).
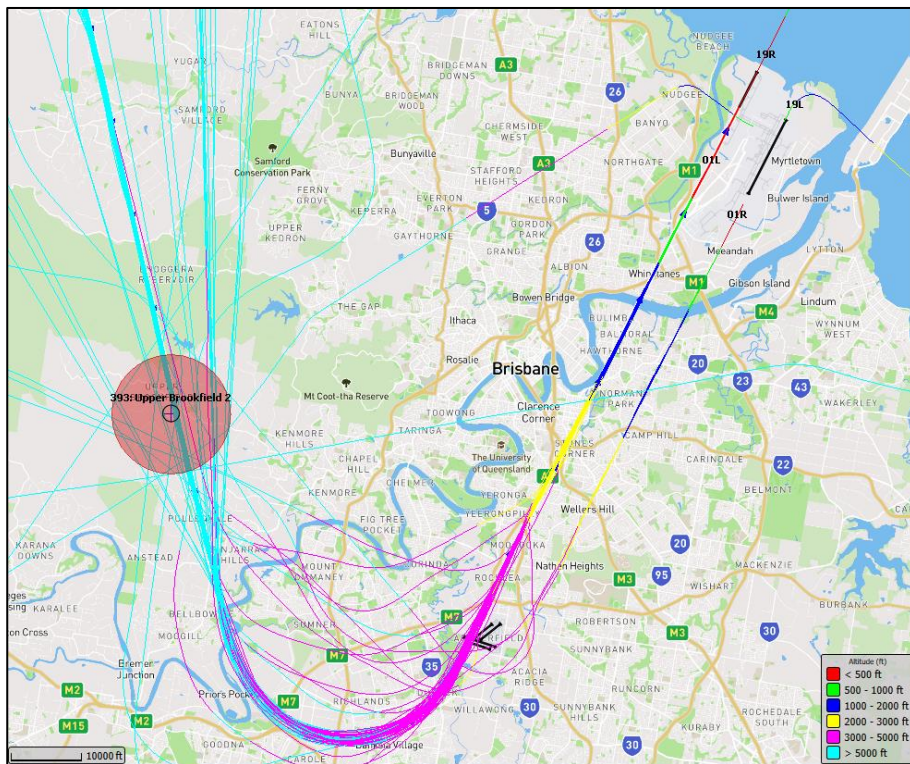

Figure 6: Busiest day flight tracks

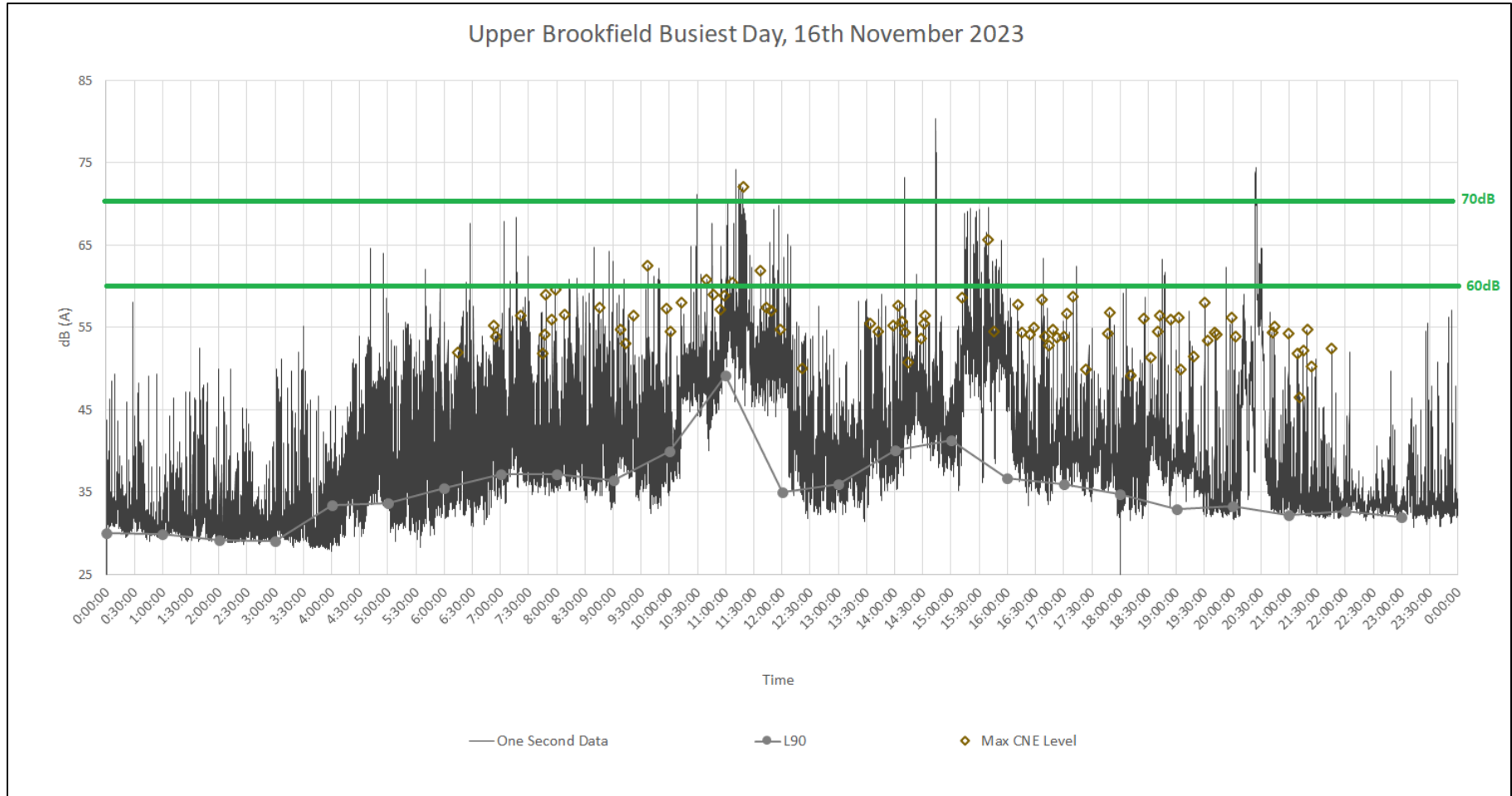## 4.2. Busiest Day Graph

Figure 7: Distributions of max CNE level, hourly L90 and one-second noise data on the busiest day

4.3.   Busiest Day Noise Levels

The loudest event on the busiest day was created by birds, reaching a maximum noise level of 80.4 dB(A) at 14:44:01 in the afternoon, lasting for 56 seconds.

The loudest Brisbane airport movement on the busiest day was created during the arrival of a A320 Jet from runway 01L at 15:39:51, registering a maximum noise level of 65.6 dB(A).

5   Further Information

The following platforms provide further information on Brisbane aircraft noise monitoring.

5.1.   Airservices Australia

Information on the noise and flight path monitoring system including approach to noise monitoring and frequently asked questions: https://www.airservicesaustralia.com/community/environment/aircraft-noise/monitoring-aircraft-noise/

5.2.   Aircraft in Your Neighbourhood

Brisbane Noise Monitoring Report (interactive tool to explore monthly noise monitoring data): https://aircraftnoise.airservicesaustralia.com/2020/10/29/brisbane-noise-monitoring-report/

The Brisbane Noise and Flight Path Monitoring System (long term noise monitor terminal locations):   https://aircraftnoise.airservicesaustralia.com/2020/06/03/the-brisbane-noise-and-flight-path-monitoring-system-nfpms/

5.3.   WebTrak

Aircraft noise data is displayed from live noise monitors across Brisbane, along with historical data: https://webtrak.emsbk.com/bne3

5.4.   Brisbane Airport

Dashboard for live noise monitor and PDF reports from past monitor locations provided by Brisbane Airport Corporation (all short term monitor placements): https://www.bne.com.au/corporate/community-and-environment/flight-paths-aircraft-noise/noise-management

6 Appendix

6.1. Noise Event Detection Details:

ISO 20906 provided technical guidance in this short-term noise monitoring. The NMT (i.e., sound level monitor) used for testing passed the Class 1 periodic calibration tests outlined in clauses of IEC 61672-3:2013 and IEC 61260-3:2016. The placement of NMT considered the vicinity of reflective surfaces and the height of the NMT relative to the target aircraft operations to minimise potential unintended anomalies. The NMT height is fixed on a supporting pole and the captured noise events were observed acceptable throughout the deployment. The background noise levels were taken into account in the monitoring area, to appropriately capture aircraft noise levels.

6.1.1. Threshold Settings

Noise monitor threshold settings are established by collecting hourly average L90 data over a period of two to five days following installation of the noise monitor. L90 represents noise level which are exceeded 90% of the time. It is considered the background noise level of an environment. For instance, if the L90 hourly noise level reads 50dB(A), it means that for 90% of that hour, the noise level is above 50dB(A). The threshold is set close to the average L90+10dB(A). The addition of 10dB(A) effectively filters out most community noise, such as birds and animal sounds, machinery, and vehicle noises. As a result, the created noise event will predominantly contain aircraft noise with minimal community noise.

6.1.2. Aircraft and Noise Event Correlation

The correlation of a noise event with an aircraft requires meeting the following conditions:

- The aircraft passes through the defined capture zone set by the monitor as shown in Figure 1.
- The rise and fall time of the measured event matches a sound pattern representative of an aircraft flyover.
- Noise levels are greater than the specified threshold for a specified period when aircraft flies over, this creates a noise event.
- Maximum noise level of the noise event known as LaMax must occur while the aircraft is within the capture zone of the noise monitor.

Aircraft that flew within the vicinity of the monitor but did not trigger a correlated noise event may have failed to meet some of the parameters above. In other instances, this could be attributed to the lack of air traffic control data (ATC). This occurs when aircraft do not have an operating transponder or when there are radar outages. Despite a noise event being created by the aircraft, without available ATC data, there will be no aircraft to correlate with the noise event.

6.2. Calibration Check

The integrity of the noise monitor relies on regularly verifying the accuracy of the microphone recording levels and time synchronisation of samples with radar data. The microphones are replaced with laboratory certified microphones every 12 months and electrostatic calibration tests are automatically performed daily to ensure data quality.