AIRSERVICES AUSTRALIA

Environment Services

REPORT No.

1494

AIRCRAFT NOISE MONITORING

PARAFIELD GARDENS

SOUTH AUSTRALIA

DISCLAIMER

This report contains a summary of data collected over the specified period and is intended to convey the best information available from the NFPMS at the time. The system databases are to some extent dependent upon external sources and errors may occur. All care is taken in preparation of the report but its complete accuracy can not be guaranteed. Airservices Australia does not accept any legal liability for any losses arising from reliance upon data in this report which may be found to be inaccurate.

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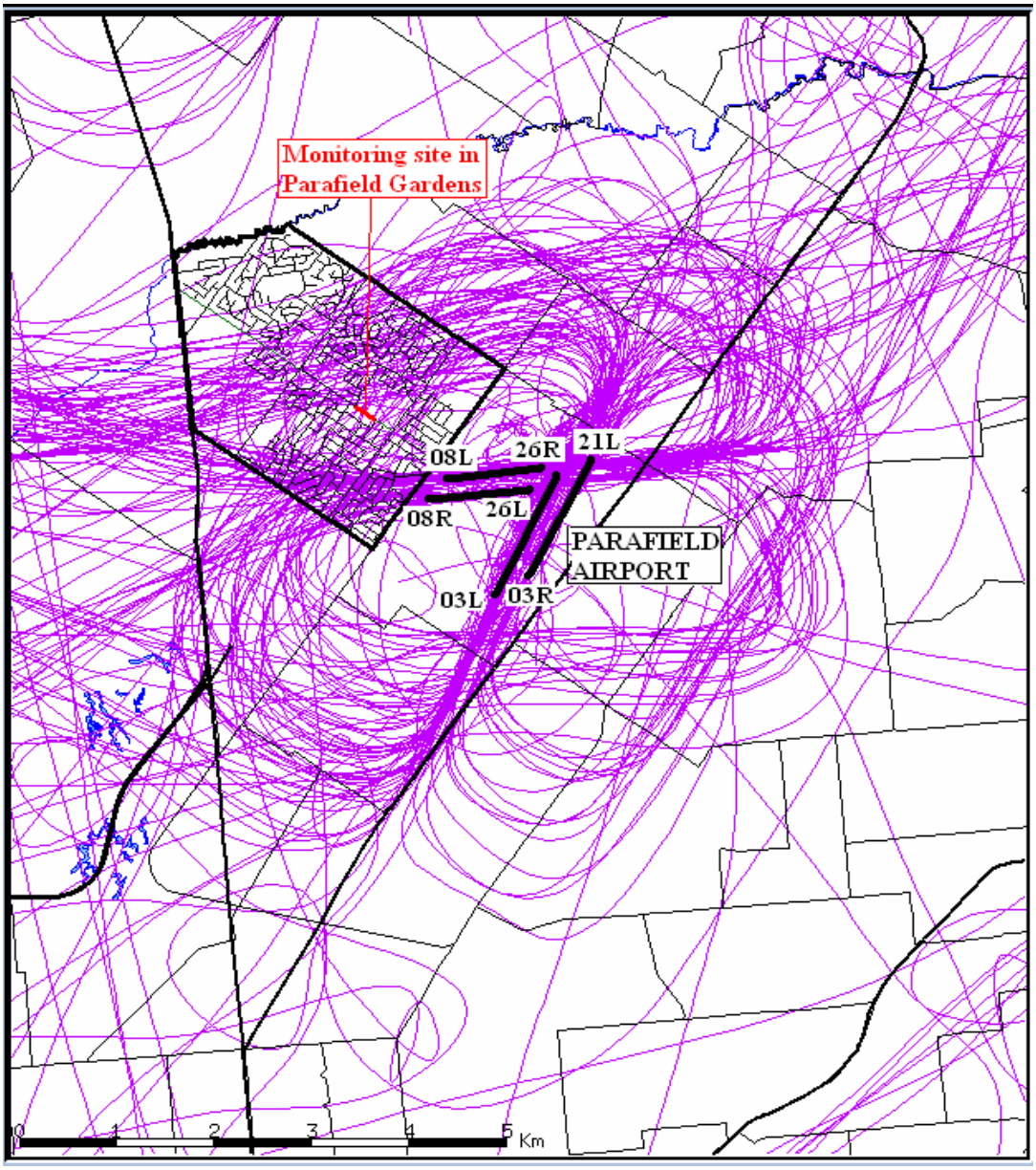
FIGURES AND TABLES

1. INTRODUCTION

In response to a large number of aircraft noise complaints from residents living close to Parafield Airport in South Australia, a portable noise monitoring terminal was installed at Parafield Gardens (as shown in Figure 1). The noise monitoring continuously measures noise, and is connected to Airservices Australia's Noise and Flight Path Monitoring System (NFPMS) for Adelaide Airport.

This report provides a summary of data collected by the portable noise monitoring during the period of 19 October 2006 to 30 January 2007. The selected site was identified by Airservices Australia as a suitable site for the measurement of the impact associated with aircraft operations at Parafield Airport.

Figure 1: Location of the portable NMT in Parafield Gardens.



2. METHODOLOGY

2.1. Measurement site.

The specific measurement site, chosen to comply with Airservices selection criteria, was at the Parafield Gardens R-7 Schools in Parafield Gardens. The purpose of this exercise was to provide information on the levels of aircraft noise experienced in the area of Parafield Gardens due to aircraft operations from Parafield Airport. Noise monitoring commenced at Parafield Gardens on 26 September 2006 and continues to collect noise data at the site. This report includes the data collected in Parafield Gardens for the period 19 October 2006 to 30 January 2007. Data collected in Parafield Gardens for the period 26 September to 18 October 2006 is included in Report 1484.

The monitoring site is approximately 1000 metres away from runway threshold 08L and is exposed to aircraft operations from all runways at Parafield Airport.

2.2. Analysis.

The portable NMT is connected to Airservices Australia's Noise and Flight Path Monitoring System (NFPMS) for Adelaide Airport. The NMT continuously measures the total noise environment and automatically transferred the noise data to the NFPMS, which also collects aircraft flight tracks and flight plans from the Airservices Australia's "The Advanced Australian Air Traffic Management System (TAAATS) for Adelaide Airport. The NFPMS the correlates an aircrafts operation with a noise events when the flight tracks of the aircraft operates in the vicinity of the NMT and there is a match between the recoded times of noise event and the flight track.

Analysis of the noise data was undertaken to assess the noise levels of the various aircraft types operating in the vicinity of the NMT. Aircraft noise levels are assessed in terms of the maximum A-weighted sound levels recorded by the NMT when the aircraft flew by the monitoring site. The measurements also provide an indication of the average noise exposure of the site over the monitoring period.

3. FLIGHT TRACKS.

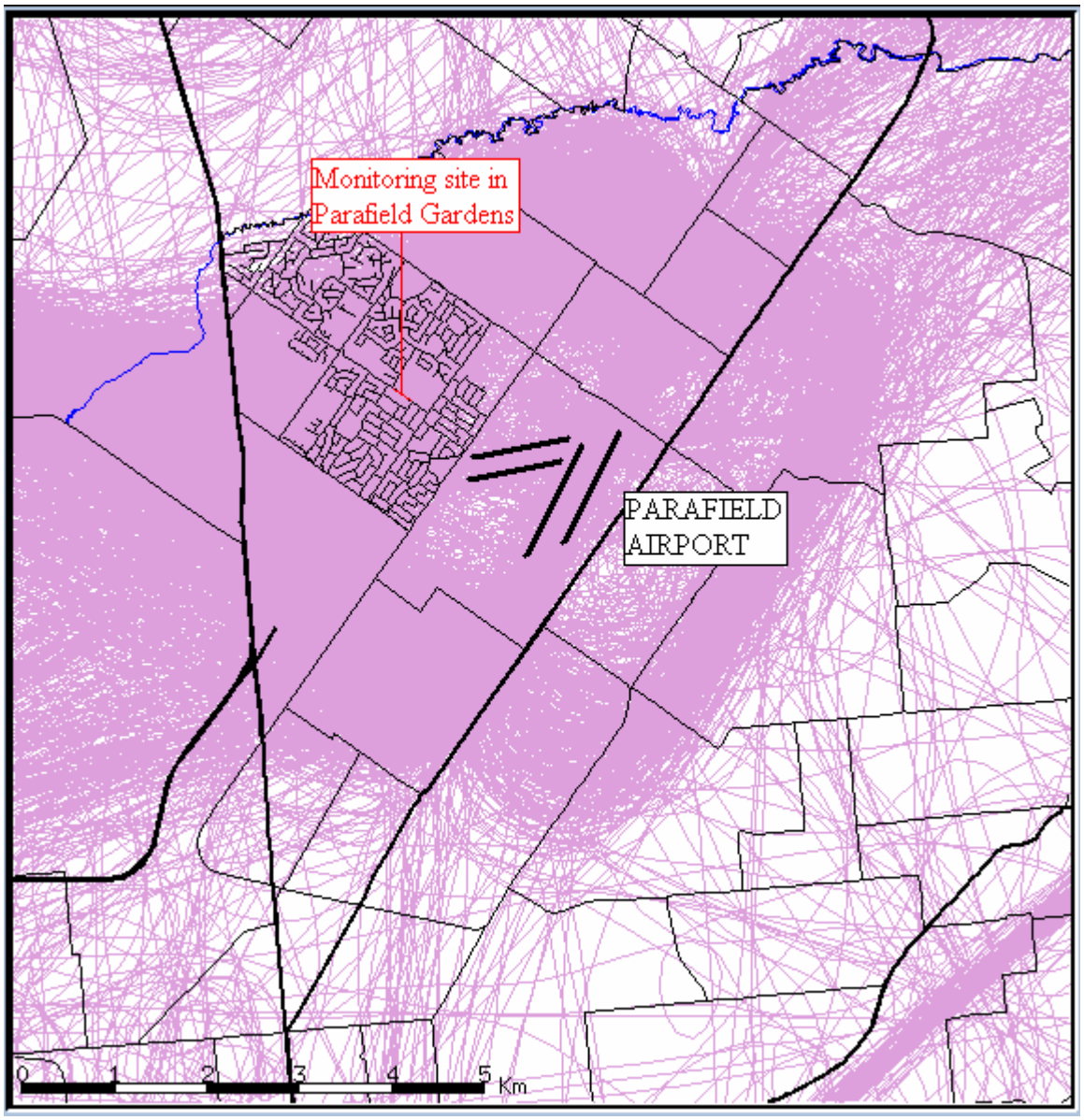
The collection of aircraft flight tracks for those aircraft that operated at Parafield Airport is from the NFPMS setup for the noise monitoring of aircraft operations at Adelaide Airport. As a result, the NFPMS is not able to determine whether an aircraft flight track is an approach or departure at Parafield Airport, resulting in the majority of the flight tracks used to prepare this report being labelled as overflights. Figure 2 shows the flight tracks flown by aircraft that operated to and from Parafield Airport and over the Parafield Gardens NMT site.

Parafield Airport is designated where aircraft are required to operate using General Aviation Aerodrome Procedures (GAAP). These procedures requires aircraft operating in the control zone (CTR) for that airport to have their transponder (aircraft radar identification broardcast instrument) set to standby when operationg within the CTR. The

requirement reduces on their radar displays at Adelaide ATC the clutter from aircraft who are undertaking circuit training at Parafield Airport.

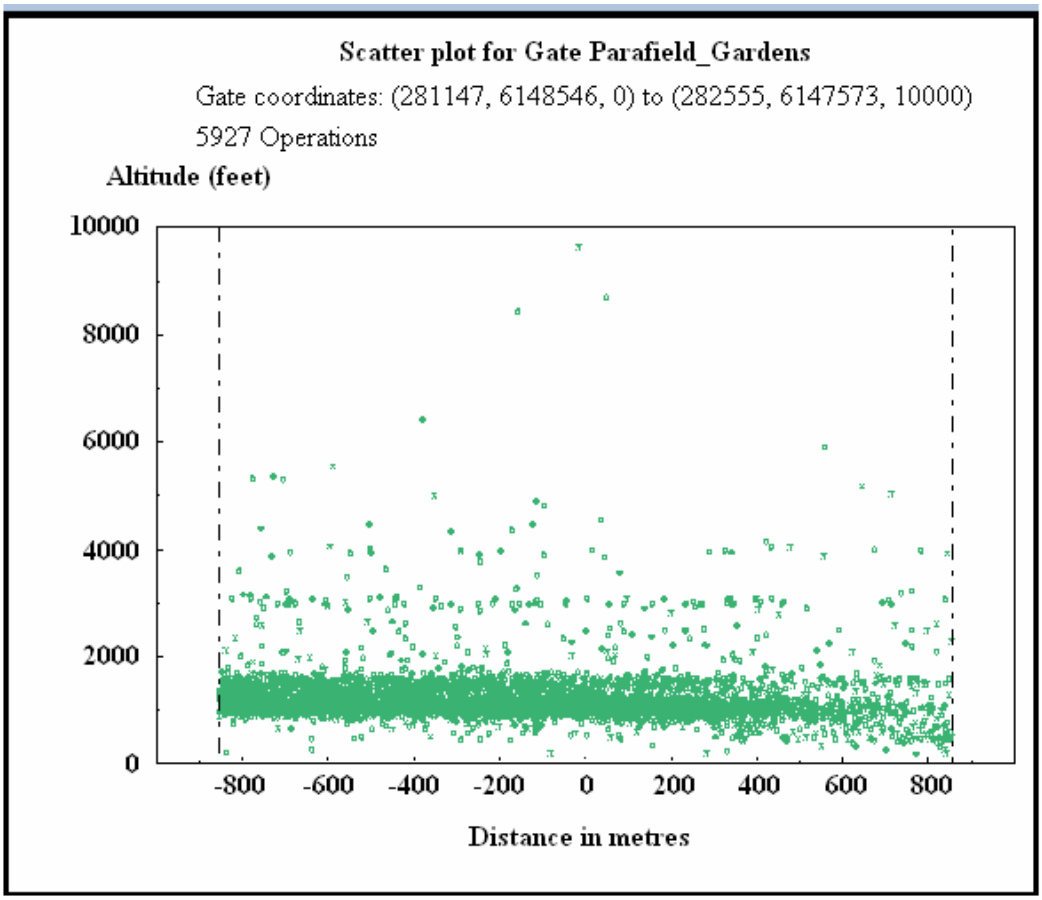
Due to these aircraft have their transponder set to standby, the Airservices Australia TAAATS air traffic control system does not record these aircraft flight paths. As a result, the NFPMS is not being able to obtain from TAAATS the flight plans and tracks of these aircraft. This has resulted in the NFPMS not being able to correlate noise events of aircraft who were conducting circuit training. A plot of aircraft operations associated with Parafield Airport and over Parafield Gardens (the monitoring site) for two weeks 19/10/06 to 1/11/06 in the monitoring period is shown in Figure 2.

Figure 2: Aircraft tracks for general aviation aircraft overflying the monitoring site in the period 19/10/06 to 1/11/06



A scatter plot illustrating the height and lateral distribution of these aircraft fly-over tracks in relation to the portable NMT location is shown in Figure 3. The horizontal distances along the X axis of this figure are relative to the portable NMT position which is located at "0". The dots in this plot below 1,000 feet on the right between 400 and 800 metres can be associated with aircraft arriving or departing Runway 08L/26R.

Figure 3: Scatter plot for general aviation aircraft overflying the monitoring site during the period 19/10/06 to 30/1/07



4. MEASURED DATA SUMMARIES

4.1. Maximum aircraft noise levels.

Tables 1 shows the number of noise events that were correlated with flight tracks for different aircraft types together with the mean, maximum and minimum noise levels recorded for each aircraft type and the standard deviation of the aircraft noise levels (L_{AS}max) that were recorded by the Parafield Gardens NMT over the monitoring period. The table is sorted in descending order of measured noise levels.

A total of 8563 correlated noise events (CNE) were recorded during the monitoring period in Parafield Gardens. While most aircraft movements within reasonable proximity to a NMT will result in correlated noise events, some movements may not correlate or others may be incorrectly associated with extraneous noise occurrences (which could be louder or quieter than the actual aircraft noise) at that location. A comparison of aircraft flight tracks shown in Figure 2 and the scatter plot shown in Figure 3 indicates some aircraft are a considerable distance from the NMT, therefore outside its correlation zone.

Table 1: Maximum aircraft noise levels for general aviation aircraft (CNE>5) in Parafield Gardens

Aircraft Description	CNE	L_{AS}max Mean dB(A)	L_{AS}max High dB(A)	L_{AS}max Low dB(A)	Standard Deviation dB(A)
Mooney M20	14	65.9	72.3	53.6	6.0
Beech 550	19	63.9	73.6	54.9	5.4
Beech 200&1300S	101	63.3	77.3	51.7	6.6
Cessna S/Skywagon	21	63.2	73.2	52.8	6.6
Piper Seneca III	28	62.6	76.6	52.4	5.4
Socata Tobago	263	62.4	80.7	51.0	6.0
Beech 760	463	62.1	81.1	51.4	5.8
Diamond Star DA-400	11	61.6	72.4	52.9	6.1
Cessna Citation II	23	61.0	70.4	51.3	4.7
Cessna Skyhawk	361	61.0	77.8	51.2	5.7
Cessna Centurion	28	61.0	74.3	51.8	6.7
Beech 360	15	60.4	68.1	51.5	5.2
Nanchang CJ6PT	22	60.1	76.2	50.9	7.3
Cessna Skylane	57	59.9	75.2	51.6	5.4
Piper PA28A	64	59.9	71.4	52.4	5.1
Cessna 205	6	59.6	65.2	54.5	3.7
Beech 650	6	59.5	72.0	52.2	6.5
Aero Commander 500	12	59.3	69.1	52.9	4.7
Cessna Chancellor	7	55.2	56.8	52.7	1.3
Total	**1521**				

When there is a large number of CNE for an aircraft type, the presence of mistaken identity of some noise events will have minimal effect on the data presented in this report. However, when the sample size for an aircraft type is small, the data for that aircraft types included in Table 1 may not be truly representative. International aircraft noise certification procedures of ICAO Annex 16 Volume 1 Standards specify a minimum of six overflights (under closely controlled conditions) to establish a mean level for noise

certification of aircraft. On this basis, Airservices requires that a minimum number of six specific operations of any one aircraft type be correlated for the data to be considered meaningful. A total of 1521 correlated noise events that were recorded during the monitoring period satisfied this criterion.

4.2. N60, N70 and N80 levels.

Environmental noise may be quantified by the number of times that a given level is exceeded in a day. For example, N60 is the number of times that a noise level of 60 dB(A) is exceeded in a day. 60 dB(A) is used as it is an external noise level which is used in Australian Standard AS2021-2000 as being equivalent to an internal design goal of 50 dB(A) (with windows open) for sleeping areas and dedicated lounge areas. It should be noted the daily average N70 is becoming widely used as an indicator of the extent of jet aircraft noise at a site.

Table 2 presents the daily average N60, N70 and N80 values based on all aircraft noise events recorded by each NMT over the measurement period. This included contributions from all aircraft types that operated over the NMT. It is worthwhile to note that only 10.7% of the CNEs recorded at Parafield Gardens during the monitoring period exceed 70 dB(A).

Table 2: N60, N70 and N80 levels

Portable NMT Location	Daily Average		
	N60	N70	N80
Parafield Gardens	70.6	12.3	0.4

4.3. Average noise levels.

Aircraft noise exposure in the vicinity of Australian airports can also be quantified in terms of the measured overall Leq (includes aircraft and non-aircraft noise) and calculated aircraft Leq value (containing only aircraft noise) are shown in Table 3. A comparison between the measured overall Leq and calculated aircraft Leq values shown in Table 3 indicates the measured overall Leq value is 5.5 dB(A) louder than the calculated aircraft value.

Table 3: Measured overall Leq and calculated aircraft Leq

Portable NMT Location	Measured overall Leq dB(A)	Calculated aircraft Leq dB(A)
Parafield Gardens	55.9	50.4

4.4. Background L90 noise levels.

Environmental noise varies over time, and may be reported in terms of a noise level that is exceeded for a certain percentage (N%) of total measurement time, L_N. For example, the L_{90} level is the noise level that was exceeded for 90% of the measurement period. The L90 value for a site in close proximity to an airfield is a reliable estimate for the non-aircraft noise level (background level); provided that the overall aircraft noise exposure time is less than 10% of the total time.

Table 4 shows the average background noise levels in Parafield Gardens, as represented by the arithmetically averaged hourly L_{90} levels over 24 hours, day (6:00 to 23:00) and night (23:00 to 6:00) during the monitoring period. The difference between aircraft and the background noise levels provides an indication of the relative "noticeability" of aircraft noise at the site.

Table 4: Background noise levels in Parafield Gardens

Averaging Period	L_{90} dB(A)
Daily (24 hour)	48.6
Day (6:00 to 23:00)	49.8
Night (23:00 to 6:00)	41.6

5. CONLUSIONS

1. Fly-overs of Mooney M20 general aviation aircraft generated the highest average noise level (L_{AS}max Mean of 65.9 dB(A)) recorded at the monitoring site in Parafield Gardens. During the monitoring period, the average noise level (L_{AS}max) of Mooney M20 general aviation aircraft overflying the monitoring site varied from 53.6 dB(A) to 72.3 dB(A) depending on the altitude and side line distance of the aircraft from the NMT.
2. A total of 8563 correlated noise events were recorded at the monitoring site during the monitoring period. However, due to the requirement that a minimum number of six correlated noise events for any one aircraft type before the data is considered to be meaningful, only 1521 correlated noise events are described in Table 1.
3. Figure 3 shows the scatter plot for general aviation aircraft overflying the monitoring site in Parafield Gardens during the period 19 October 2006 to 30 January 2007. As indicated from this plot, aircraft overflying the site were on average in the range of 1000 feet altitude above the site.
4. The extent to which aircraft noise will be noticeable at any particular location may be objectively assessed by considering the differences between the maximum aircraft noise levels (Table 1) and the average background noise levels (Table 4). When

aircraft noise levels at a site are more than 25 dB(A) above the average background noise levels are considered to be more significant and when an aircrafts maximum noise levels exceed the background noise level by 10 dB(A) or more, the aircraft noise would be expected to be particularly noticeable.

5. REFERENCES

1. Australian Standard AS 2021-2000, Acoustics - Aircraft Noise Intrusion - Building Siting and Construction.

GLOSSARY OF TERMS

A:	Arrivals
ANEI:	Australian Noise Exposure Index
ANEF:	Australian Noise Exposure Forecast
CNE:	Correlated noise event – a noise event which is concurrent with an aircraft movement in the correlation zone around the NMT
dB(A):	The A-weighted sound level in decibels. A-weighting is a frequency weighting characteristic incorporated within a sound level meter (such as an NMT) to approximate to the characteristics of the human ear. It is commonly used in the measurement of environmental noise including aircraft noise.
D:	Departures
L_{90}:	The A-weighted sound level exceeded for 90% of the sample period. L90 is generally regarded as the background noise level.
L_{AS}max:	During an aircraft overflight, the sound level rises steadily from the background level, reaches a maximum and then falls away again as the aircraft recedes. Aircraft noise may be assessed in terms of the instantaneous maximum sound level that is reached during the overflight. The metric L_{AS}max is the maximum A-weighted sound level obtained using time-weighting characteristic "S" during the overflight.
L_{AS}max High:	The highest value of all individual L_{AS}max levels recorded for each aircraft type and operation.
L_{AS}max Mean:	The mean value of all individual L_{AS}max levels recorded for each aircraft type and operation.
L_{AS}max Low:	The lowest value of all individual L_{AS}max levels recorded for each aircraft type and operation.
Leq:	Time average A-weighted sound pressure level
Movement:	An aircraft operation, such as a take-off or landing
N70:	Aircraft noise, which consists of discrete events separated by intervals of background noise, may be quantified by the number of times that a given noise level is exceeded in a day. The quantity N70 is the number of aircraft noise events equal to or greater than 70 dB(A). Daily N70 is calculated by dividing the total number of correlated noise events equal to or greater than 70 dB(A) detected during the monitoring period, by the number of days in the monitoring period in which the portable NMT is in operation.

N80:	The quantity N80 is the number of aircraft noise events equal to or greater than 80 dB(A). Daily N80 is calculated by dividing the total number of correlated noise events equal to or greater than 80 dB(A) detected during the monitoring period, by the number of days in the monitoring period in which the portable NMT is in operation.
N90:	The quantity N90 is the number of aircraft noise events equal to or greater than 90 dB(A). Daily N90 is calculated by dividing the total number of correlated noise events equal to or greater than 90 dB(A) detected during the monitoring period, by the number of days in the monitoring period in which the portable NMT is in operation.
NFPMS:	Noise and Flight Path Monitoring System
NMT:	Noise Monitoring Terminal
Noise Event:	A noise event is a particular noise occurrence recorded by the NMT when the occurrence meets preset detection criteria, including threshold levels, duration above threshold and rise and fall times. A noise event may be triggered by a variety of noise sources, not just aircraft.
Correlated Noise Event:	A noise event will be correlated with a particular aircraft movement if the corresponding radar flight track is within the NMT correlation zone at the time of the noise event.
Noise Event Setting:	Individual NMT settings, including the correlation zone, are chosen to maximise the chances of detecting and correlating all significant aircraft noise occurrences at the particular location, whilst minimising the recording and/or false correlation of extraneous noise events.
Operation:	A = Arrival D = Departure
OVERALL Leq:	The overall time average A-weighted sound pressure level of all sources over the monitoring period measured at the NMT site
Runway:	Runway on which the aircraft operates
Spatial Analysis Window:	A user defined software selection “window” in the NFPMS used for showing the position of an aircraft relative to a point on the ground. In this case, it comprised a vertical plane centred on the NMT and oriented approximately normal to the relevant flight path. The width of the plane corresponded approximately to that of the detection zone of the NMT. The plane extends from the ground level up to a height of 10000 feet. Any aircraft radar track passing through this plane has the height in feet above mean sea level and lateral (horizontal) position in metres recorded at the track’s intersection with the plane. The lateral position is relative to the centre of the window, ie. relative to the location of the NMT.