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**A REPORT OF MONITORING OF
AIRCRAFT NOISE FROM GATWICK AIRPORT
AT LINGFIELD, SURREY
BETWEEN JANUARY AND DECEMBER 2010**

Client: Gatwick Airport Limited



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Summary

A mobile Noise Monitoring Terminal (NMT) has been deployed at Lingfield in Surrey by Gatwick Airport since 1998. The site is approximately 13 km north east of the airport.

The aim of this report is to present the results of the noise monitoring exercise over the twelve month period from January to December 2010, to compare these data with the predictions of published aircraft noise contours, and to interpret the results in a way that places the contribution of the noise from aircraft using Gatwick in the context of the overall noise climate from all other sources.

Under prevailing wind conditions when aircraft are taking off to the west the site is overflown by arriving aircraft, and conversely by departing aircraft, when take off is in the easterly direction. A total of about 86334 aircraft noise events were recorded by the noise monitor in 2010, which corresponds, on average, to about 11 events per hour during the daytime and evening hours (07.00 to 23.00 hours). On average over the year 86 % of these events were due to arrivals, and 14 % were due to departures.

The variation in numbers of such events has been examined: month by month throughout the year, day to day throughout each month and hour by hour throughout the day. The highest numbers of events occurred during the summer months, July August and September, the busiest hours of the day were between 17.00 and 20.00 in the evening and between 08.00 and 09.00 in the morning. The day to day variation in numbers of events depends on the wind, which determines take off direction, with about 300 events per day on those days when aircraft were taking off to the west and about 100 to 150 events per day when take offs were to the east.

The maximum noise level produced by each aircraft over-flight has been recorded by the monitor. These values ranged between 60 dBA and over 80 dBA, but over 90% of values lie between 61 and 74 dBA, and the average of these values over the year is 69.2 dBA for arrival events and 67 dBA for departures, and 68.8 dBA overall. A statistical distribution of the values has been displayed in the report.

Each aircraft noise event may also be characterised by its duration (the time for which the aircraft noise exceeds the trigger level value of 60 dBA) and the average noise levels during this period. The average event duration is 26 seconds and the average noise level during events is 65 dBA.

The noise level from each aircraft noise event at the site may be combined to produce average aircraft noise levels for each month ($L_{Aeq,T}$ value) and over the entire year. The average aircraft noise level during the daytime was 55.5 dBA and 50.7 dBA at night-time.

The average level of aircraft noise at the site is generally about 2 dB higher than that of the residual noise, i.e. at this location, aircraft contribute 2 dB more to the total noise experienced than all other noise sources. The total noise level, which is the combination of aircraft noise and residual noise levels, is generally about 2 dB higher than that of the aircraft noise.

It is possible to convert the hourly aircraft noise L_{Aeq} values into the 24 hour L_{den} noise index (day evening night level) used by Defra for noise mapping purposes, giving, on the basis of the data collected at this site over the twelve months period, an L_{den} value of 56 dBA for aircraft noise and 60 dBA for total noise at the site.

The daytime (16 hour) and night-time (8 hour) average noise levels, and the day-evening-night level at the site have been compared with the 2008 (daytime), and 2006 (night-time and L_{den}) aircraft noise contours for Gatwick Airport. The comparison shows that the noise levels shown on the contours are in reasonable agreement with the noise levels obtained from the noise monitor at the site.

In order to place the noise climate at the site in a wider UK context it is compared with the results of the National Noise Index survey of noise levels in the UK in 2000, carried out by the Building Research Establishment for Defra. This gave a breakdown of the proportion of UK residents exposed to various noise levels, in four 5 dBA bands. As an example the $L_{Aeq,16h}$ value for this site places it in the 55 to 60 dBA noise exposure band, occupied by 18% of dwellings in the UK, with 67% of dwellings in lower, quieter bands and 15% in higher, noisier bands.

Levels of total noise exposure (L_{Aeq}) at this site are above the World Health Organisation Guidelines of 55 dBA in the daytime, and 45 dBA at night-time. If there were no aircraft noise the level of total noise at the site (i.e. the existing residual noise level) would fall below the daytime WHO guideline, but would remain above the night-time guideline value.

The information presented in this report will serve as a baseline for comparison with any future noise level surveys in this format that may be undertaken at this location.

A summary of the main noise related parameters (yearly average for 2010) for the site are shown in the Table below:

Survey period	1 January to 31 December 2010
Aircraft noise event trigger level	60 dBA for 10 seconds
Number of aircraft noise events	86334
% of events due to Arrivals and Departures	86% Arrivals; 14% Departures
Average maximum noise level of events	67.0 dBA Departures, 69.2 dBA Arrivals; 68.8 dBA overall
Average noise level and duration of aircraft noise events	Average level 64.8 dB Average duration 26 s
Average total noise level	58 dBA Day (16h); 51 dBA Night
Average aircraft noise level	58 dBA Day (16h); 50 dBA Night
Average residual noise level	50 dBA Day (16h); 46 dBA Night
Daytime level (12 hours)	Total noise 58 dBA, aircraft noise 56 dBA
Evening level (4 hours)	Total noise 57 dBA, aircraft noise 55 dBA
Day-evening night level	Total noise: 60 dBA, Aircraft noise: 59 dBA, Residual noise 56 dBA
Background noise (L_{AS90})	39 dBA Day (16h); 31 dBA Night
Aircraft types responsible for the majority of aircraft noise events:	Airbus A319: 29 % Boeing 737-400: 14% Airbus A320: 11 % (84 aircraft types in total)

1.0 Introduction

- 1.1 A mobile Noise Monitoring Terminal (NMT) has been deployed by Gatwick Airport at a site in Lingfield in Surrey since 1998.
- 1.2 The site is approximately 13 km north east of the airport, at Lingfield in Surrey. The noise monitor is located in the grounds of a residential care home at the boundary with the racecourse, and the microphone was located at a height of about 3 metres from the ground. A major road runs past the property about 300 m away. The dominant source of noise audible at the site is that from aircraft arriving at or departing from Gatwick. Both arriving and departing aircraft can be seen and heard from the site. The proximity of the site to overflights can be seen from typical aircraft tracks for both easterly and westerly take-offs shown in Appendix 1. Apart from aircraft noise the main source of noise at the site is from road traffic.
- 1.3 The aims of this report are:
 - to present the results of the twelve month noise monitoring survey, and
 - to compare the survey results with published aircraft noise contours
 - to interpret the results in a way that places the contribution of the noise from passing aircraft using Gatwick airport in the context of the overall noise climate from all other sources, and
 - To provide a baseline for comparison with any future noise surveys in this format that may be undertaken at this location.

2.0 Data from the Noise Monitoring Terminal

- 2.1 The Noise Monitoring Terminal (NMT) gathers data about the number and level of aircraft noise events, and also data about the total level of noise at the site, on an hourly basis. The hourly values of total noise are a combination of the noise from the aircraft noise events and from all other noise sources, called residual noise.
- 2.2 Further details about the way the NMT gathers and processes noise data is given in Appendix 2.

3.0 Analysis of Noise Monitoring Survey Results

3.1 The numbers of aircraft noise events

- 3.1.1 Aircraft noise events are bursts of noise which exceed a threshold condition (of 60 dBA for at least 10 seconds for this monitor) and which have been correlated with radar tracks of aircraft arriving at or departing from Gatwick. (Appendix 2 gives more details).
- 3.1.2 A total of 86,334 such events were recorded at the noise monitor at Lingfield in 2010, which corresponds, on average, to about 240 events per day.
- 3.1.3 The average daily number of events does, however, vary throughout the year. Figure 1 shows the month by month variation in average numbers of aircraft noise events per day throughout 2009. It can be seen that the highest numbers of events per day occurred in July, August and September with the lowest numbers in January, February and December.
- 3.1.4 Over the year the airport operated westerly departures for 64% of the time and easterlies for 36%, with the highest proportion of westerly operations occurring in July (97%), August (75%) and September (74%). On average over the year 84% of all aircraft noise events were due to arrivals, and 16% were due to departures. The month by month variation is shown in Figure 2. In July August and September more than 85% of the events recorded were arrivals. The greatest proportion of departure events (more than 25% of events) occurred in February, May, June and December.
- 3.1.5 The number of aircraft noise events varies, hour by hour, throughout each day. Figure 3 shows this variation. It can be seen that the number of events per hour is highest in the daytime and evening hours between 7.00 hours and 22.00 hours, with the highest numbers occurring between 17.00 and 20.00 hours.
- 3.1.6 The variation in the number of events recorded from day to day is mainly determined by wind direction and take off direction because almost all arrival events fly over or close by the monitor, whereas when take off is to the east only a proportions of departure events (approximately about 30%) pass close to the monitor as shown by the typical tracks shown in Appendix 3.

3.1.7 Figure 4 shows the number of events which occurred each day in May 2010, with, typically between 300 and 400 events on some days (corresponding to 'westerlies') and between 100 and 150 events per day on other days (easterly days). Similar variations occurred for other months. There were some very low numbers of events recorded in January and December because of airport closure during parts of some days, and also in April due to closure because of the 'ash cloud' from Iceland.

3.2 Maximum noise levels of aircraft noise events

3.2.1 Figure 5 shows the monthly average of maximum noise levels (L_{ASmax}) of aircraft noise events throughout 2010, for daytime and night-time arrival and departure events. It can be seen (i) that there is no significant variation from month to month. (ii) that for the same type of movement, whether arrival or departure, there is no significant difference between daytime and night-time values, and (iii) maximum noise levels of arrival events are on average between 2 and 3 dB higher than those from departures.

3.2.2 The maximum noise level produced by each aircraft over-flight ranged between 60 dBA and 86dBA, but over 90% of values lie between 61 and 74 dBA, and the average of these values over the year is 69.2 dBA for arrival events and 67 dBA for departures, and 68.8 dBA overall. Figure 6 shows a statistical analysis of the maximum noise levels of departure and arrival events, which shows the spread of the values, and a difference in the peak of the distributions of 3 dB between arrivals and departures.

3.3 The Total noise climate at the site

3.3.1 Figure 7 shows the month by month average daytime noise levels of aircraft noise, residual noise and total noise at the site throughout 2010. Also shown are the corresponding average values of maximum noise levels (as discussed earlier in paragraphs 3.2.1) of aircraft noise events, and of background noise (L_{AS90} values). Figure 8 shows similar data for night-time

3.3.2 These graphs show that the level of aircraft noise is generally about 2 dB higher than that of the residual noise, i.e. at this location, aircraft contribute 2dB more to the total noise experienced than all other noise sources. The total noise level, which is the combination of aircraft noise and residual noise levels, is generally about 2 dB higher than that of the aircraft noise.

3.3.3 Figure 9 shows the variation of average levels of aircraft noise, residual noise, background noise and total noise at the site with hour of day. It can be seen that the noise levels do not vary much during the daytime period (06.00 to 20.00 hours) but then fall during the late evening and early morning periods, rising again from 04.00 to 06.00 hours. The average levels over the 12 month period for various parts of the 24 hour day are shown below:

	Total noise $L_{Aeq,T}$	Aircraft noise $L_{Aeq,T}$	Residual noise $L_{Aeq,T}$	Background noise level (L_{AS90})
Day (16h) (07.00 - 23.00 h)	58 dBA	56 dBA	54 dBA	43 dBA
Night (8h) (23.00 - 07.00 h)	52 dBA	51 dBA	47 dBA	31 dBA
Day (12 h) (07.00 - 19.00 h)	58 dBA	56 dBA	54 dBA	44 dBA
Evening (4 h) (19.00 - 23.00 h)	57 dBA	55 dBA	51 dBA	38 dBA
24 hours	56 dBA	54 dBA	52 dBA	39 dBA

3.4 The contribution of aircraft noise events to the total noise climate at the site

3.4.1 It can be seen from the above Table that the average noise levels of Total noise and aircraft noise are very close (within 1 or 2 dBA) indicating that aircraft noise is the dominant influence on the noise climate at this site, with the remaining component of the noise at the site, the residual noise, being, on average about 2 decibels lower.

Day evening night level (L_{den})

3.4.2 It is possible to use the hourly aircraft L_{Aeq} values to calculate average (L_{Aeq}) values for the daytime (07.00 to 19.00), evening (19.00 to 23.00) and night-time (23.00 to 07.00) periods used in the determination of the 24 hour L_{den} (the day evening night level) noise index used by Defra for noise mapping purposes (see Appendix 4). The values of L_{den} calculated for the 12 month period using the values in the Table above are: Total Noise 60.4 dBA, Aircraft Noise 58.7 dBA, Residual Noise 55.5 dBA.

3.5 Comparison with Contours

3.5.1 The table below shows a comparison of aircraft noise levels from the noise monitor at the site compared with the published noise contours from Appendix 3.

	Value from Contour	Value from noise monitor
$L_{Aeq,16h}$ Day (2009)	below 57 dB	55.5
$L_{Aeq,8h}$ Night (2006)	Just on 50 dB contour	50.7
L_{den} (2006)	Just on 55 contour	58.7

It can be seen that the contour levels are in reasonable agreement with the noise levels obtained from the noise monitor at the site.

3.6 Putting the noise climate at the site into a wider UK context

3.6.1 The National Noise Incidence survey of noise levels in England and Wales in 2001 carried out by the Building Research Establishment for Defra gave a breakdown of the proportion of UK residents exposed to noise, as follows:

Proportion of the population of England and Wales living in dwellings exposed to daytime noise levels ($L_{Aeq, 16 \text{ hour}}$) in 5 dB bands, in the 2000 National Noise Incidence Study	
5 dB noise exposure level bands*	Proportion in band
Less than 50 dBA	30%
50 dBA < L < 55 dBA	37%
55 dBA < L < 60 dBA	18%
Greater than 60 dBA	15%

*The noise level exposure bands in the above Table are for 'free field' noise levels, i.e. noise levels unaffected by sound reflections from nearby surfaces. All the noise levels from the NMT at Lingfield are also free field values.

3.6.2 Since the 16 hour L_{Aeq} value for this site is 57.7 dBA (from the Table in paragraph 3.3.2) this puts the site in the 55 to 60 dBA noise exposure band, occupied by 18 % of dwellings in the UK. In the absence of aircraft noise the noise level at the site would be 53.7 dBA, i.e. the residual noise level (from the Table in paragraph 3.3.2) which would put the site in the lower, i.e. quieter, category (50 to 55 dBA).

3.6.3 The National Noise Incidence survey also gave a similar breakdown for the L_{den} index, as shown below

Proportion of UK population living in dwellings exposed to noise levels in 5 dB bands, according to the L_{den} noise index, in the National Noise Incidence Study 2002	
5 dB noise exposure level bands**	Proportion in band
Less than 55 dBA	33%
55 dBA < L < 60 dBA	38%
60 dBA < L < 65 dBA	16%
Greater than 65 dBA	13%

**The noise level exposure bands in the above Table are for noise levels measured at 1m from a building facade, and so will include a contribution (assumed to be 3 dBA) from sound reflected from the facade of the building. All the noise levels from the NMT are free field values and therefore 3 dB must be added for them to be comparable with the exposure bands in the above Table.

3.6.4 Since the L_{den} value for the total noise at this site is 60.4 dBA (paragraph 3.4.6) the addition of 3dB (i.e. a facade level of 63.4 dBA) puts the site in the 60 to 65 dBA' noise exposure band, occupied by 16 % of dwellings in the UK.

3.6.5 In the absence of aircraft noise the residual noise level at the site would be 55.5 dBA, (i.e. a facade level of 58.5 dBA) i.e. the residual noise level (from the Table in paragraph 3.3.2) which would put the site in the lower, i.e. quieter, category (55 to 60 dBA).

World Health Organisation and PPG 24 Guidance on Community Noise

3.6.6 In 2000 the World Health Organisation issued 'Guidelines for Community Noise', which are reflected in the UK Planning Policy Guidance Note 24 (Annex 2, paragraph 4): that "general daytime outdoor noise levels of less than 55 dBA are desirable to prevent significant community annoyance" and that "at night, sound pressure levels at the outside façades of living spaces should not exceed 45 dB (L_{Aeq}) so that people may sleep with bedroom windows open."

3.6.7 The National Noise Incidence Study 2000 has estimated that 55% of the population of England and Wales live in dwellings exposed to day-time noise levels above the WHO level of 55 dB $L_{Aeq, 16h}$, and that 68% are exposed to night-time levels above the WHO level of 45 $L_{Aeq, 8h}$.

3.6.8 The noise exposure levels at this site (see Table in paragraph 3.3.3) are above both the WHO Guidelines of 55 dBA in the daytime, and also the night-time Guideline value of 45 dBA.

4.0 Aircraft types contributing to the aircraft noise level at the site

4.1 Ninety six different aircraft types contributed to the total number of 86331 aircraft noise events which occurred during the 12 month period, but most of the events arose from a relatively small number of aircraft types, with only three types being responsible for more than 40% of all aircraft noise events at the site:

- Airbus A319: 29%
- Boeing 737 - 400: 14%
- Airbus A320: 11%

4.2 The Table below lists the 21 aircraft types responsible for 95 % of the aircraft noise events which occurred during the year, showing the number of events and average L_{ASmax} value for each aircraft type, and presented in order of frequency of events per aircraft type. The aircraft type is denoted by a three character identification code. A list of these codes is given in Appendix 5.

	Aircraft type ID Code	Number of events in 2010	Average L_{ASmax}	% number of events	Cumulative % of events
1	319	25089	68.9	29.1	29.1
2	734	12217	70.3	14.2	43.2
3	320	9405	69.2	10.9	54.1
4	73H	5712	68.4	6.6	60.7
5	752	5121	67.1	5.9	66.7
6	DH4	4850	64.8	5.6	72.3
7	E95	3710	68.1	4.3	76.6
8	321	3287	68.5	3.8	80.4
9	733	2112	69.9	2.4	82.8
10	772	1791	69.6	2.1	84.9
11	332	1557	72.3	1.8	86.7
12	744	1264	74.3	1.5	88.2
13	AT7	978	66.9	1.1	89.3
14	763	963	70.1	1.1	90.4
15	DH3	802	65.4	0.9	91.3
16	77W	720	71.1	0.8	92.2
17	AB6	703	71.8	0.8	93.0

Aircraft Noise levels at Lingfield, January to December 2010

18	73G	592	67.2	0.7	93.7
19	73W	589	67.9	0.7	94.4
20	738	520	68.2	0.6	95.0
21	75W	513	66.7	0.6	95.6

- 4.3 The Table below shows the aircraft types which produce the highest average L_{ASmax} noise levels, above 70 dBA. It can be seen that for most of these the number of aircraft noise events is very small

	Aircraft type ID Code	Average L_{ASmax} dBA	Number of events in 2010
1	D1C	77.5	3
2	74E	76.4	2
3	IL9	75.1	25
4	744	74.3	1264
5	345	74.2	1
6	310	73.3	1
7	CN1	72.7	12
8	333	72.6	472
9	M83	72.6	37
10	313	72.4	171
11	332	72.3	1557
12	M82	72.0	2
13	A26	71.9	3
14	AB6	71.8	703
15	MP2	71.8	6
16	342	71.7	5
17	74X	71.7	1
18	73J	71.3	1
19	773	71.2	106
20	77L	71.2	16
21	77W	71.1	720
22	BEC	70.9	1
23	76W	70.7	144
24	M87	70.6	4

25	73E	70.3	7
26	734	70.3	12217
27	764	70.3	126
28	343	70.1	62
29	763	70.1	963
30	E90	70.0	31
31	346	70.0	3

- 4.4 From these two tables it can be seen that the average maximum noise level (L_{ASmax}) of aircraft noise events did not vary significantly with aircraft type for the relatively few aircraft types which make up most of the aircraft noise events, and that although there are some aircraft types which produce significantly higher values of L_{ASmax} there are only very small numbers of these types of events.

5.0 Summary and Conclusions

- 5.1 A total of about 86334 aircraft noise events were recorded by the noise monitor in 2010, which corresponds, on average, to about 11 events per hour during the daytime and evening hours (07.00 to 23.00 hours). On average over the year 86 % of these events were due to arrivals, and 14 % were due to departures.
- 5.2 The highest numbers of events occurred during the summer months, July, August and September; the busiest hours of the day were between 17.00 and 20.00 in the evening and between 08.00 and 09.00 in the morning. The day to day variation in numbers of events depends on the wind, which determines take off direction, with about 300 events per day on those days when aircraft were taking off to the west and about 100 to 150 events per day when take offs were to the east.
- 5.3 The maximum noise level produced by each aircraft over-flight has been recorded by the monitor. These values ranged between 60 dBA and over 80 dBA, but over 90% of values lie between 61 and 74 dBA, and the average of these values over the year is 69.2 dBA for arrival events and 67 dBA for departures, and 68.8 dBA overall. A statistical distribution of the values has been displayed in the report.
- 5.4 Each aircraft noise event may also be characterised by its duration (the time for which the aircraft noise exceeds the trigger level value of 60 dBA) and the average noise

levels during this period. The average event duration is 26 seconds and the average noise level during events is 65 dBA.

- 5.5 The noise level from each aircraft noise event at the site may be combined to produce average aircraft noise levels for each month ($L_{Aeq,T}$ value) and over the entire year. The average aircraft noise level during the daytime was 55.5 dBA and 50.7 dBA at night-time.
- 5.6 The average level of aircraft noise at the site is generally about 2 dB higher than that of the residual noise, i.e. at this location, aircraft contribute 2dB more to the total noise experienced than all other noise sources. The total noise level, which is the combination of aircraft noise and residual noise levels, is generally about 2 dB higher than that of the aircraft noise.
- 5.7 It is possible to convert the hourly aircraft noise L_{Aeq} values into the 24 hour L_{den} noise index (day evening night level) used by Defra for noise mapping purposes, giving, on the basis of the data collected at this site over the twelve months period, an L_{den} value of 59 dBA for aircraft noise, 56 dBA for residual noise, and 60 dBA for total noise at the site.
- 5.8 The daytime (16 hour) and night-time (8 hour) average noise levels, and the day-evening-night level at the site have been compared with the 2009 (daytime), and 2006 (night-time and L_{den}) aircraft noise contours for Gatwick Airport. The comparison shows that the noise levels shown on the contours are in reasonable agreement with the noise levels obtained from the noise monitor at the site.
- 5.9 In order to place the noise climate at the site in a wider UK context it is compared with the results of the National Noise Index survey of noise levels in the UK in 2000, carried out by the Building Research Establishment for Defra. This gave a breakdown of the proportion of UK residents exposed to various noise levels, in four 5 dBA bands. As an example the $L_{Aeq,16h}$ value for this site places it in the 55 to 60 dBA noise exposure band, occupied by 18% of dwellings in the UK, with 67% of dwellings in lower, quieter bands and 15% in higher, noisier bands.
- 5.10 Levels of total noise exposure (L_{Aeq}) at this site are above the World Health Organisation Guidelines of 55 dBA in the daytime, and 45 dBA at night-time. If there

were no aircraft noise the level of total noise at the site (i.e. the existing residual noise level) would fall below the daytime WHO guideline, but would remain above the night-time guideline value.

- 5.11 A summary of the main noise related parameters (yearly average for 2010) for the site are shown in the Table below:

Survey period	1 January to 31 December 2010
Aircraft noise event trigger level	60 dBA for 10 seconds
Number of aircraft noise events	86334
% of events due to Arrivals and Departures	86% Arrivals; 14% Departures
Average maximum noise level of events	67.0 dBA Departures, 69.2 dBA Arrivals; 68.8 dBA overall
Average noise level and duration of aircraft noise events	Average level 64.8 dB Average duration 26 s
Average total noise level	58 dBA Day (16h); 51 dBA Night
Average aircraft noise level	58 dBA Day (16h); 50 dBA Night
Average residual noise level	50 dBA Day (16h); 46 dBA Night
Daytime level (12 hours)	Total noise 58 dBA, aircraft noise 56 dBA
Evening level (4 hours)	Total noise 57 dBA, aircraft noise 55 dBA
Day-evening night level	Total noise: 60 dBA, Aircraft noise: 59 dBA, Residual noise 56 dBA
Background noise (L_{AS90})	39 dBA Day (16h); 31 dBA Night
Aircraft types responsible for the majority of aircraft noise events:	Airbus A319: 29 % Boeing 737-400: 14% Airbus A320: 11 % (84 aircraft types in total)

- 5.12 The information presented in this report will serve as a baseline for comparison with any future noise level surveys in this format that may be undertaken at this location.

Figure 1 Monthly Variation in Average Numbers of Aircraft Noise events per day recorded at Lingfield in 2010

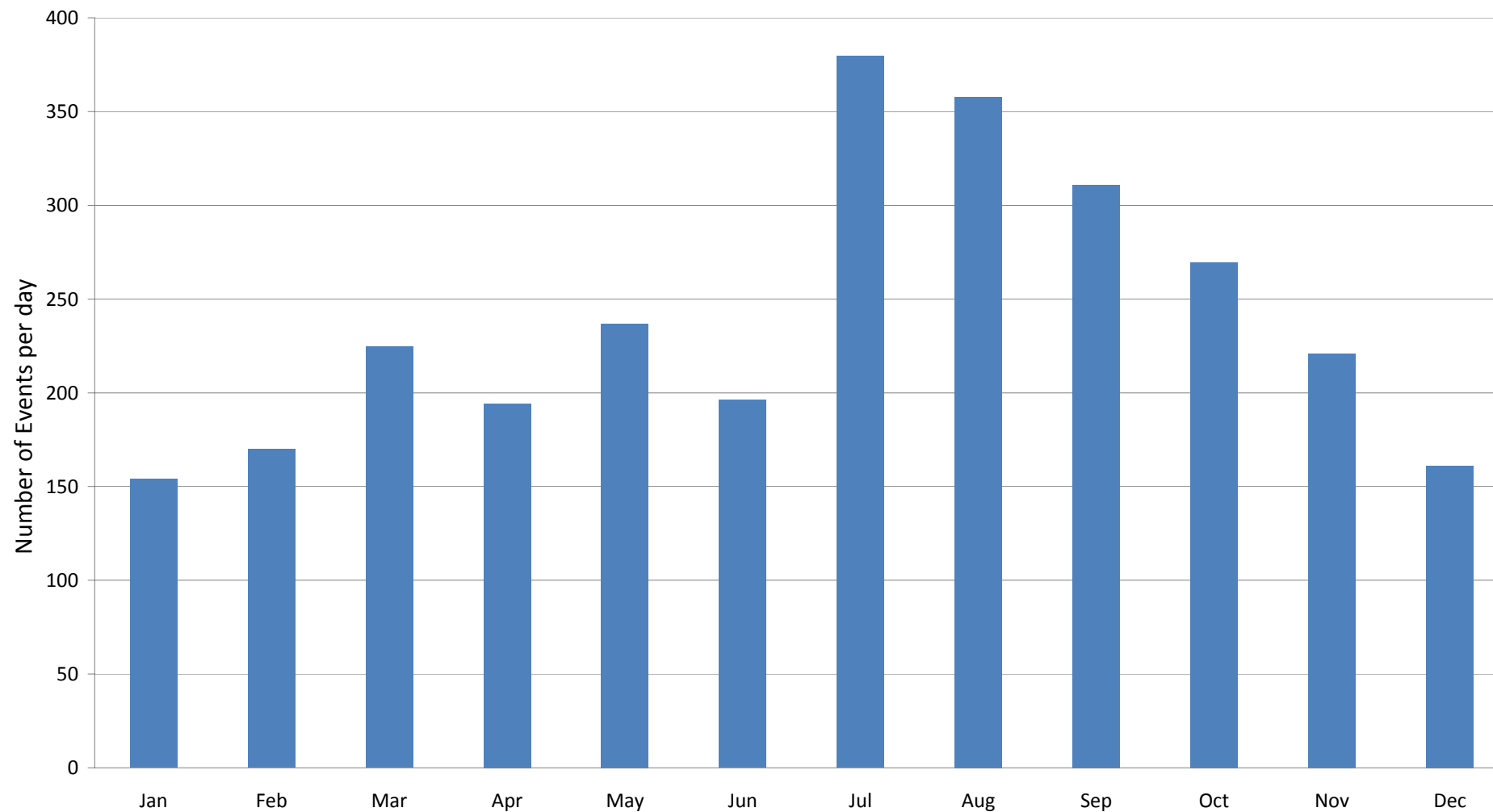


Figure 2 Monthly % of Aircraft Noise Events arising from Arrivals and Departures at Lingfield in 2010

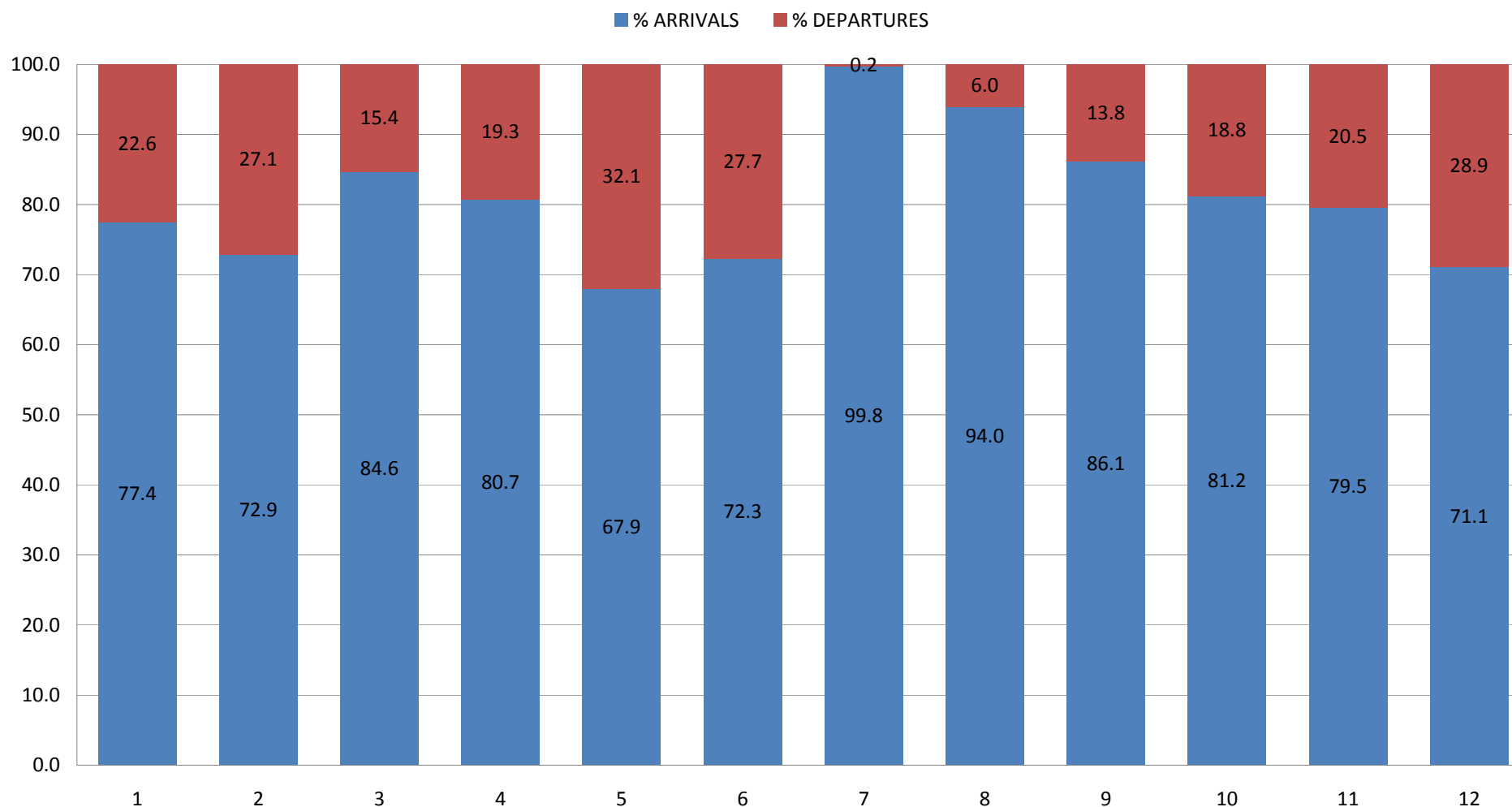


Figure 3 Average Number of aircraft noise events per hour at Lingfield by hour of day, in 2010

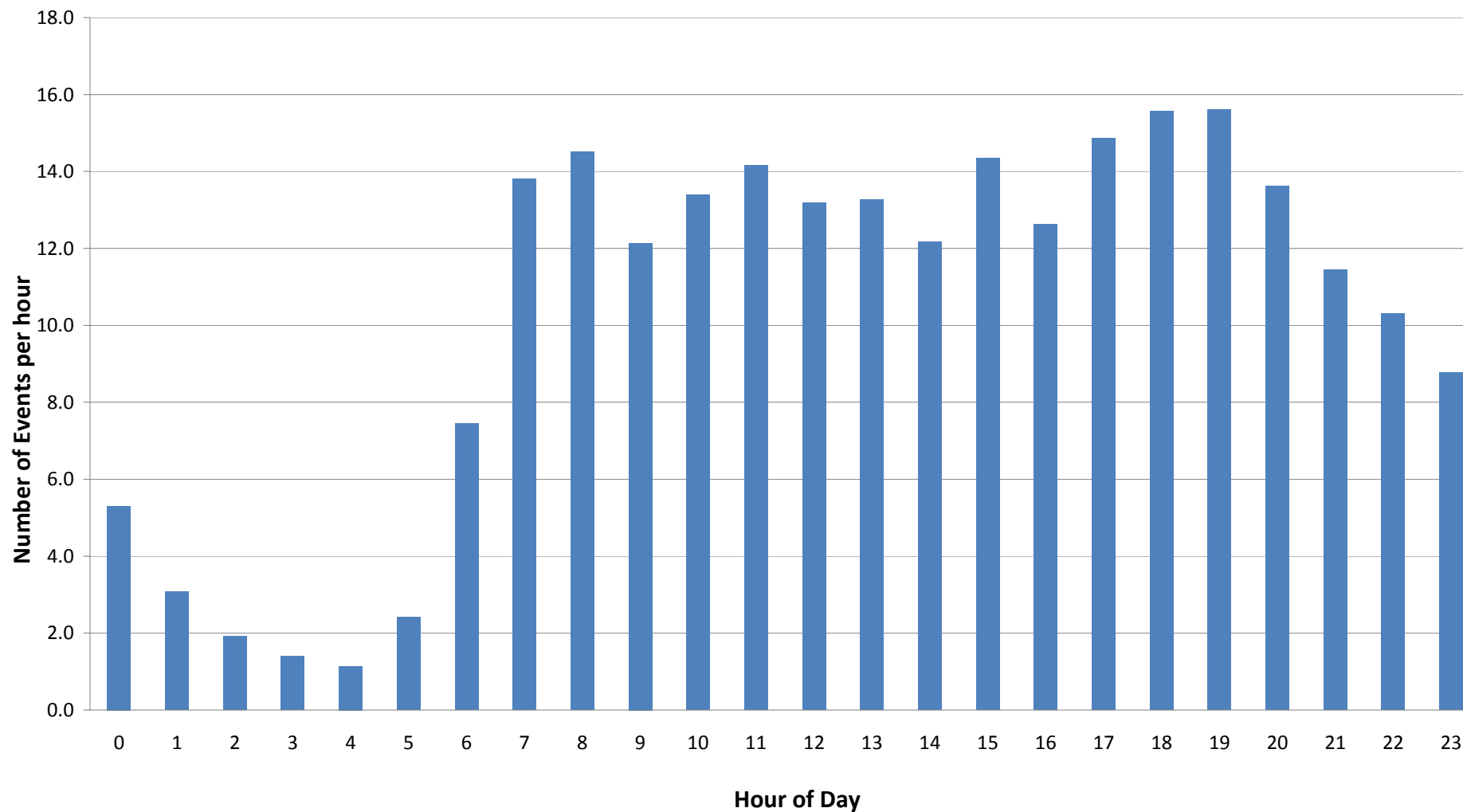


Figure 4: Number of Aircraft noise events each day at Lingfield during May 2010

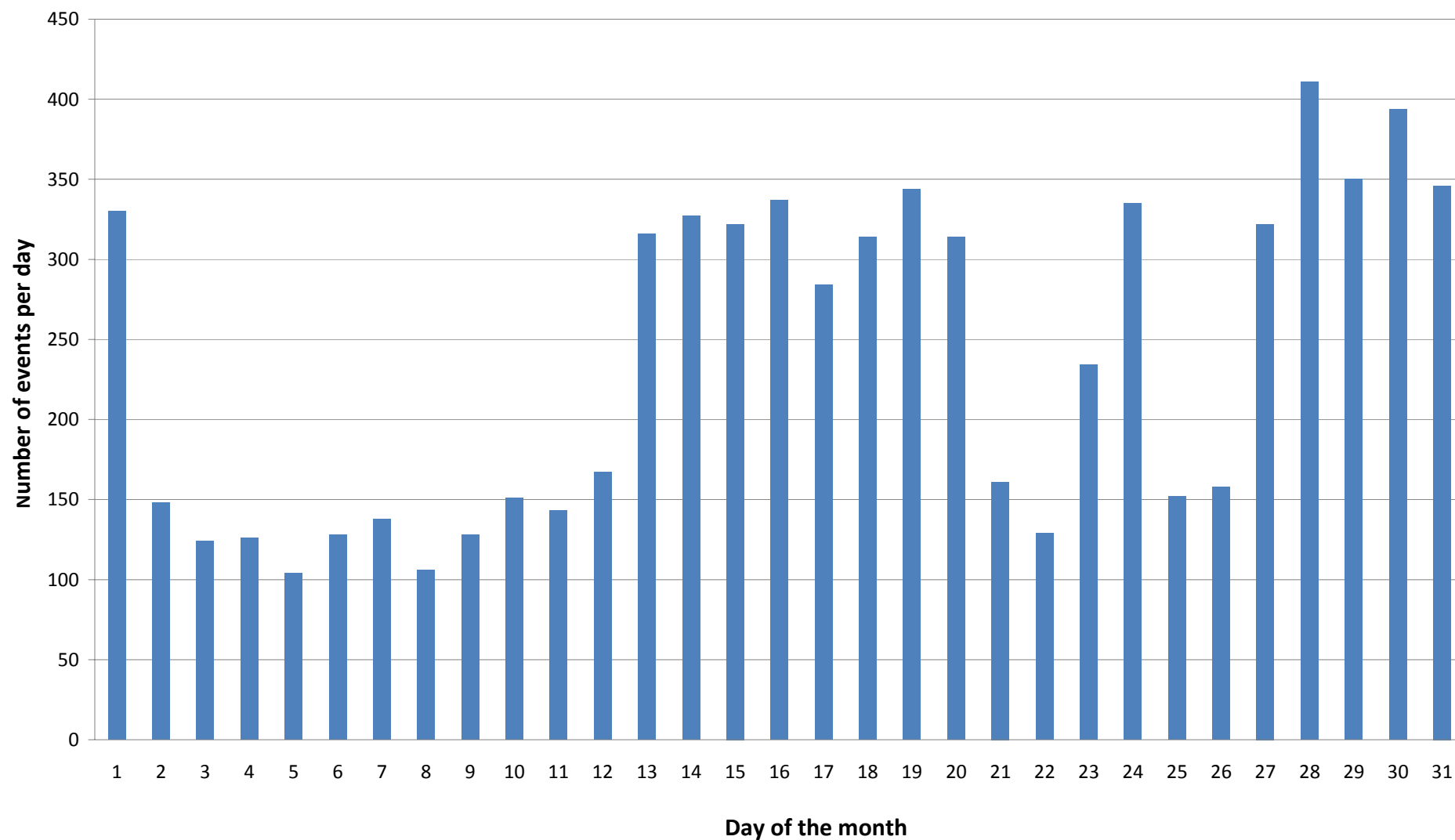


Figure 5 Monthly average maximum values of aircraft noise events at Lingfield in 2010

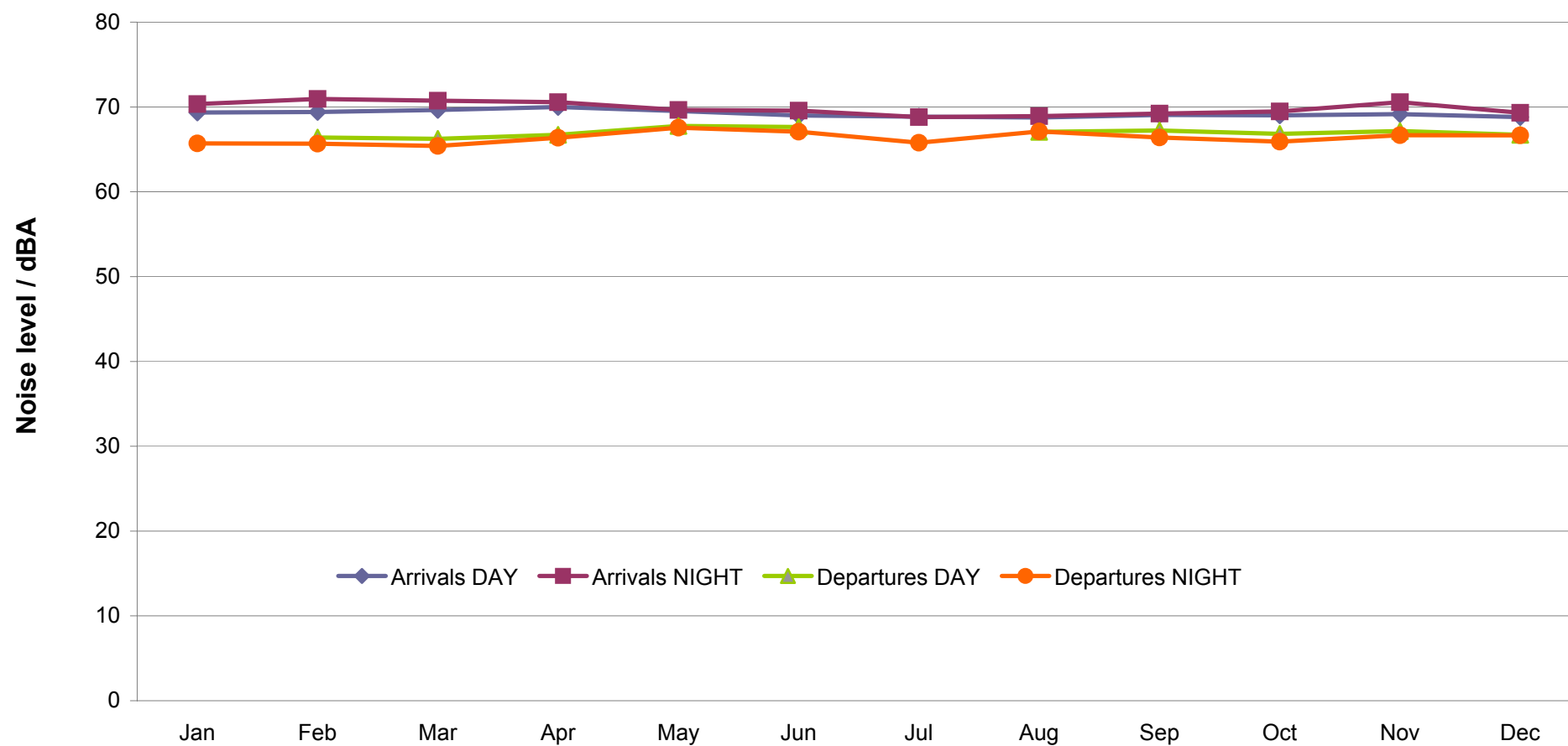


Figure 6 Statistical distribution of maximum values of aircraft noise values at Lingfield, January to December 2010

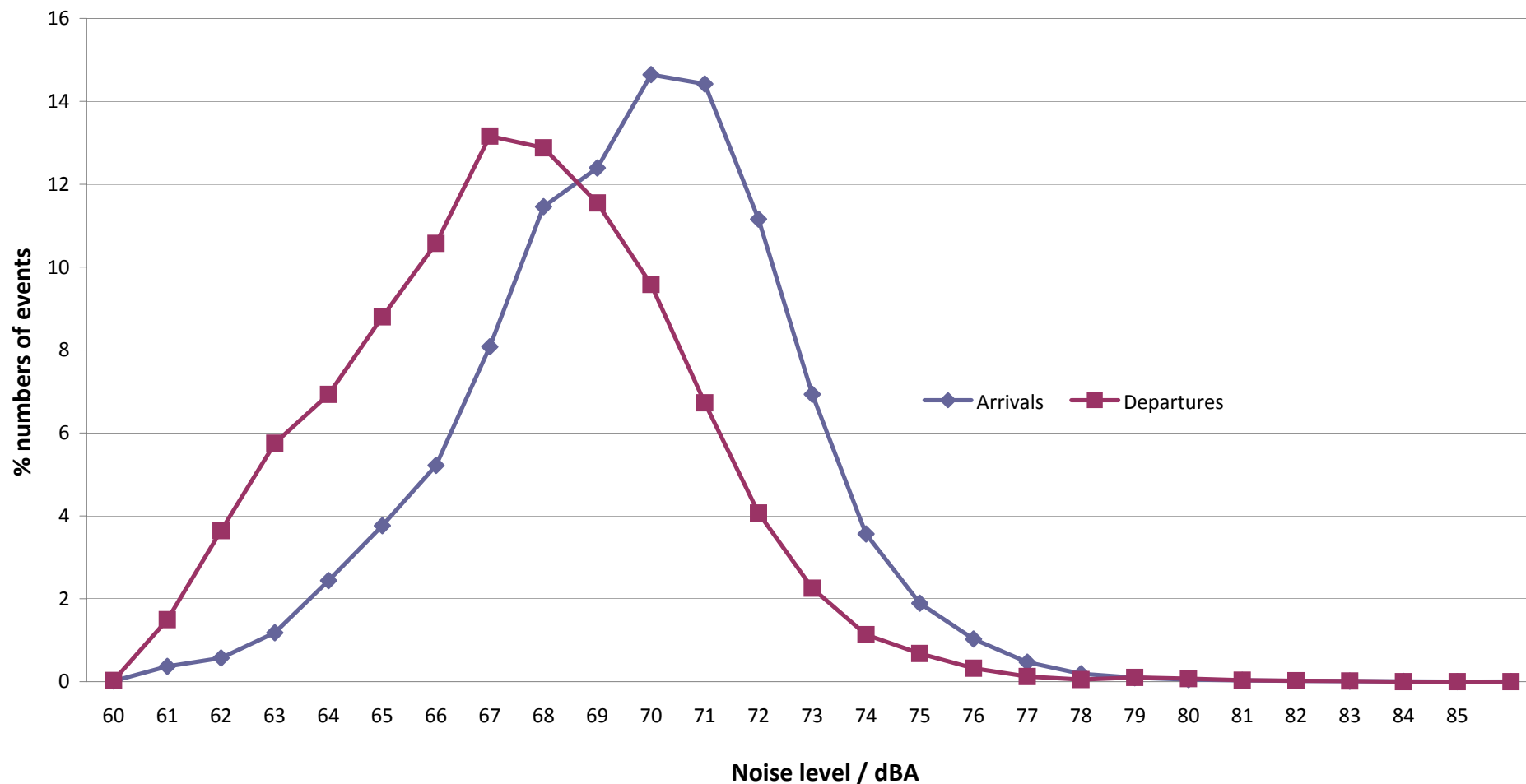


Figure 7 Lingfield: Daytime Noise climate trends - Monthly 16 hr L_{Aeq} values, and monthly average L_{ASmax} and L_{AS90} values (January to December 2010)

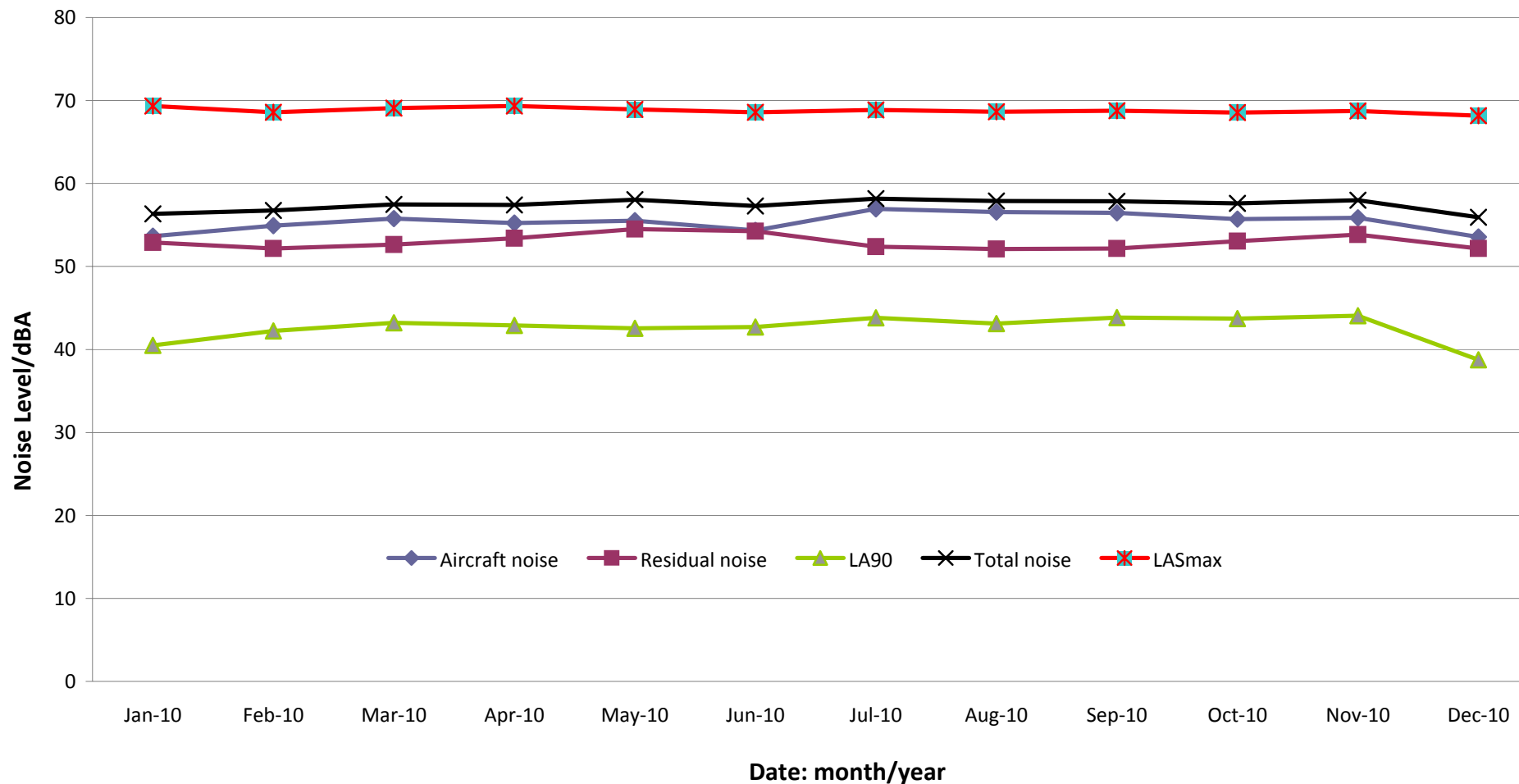


Figure 8: Lingfield: Night-time Noise climate trends - Monthly 8 hr L_{Aeq} values, and monthly average L_{ASmax} and L_{AS90} values (January to December 2010)

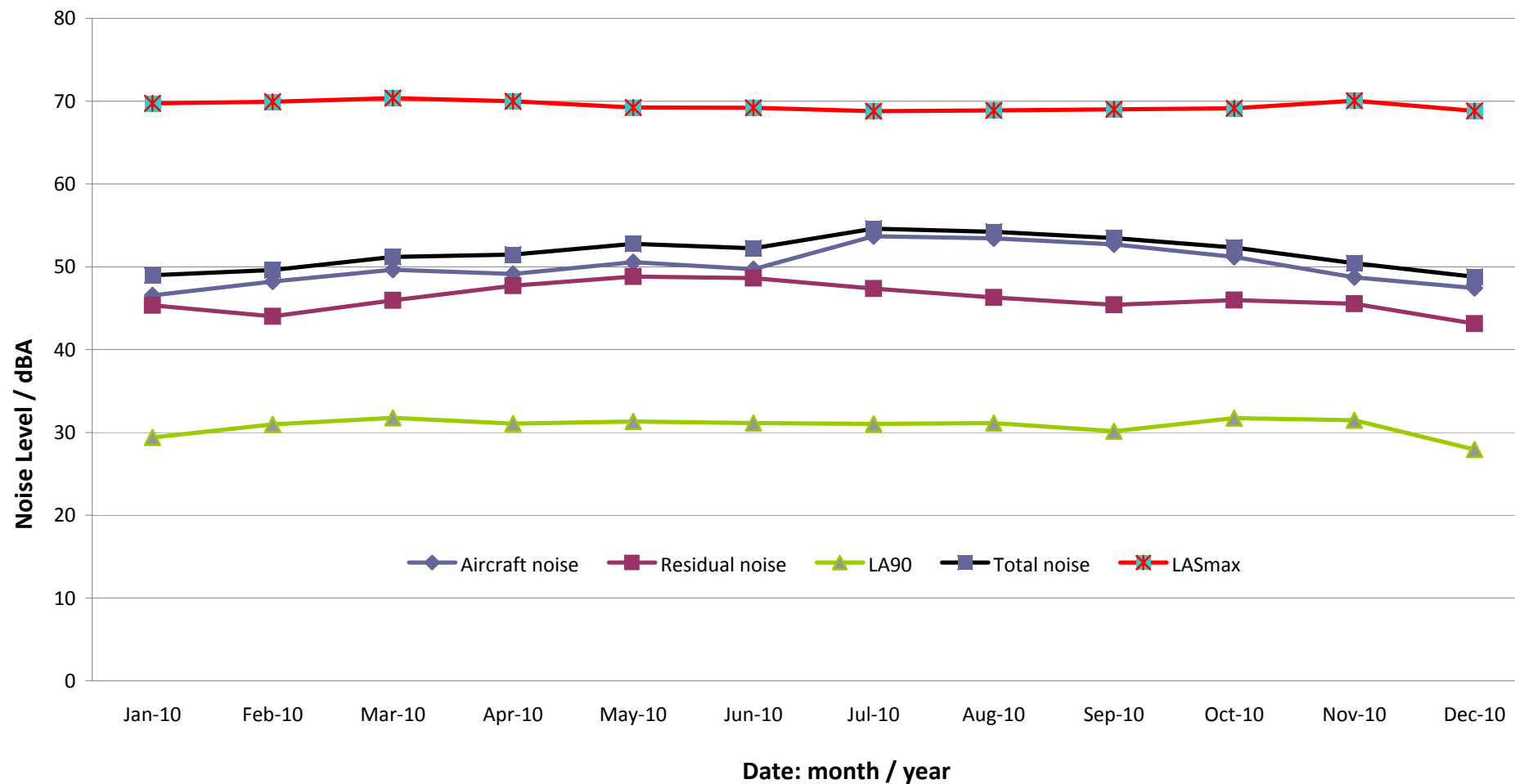
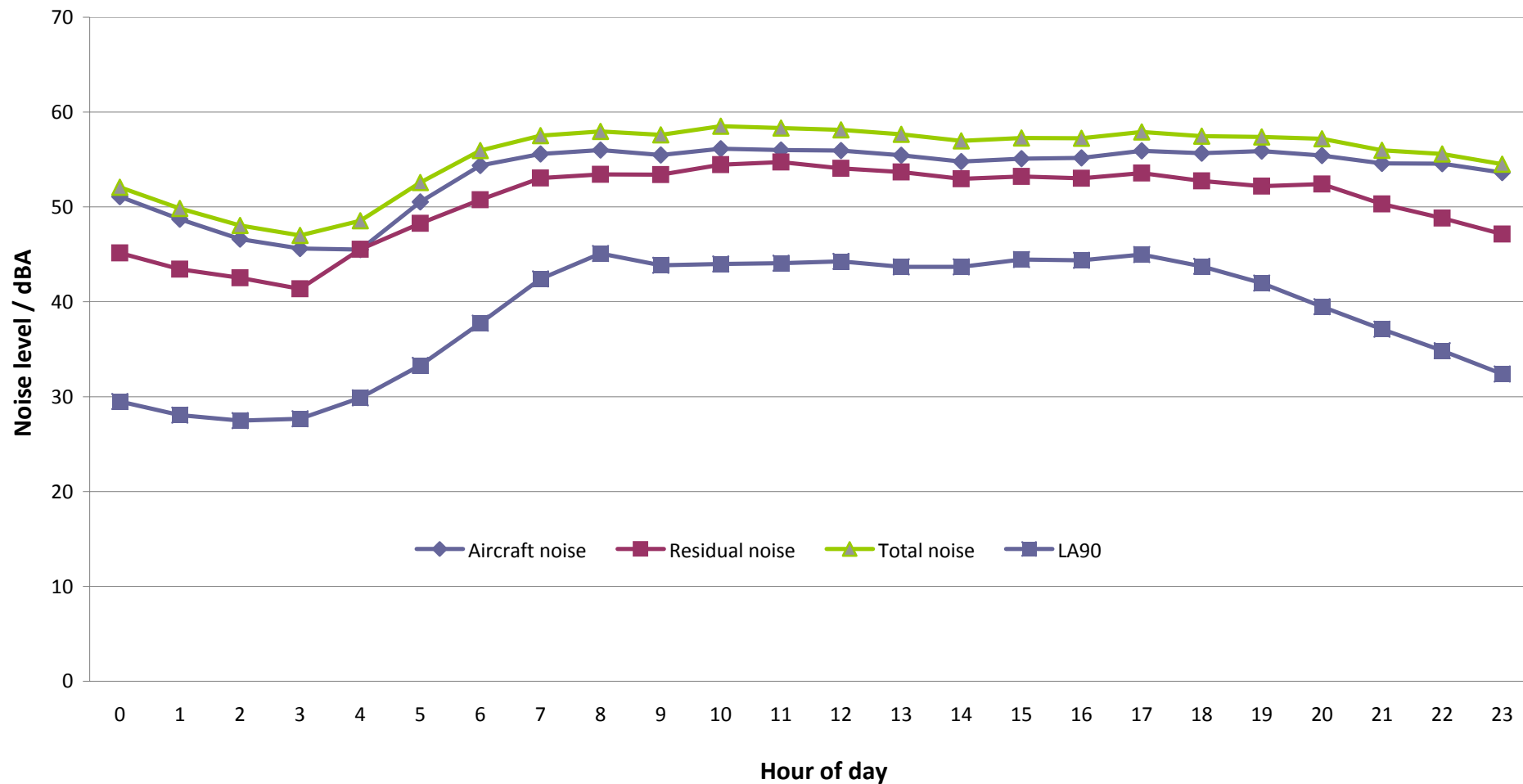


Figure 9 Illustrating contributions of Aircraft noise and Residual noise to the Total noise level at Lingfield, January to December 2010 (by hour of day)



APPENDIX 1

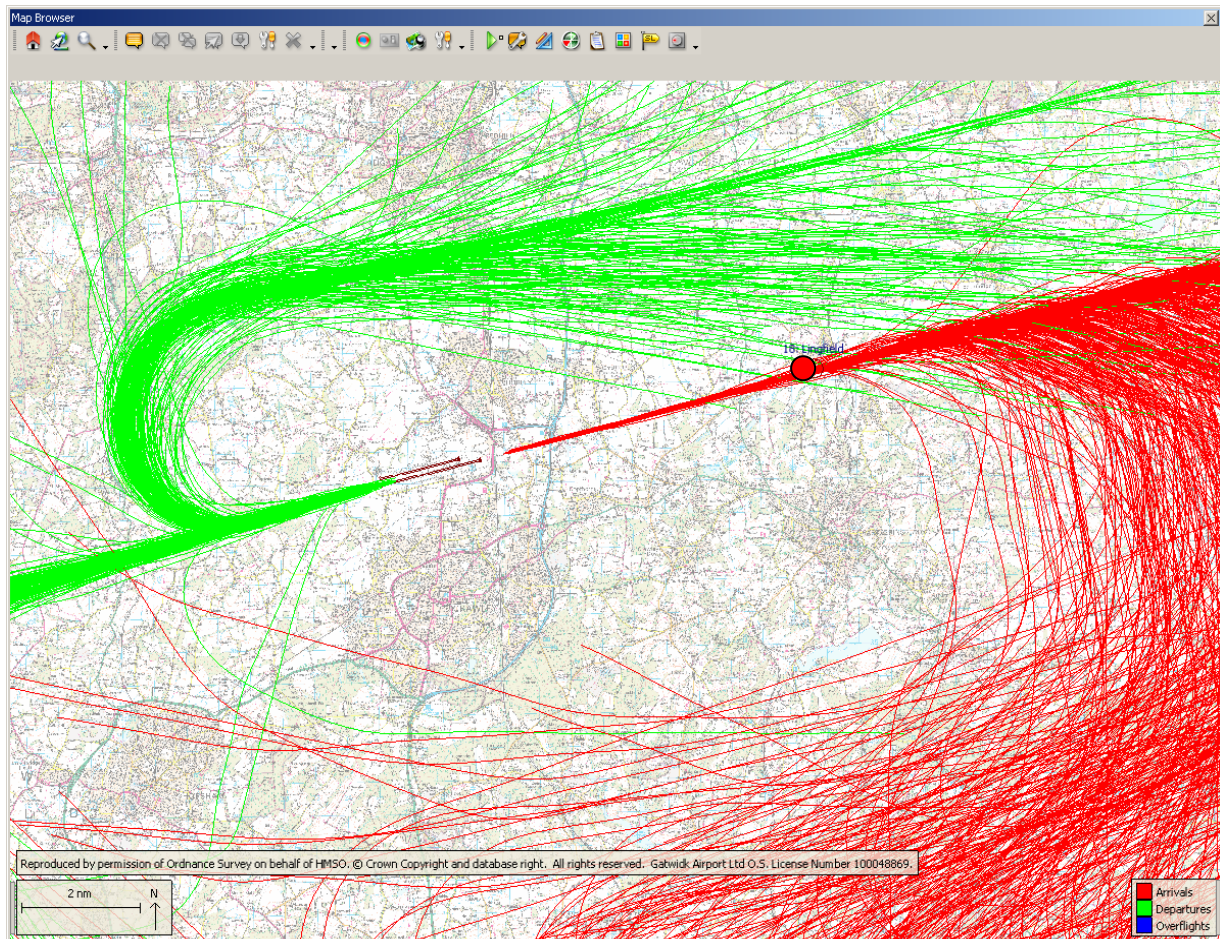
TYPICAL ARRIVAL AND DEPARTURE TRACKS



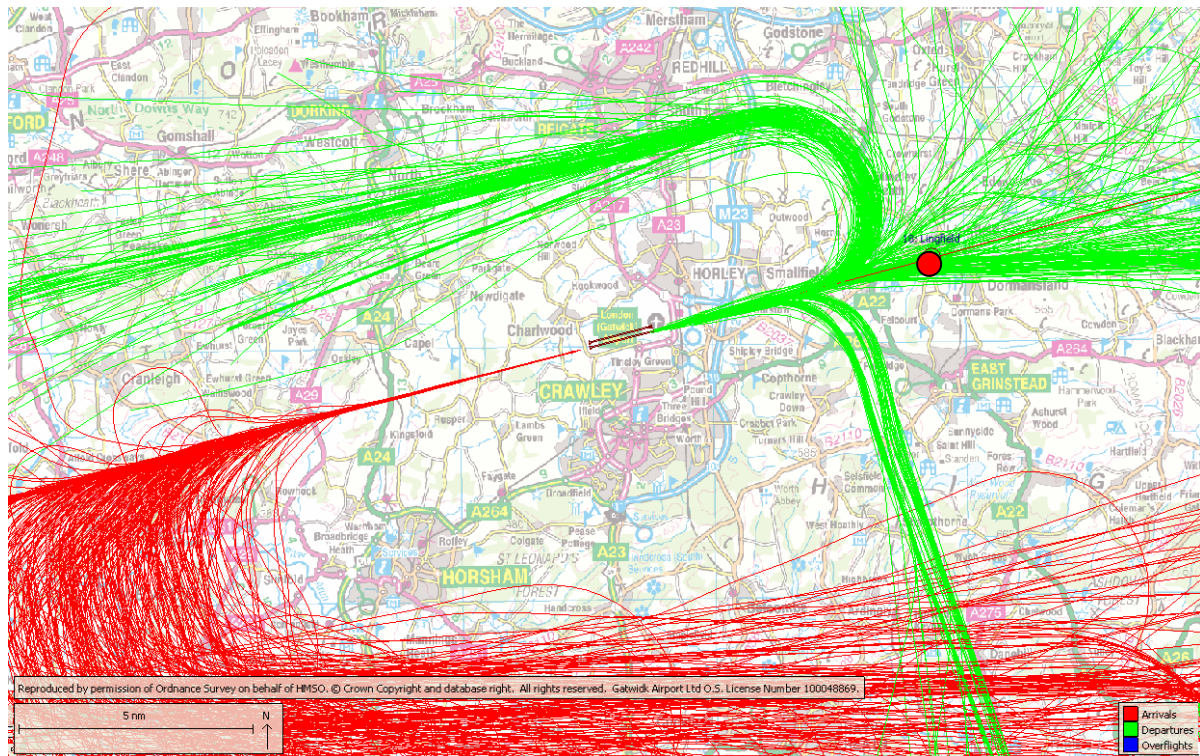
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Flight paths for a typical day of departures to the West (Arrivals are shown in Red and Departures in Green). The red dot shows the location of the noise monitor at Lingfield.



Flight paths for a typical day of departures to the East (Arrivals are shown in Red and Departures in Green). The red dot shows the location of the noise monitor at Lingfield



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APPENDIX 2

DATA FROM THE NOISE MONITORING TERMINAL



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Appendix 2

Data from the Noise Monitoring Terminal

The NMT always records all noise from all sources. It has, however, the facility to capture and show separately all noise events that meet particular pre-set conditions. This facility is used to capture noise events likely to arise from aircraft flying near to the monitor. The pre-set condition used for this study is that the noise must exceed a level of 55 dBA for a minimum duration of 10 seconds. This is arrived at following preliminary noise measurements at the site, and is broadly similar to conditions set for other such studies. It is of course likely that noise arising from activities other than aircraft using Gatwick Airport will occasionally cause noise events to be captured.

To determine which of all those events are due to aircraft using Gatwick Airport their ANOMS (Aircraft Noise Management System) 'noise to track' matching software compares all captured noise events with all Gatwick Airport's air traffic radar tracks. Noise events that are matched to aircraft are combined to provide a measure of 'aircraft noise' and noise events that are not matched to aircraft are included with 'all other noise' (i.e. that noise which is not captured as noise events, because it fails to meet the capture conditions of being above 55 dBA for 10 seconds), and is called residual noise.

Therefore wherever reference is made to aircraft noise events within this document it should be understood that these relate only to aircraft using Gatwick airport. Any noise arising from aircraft travelling to or from any other airport will be included as residual noise.

The selection of the threshold conditions (noise level and time period) which trigger the capture of a noise event is a compromise judgement designed to include as much of the noise from passing aircraft as possible whilst at the same time excluding, as far as possible, noise from other sources. For this survey a threshold trigger level 55 dBA for a duration of at least 10 seconds was used.

The following information is recorded for each noise event: date, time, duration, maximum noise level ($L_{A_{Smax}}$) and SEL values, and, in addition, for aircraft noise events, event type (arrival/ departure), departure route, runway used, and aircraft type.

In addition to gathering data about noise events the NMT also collects and stores information on an hourly basis about the total level of noise at the site from all sources (including that from aircraft movements), including individual noise events.

Because the noise level is usually not constant, but varies continuously throughout each hour it is necessary to describe the total noise level statistically in terms of a measure of the average noise level throughout the hour (and called the hourly continuous equivalent noise level, L_{Aeq}) and also in terms of a series of hourly percentile levels. The most important of these is the L_{AS90} , which is the noise level exceeded for 90% of each hour. This level of noise is conventionally taken to be a measure of the background noise level for each hour, and is the more or less constant level of noise which underlies the variations caused by various transient sources including aircraft.

APPENDIX 3

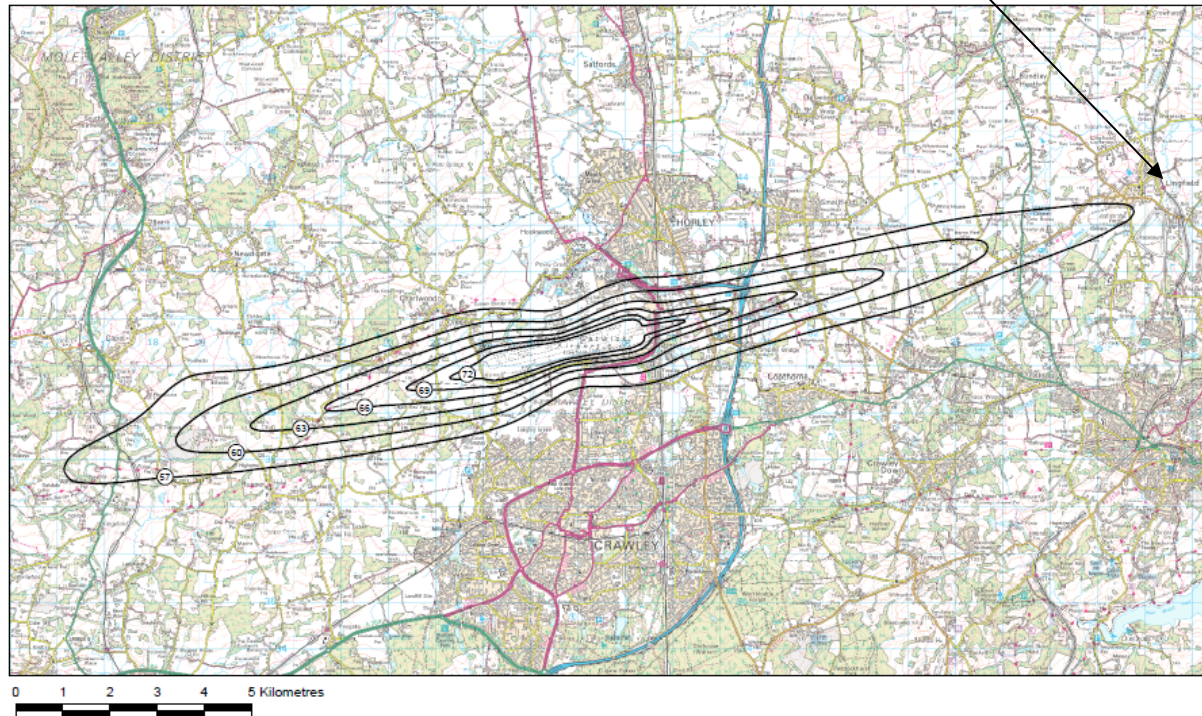
AIRCRAFT NOISE CONTOURS



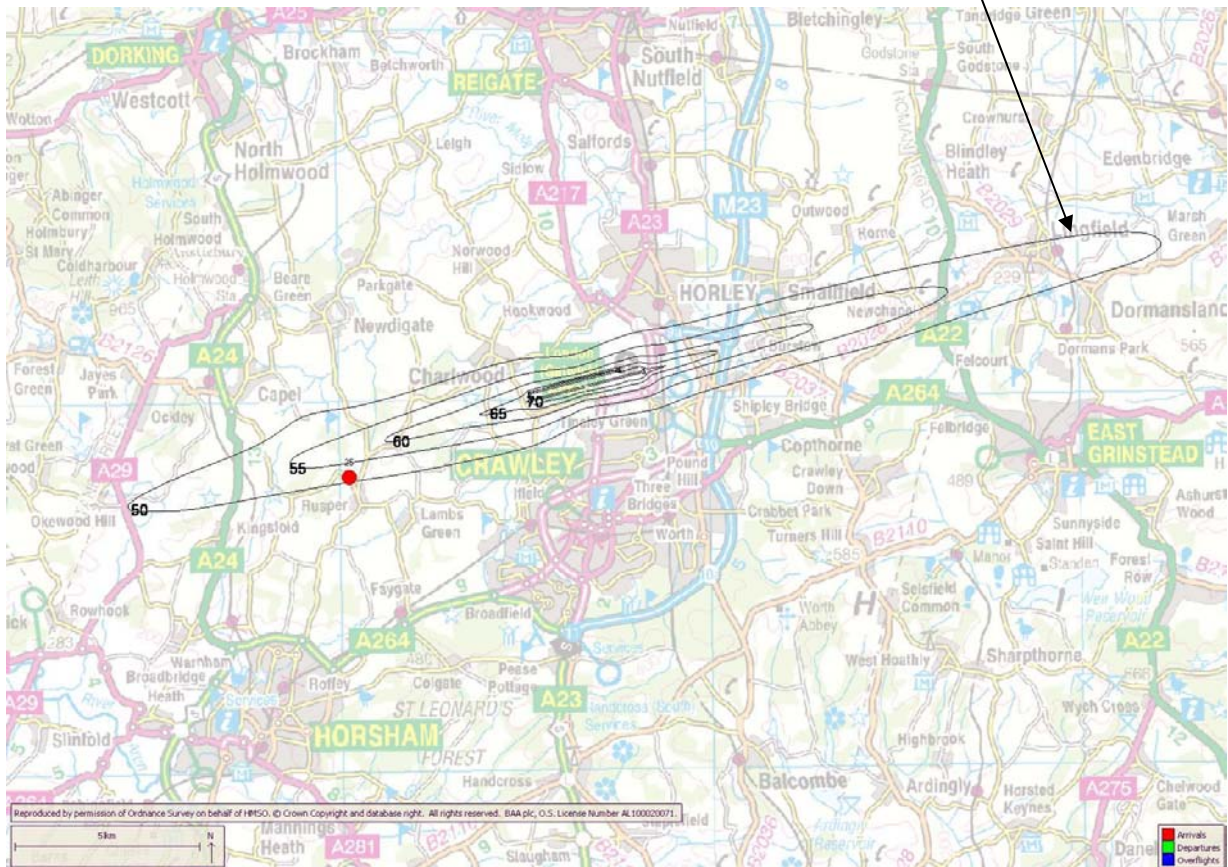
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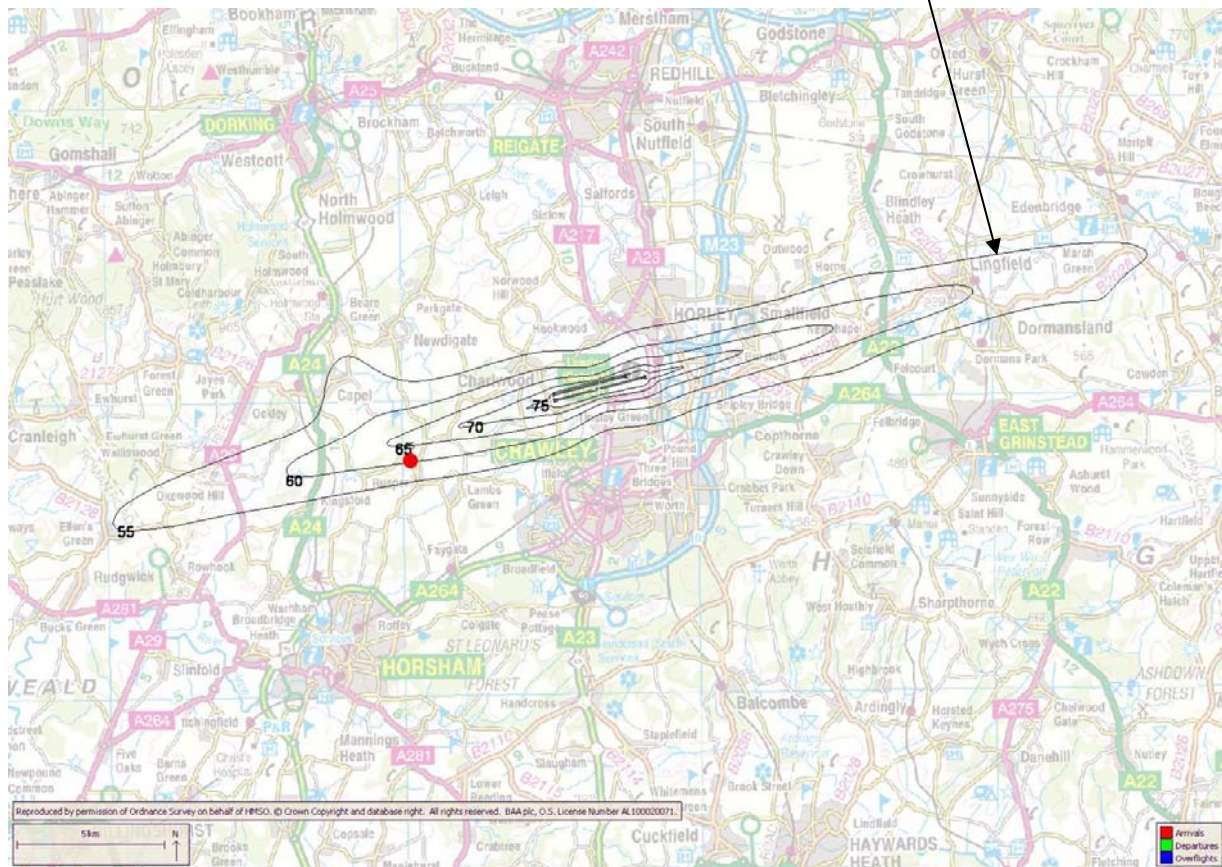
$L_{Aeq,16h}$ contours for 2009 (approximate location of noise monitor at Lingfield is shown)



L_{night} contours for 2006 (approximate location of noise monitor at Lingfield is shown)



L_{den} contours for 2006 (approximate location of noise monitor at Lingfield is shown)



APPENDIX 4

GLOSSARY OF ACOUSTIC TERMS



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GLOSSARY OF TERMS

This glossary is presented in two parts. The first part contains definitions relating specifically to the context of this report, followed, in the second part, by a more general glossary of acoustic terms.

Definitions relating specifically to the context of this Report:

Aircraft Noise events Noise events which have been matched by the GEMS noise and track keeping system to radar tracks in the vicinity of the NMT from aircraft arriving at or departing from Gatwick airport.

Aircraft noise level The average noise level derived from aircraft noise events, aggregated into hourly, daily or monthly average (LAeq) values.

ANOMS Airport Noise and Operations Monitoring System.

The software data analysis system currently in use at the airport (incorporating the NTK system).

Applied Acoustic Design (AAD)

Acoustic consultants retained by FEU

Average L_{ASmax} level The arithmetic average of the L_{ASmax} values of all the events (of a particular type i.e. either aircraft noise or community noise) which occur over a particular period of time (eg hour, day or month).

Building Research Establishment

A former government organisation, now privately owned, which conducts research on noise. Carried out the National Noise Incidence Study for Defra in 2000.

Defra UK government Department for Environment Food and Rural Affairs, which has responsibility for aspects of policy relating to environmental noise

Flight Evaluation Unit (FEU)

The unit within Gatwick Airport which monitors all aircraft movements to ensure compliance with Department for Transport noise regulations relating to track keeping, noise abatement and night flights, and which also provides a means of investigating and responding to complaints and enquiries from the public.

National Noise Incidence Study 2000

A study carried out by the Building Research Establishment for Defra based on a survey of noise levels outside 1020 dwellings in England and Wales in 2000, and extended to the whole of the UK in 2001, giving

proportions of the population exposed to various levels of environmental noise.

Noise event A burst of noise at a high level which satisfies the noise event capture conditions for a particular NMT, i.e. which exceeds the pre-set trigger noise level (in this report 55 dBA) for a pre-set time interval (in this report 10 seconds).

Noise events are detected, captured and stored by the NMT, and following subsequent processing by the NTK system are classified in this report as either aircraft noise events or community noise events

Noise Monitoring Terminal (NMT)

The noise measurement and analysis system installed at each site consisting of a precision grade sound level meter (Larson Davis type 870) inside a weather proof and tamper proof metal cabinet connected to an outdoor microphone located at a height of approximately 3.5 m above ground level.

NTK system Noise and Track Keeping system.

A software system able to match noise events recorded by the NMTs with aircraft tracks.

PPG24 Planning Policy Guidance Note 24: Planning and Noise, a document issued by the UK government Department for the Environment in 1994 which gives guidance to local authorities and others on noise and planning.

Residual noise All noise arriving at the NMT microphone apart from aircraft noise events, i.e. comprising residual noise events and all other noise which does not satisfy the trigger conditions for capture as a noise event.

Residual Noise events

Those noise events which have not been matched by the NTK system to aircraft tracks using Gatwick Airport in the vicinity of the NMT.

Statistical frequency Analysis (of L_{ASmax} noise levels)

An analysis of a group of L_{ASmax} values giving the numbers of events (or percentages of total numbers) at different dBA levels

Total noise All noise arriving at the NMT microphone, i.e. not only including all noise events (both aircraft and residual) but also all other noise which does not satisfy the trigger conditions for capture as a noise event.

Total noise level The average or continuous equivalent level (L_{Aeq}) of the total noise at the site, recorded each hour by the NMT, which may also be aggregated into daily or monthly values.

Total noise climate The level of the total noise at the NMT microphone varies with time. Over a particular period of time e.g. one hour, this variation may be described in terms of a number of different noise indices including the average or equivalent noise level, maximum and minimum noise level values and various percentile levels.

Such a description constitutes the noise climate at the site over that period of time.

The NMT records the following total noise indices every hour:

L_{Aeq} , L_{ASmax} , L_{AS10} , L_{AS50} , L_{AS90} and L_{AS99} .

World Health Organisation

Issued 'Guidelines for Community Noise' in 2000

A general Glossary of acoustic Terms:

A-weighting A method of producing a single figure measure of a broad band noise (as opposed to the 8 or 9 figures which make up an octave band spectrum) which takes into account, in an approximate way at least, the frequency response of the human hearing system. The idea is that sound levels measured in this way should give an indication of the loudness of the sound.

A-weighted sound pressure level (dBA).

The value of the sound pressure level, in decibels, measured using an A-weighting electronic circuit built into the sound level meter. The vast majority of noise measurements are carried out in this way.

Day, evening, night level, L_{den}

An index of environmental noise based on average noise levels (L_{Aeq}) throughout the 24 hour period, but with a weighting factor of 5 dBA added to evening noise levels (19.00 to 23.00 hours), and a weighting of 10 dB added to night-time noise levels (23.00 to 07.00 hours). It is the noise index used in the UK Noise mapping exercise commissioned by Defra in response to the European Union Directive on Environmental Noise in 2002.

Decibel scale The decibel scale is the scale on which sound pressure levels are commonly measured. It is a logarithmic scale and is used for convenience to compress the audible range of sound pressures into a manageable range, from 0 dB to 140 dB. The zero of the scale, 0 dB, corresponds to the notional threshold of hearing, 0.00002 Pa, and the upper limit, 140 dB, corresponds to 20 Pa, which would cause immediate damage to the ear.

Equivalent continuous sound level ($L_{Aeq,T}$), also called the Average noise level.

The $L_{Aeq,T}$ represents a measure of the 'average' sound level over the measurement period. It corresponds to the steady continuous level of sound which, over the same period of time, T , would contain the same amount of (A-weighted) sound energy as the time varying noise.

This is the most common method of measuring time varying noise, and within certain limits gives the best correlation with human response to noise, for example with annoyance.

Frequency

The frequency of a musical note is what gives it its pitch. It is the number of cycles of the fluctuating sound pressure which occur each second, and is measured in cycles per second, Hertz (Hz). The human ear can detect frequencies in the range 20 to 20000 Hz.

Most noises are a mixture of all frequencies, called broad-band noise.

$L_{AS90,T}$

This is the most commonly used of many possible statistical measures of a time varying noise. It is the 90th percentile of the statistical noise level distribution, or, more simply, the noise level that is exceeded for 90% of the measurement time (T). Thus over one hour for example it represents the noise level which is exceeded for all but (the quietest) six minutes of that hour.

It is commonly used as a measure of the background noise in any given situation, against which the level of any new, potentially intrusive source of noise is often compared. Background noise itself often varies with time and so the $L_{A90,T}$ is almost universally used as the best measure of the 'more or less always present' noise level which underlies short term variations from other sources of noise.

Although it is more usual to measure LA90 using the F weighting, the Slow weighting has been used for the data in this report, i.e. LAS90. It is not considered that the use of the S weighting will make any significant difference to the LA90 values in this case. (See under Time Weighting, Fast(F) and Slow(S)) below.

Maximum sound pressure level ($L_{ASmax,T}$)

This is the highest value of the time weighted sound pressure level, (measured using the A frequency weighting and the Slow time weighting) which occurred during the measurement period, T . It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the $L_{Aeq,T}$ value.

In the context of this report the L_{ASmax} value for each aircraft noise event and community noise event is monitored

In this report, in line with standard practice for aircraft noise measurement, the Slow (S) time weighting has been used for measurement of maximum levels of aircraft noise, hence reference is made to L_{ASmax} . (See under Time Weighting, Fast(F) and Slow(S)) below.

Noise Unwanted sound

Octave band spectra In order investigate the frequency content of broad band sounds, called its frequency spectrum, measurements of sound pressure are carried out over a range of frequency bands. The most common method is to split the audio frequency range into 8 or 9 octave bands. An octave is a frequency range from one particular frequency to double that frequency.

Octave band measurements are not referred to in this report.

Percentile noise level, (L_{ASN} , where N is a number between 0 and 100)

The noise level which is exceeded for N% of the measurement period. For example, a value of $L_{A10,1hour}$ of 57 dBA means that in that hour the noise level was at or above 57 dBA for 6 minutes (i.e. 10% of an hour), or alternatively, was at or below 57 dBA for 54 minutes.

Sound exposure level (SEL)

This is a measure of the A-weighted sound energy used to describe single noise events such as the passing of a train or aircraft; it is the A-weighted sound pressure level which, if occurring over a period of one second, would contain the same amount of A-weighted sound energy as the event.

SEL values for events may be used to calculate the average noise level over a period of time (hour, day or month)

Sound pressure sound is a disturbance or fluctuation in air pressure, and sound pressure, measured in Pascals (Pa), is used as a measure of the magnitude of the sound. The human ear can detect sound pressures in the range from 0.00002 Pa to 20 Pa. This is an enormously wide range and so for convenience sound pressures are commonly measured on a decibel (dB) scale.

Time varying noise When the level of noise varies with time, as is often the case, for example with noise from road traffic, various measures or noise indices as they are called are used to give a single figure description of the noise over a given period of time. The three most commonly used noise indices are the $L_{Aeq,T}$, the $L_{A90,T}$ and the $L_{Amax,T}$ values.

In all three cases the 'L' stands for the level of the sound in decibels, the 'A' for the fact that it is the A- weighted value, and the 'T' for the time period over which the noise is measured, for example 5min, 1 hour, 24 hour etc.

Time weighting (Fast (F) and Slow (S))

An exponential function of time, of a specified time constant, that weights the square of the instantaneous sound pressure. (Defined in BS EN 61672 – 1:2003).

There are two time constants defined in BS EN 61672 – 1:2003, designated Fast (F) and Slow (S), and noise indices such as the maximum, or percentile noise levels which are based on instantaneous time-weighted sound pressure should indicate which time weighting has been used in the measurement.

In this report, in line with standard practice for aircraft noise measurement, the Slow (S) time weighting has been used for measurement of maximum levels of aircraft noise, hence reference is made to L_{ASmax} . Because the sound level meter cannot measure using both Fast and Slow weightings simultaneously this necessarily means that the 90th percentile values have also been measured using the S weighting, hence reference is made to L_{AS90} . Although it is more usual to measure $LA90$ using the F weighting, it is not considered that the use of the S weighting will make any significant difference to the L_{A90} values in this case.

APPENDIX 5

LIST OF AIRCRAFT IDENTIFICATION SOURCE CODES



THE GREEN BUSINESS CENTRE
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STAINES
MIDDLESEX
TW18 3AL

TELEPHONE: 01784 464404
FACSIMILE: 01784 465447
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List of Aircraft Identification Codes

Code	Aircraft Type
100	Fokker 100
141	BAe 146-100
142	BAe 146-200
143	BAe 146-300
14Y	BAe 146-200 Freighter
14Z	BAe 146-300 Freighter
310	Airbus A310 all pax models
313	Airbus A310-300 pax
319	Airbus A319
31X	Airbus A310-200 Freighter
31Y	Airbus A310-300 Freighter
320	Airbus A320
321	Airbus A321
332	Airbus A330-200
333	Airbus A330-300
342	Airbus A340-200
343	Airbus A340-300
345	Airbus A340-500
346	Airbus A340-600
721	Boeing 727-100
722	Boeing 727-200
732	Boeing 737-200
733	Boeing 737-300
734	Boeing 737-400
735	Boeing 737-500
736	Boeing 737-600
738	Boeing 737-800
73E	Boeing 737-500
73G	Boeing 737-700
73H	Boeing 737-800 (winglets)
73J	Boeing 737-900
73W	Boeing 737-700 (winglets)
73Y	Boeing 737-300 Freighter
743	Boeing 747-300

Aircraft Noise levels at Lingfield, January to December 2010

744	Boeing 747-400
74E	Boeing 747-400 Combi
74L	Boeing 747SP
74U	Boeing 747-300 Freighter
74X	Boeing 747-200 Freighter
74Y	Boeing 747-400 Freighter
752	Boeing 757-200
75F	Boeing 757-200 Freighter
75W	Boeing 757-200 winglets
762	Boeing 767-200
763	Boeing 767-300
764	Boeing 767-400 pax
76W	Boeing 767-300 winglets
76Y	Boeing 767-300 Freighter
772	Boeing 777-200
773	Boeing 777-300 pax
77L	Boeing 777-200 LR
77W	Boeing 777-300 ER
A26	Antonov AN-26
A4F	Antonov AN-124 Freighter
ABX	Airbus A300 Freighter
A B6	Airbus A300-600 pax
ANF	Antonov AN-12 Freighter
AN7	Antonov AN-72
AR1	Avro RJ-100
AR7	Avro RJ-70
AT4	ATR-42
AT7	ATR-72
ATP	BAe ATP
BE2	Beech B200
BEC	Beechcraft light aircraft
CCX	Bombardier Global Express
CN1	Cessna light aircraft - single piston engine
CNJ	Cessna Citation
CR2	Bombardier CRJ-200
CS5	Casa CN-235
D38	Dornier 328

D8X	Boeing (McDonnell Douglas) DC8-61/62/63 Freighter
D8Y	Boeing (McDonnell Douglas) DC8-71/72/73 Freighter
D93	Boeing (McDonnell Douglas) DC9-30
DF2	Dassault Falcon 10/20/2000
DF3	Dassault Falcon 50/900
DH2	Bombardier Dash 8-200
DH3	Bombardier Dash 8-300
DH4	De Havilland DHC-8-400 Dash 8Q
D1C	Douglas DC-10-30/40 pax
ER4	Embraer RJ-145
E90	Embraer 190
E95	Embraer 195
F50	Fokker 50
F70	Fokker 70
FRJ	Dornier 328 Jet
GRJ	Gulfstream II/III/IV/V
H25	Hawker HS-125
HS7	BAe HS748
IL9	Ilyushin IL96 pax
IAI	Gulfstream G200
J41	BAe Jetstream 41
L15	Lockheed TriStar 500
LOF	Lockheed Electra Freighter
LOH	Lockheed Hercules
LRJ	Bombardier Learjet 23/24/25/31/35/40/45/55/60
M11	Boeing (McDonnell Douglas) MD11
M1F	Boeing (McDonnell Douglas) MD11 Freighter
M82	Boeing (McDonnell Douglas) MD82
M83	Boeing (McDonnell Douglas) MD83
M87	Boeing (McDonnell Douglas) MD87
M90	Boeing (McDonnell Douglas) MD90
MP2	Miscellaneous twin prop (Piaggio P180Avanti)
SH6	Shorts 360
SWM	Fairchild (Swearingen) Metro
TU5	Tupolev TU-154