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**A REPORT OF MONITORING OF
AIRCRAFT NOISE FROM STANSTED AIRPORT
AT THORLEY, HERTFORDSHIRE
BETWEEN JULY AND OCTOBER 2010
AND COMPARISON WITH A SIMILAR
STUDY IN 2005**

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Executive Summary

A mobile Noise Monitoring Terminal (NMT) was deployed by Stansted Airport between 6th July and 30th October 2010 at Thorley in Hertfordshire, on the southern outskirts of Bishop's Stortford, approximately 8 km South West of Stansted Airport. On days when aircraft are taking off from Stansted to the west, the site lies nearby the flight paths of departing aircraft.

The aim of this report is to present the results of this three month noise monitoring exercise, to interpret the results in a way that places the contribution of the noise from aircraft using Stansted in the context of the overall noise climate from all other sources, and to compare results with an earlier noise monitoring exercise at the same site in 2005.

The NMT records noise data relating to all noise events which exceed a selected threshold noise level for a selected minimum period of time. These selected conditions were 60 dBA for 10 seconds.

These noise events are then compared by the airport's ANOMS (Airport Noise and Operations Monitoring System) noise and track keeping computer system with radar tracks of aircraft arriving at or departing from Stansted Airport. Only those noise events which are matched with Stansted aircraft tracks are called aircraft noise events, and those that are not matched are designated as residual noise events. The remainder of the noise at the site, i.e. that noise which is not captured as noise events, (because it fails to meet the capture conditions of being above 60 dBA for 10 seconds) is also classified as 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 Stansted airport. Any noise arising from aircraft travelling to or from any other airport will be included as residual noise.

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

A total of 14,687 aircraft noise events occurred during the approximate three month (98 day) survey period. Most of these aircraft noise events were due to departing aircraft, using the 22BZD (55 % of all events) and 22 DVR (19 %) departure routes, with arrivals accounting for 25% of the events. The number of aircraft noise events per day ranged from 54 to 196, with an average of 150 events per day. This distribution almost certainly reflects the day to day variation between easterly and westerly departure directions, determined by wind direction.

The numbers of aircraft noise events per day did not show any obvious correlation with day of the week or weekends. The highest number of events per hour occurred in the morning between 06.00 and 09.00 hours, with lower peaks during the mid-day period between noon and 13.00 hours, and in the late afternoon between 17.00 and 19.00 hours, local time. During the busiest hours there were between 10 and 13 events per hour.

The maximum noise level (L_{ASmax}) of aircraft noise events ranged from 60 dBA to 91 dBA, but for more than 90% of the events was below 72 dBA, with an overall average of 68 dBA. There were 199 events greater than 75 dBA and 23 events with a maximum noise level greater than 80 dBA.

The average noise level (L_{Aeq} value) during aircraft noise events, which had an average duration of about 29 seconds, was 64 dBA.

The total noise climate at the site may be characterised by average hourly values of various noise percentile levels, and by the average (or equivalent) noise level (L_{Aeq}). These values were fairly constant during the daytime, between 07.00 and 19.00 hours (with average values of L_{AS10} of 60 dBA, L_{AS90} of 47 dBA and L_{Aeq} of 57 dBA), but falling to lower levels in the late evening, night-time and early morning periods. The average value over the night-time period from 23.00 to 07.00 hours (L_{Aeq} values) was 52 dBA, and for the evening period from 19.00 to 23.00 hours was 56 dBA.

The daily average (L_{Aeq}) level of the total noise at the site is a combination of that due to aircraft noise events and that due to residual noise. On average over the 3 month period the level of the residual noise (55 dBA) was about 2 dB below that of the total noise level (57 dBA) with aircraft noise level on average a further 2 dBA below, at 53 dBA.

Therefore the noise from aircraft noise events, when cumulatively averaged over an extended period of time (of hours, days or weeks) makes a significant but not a dominant contribution to the average level of total noise at the site, with noise from all other sources, i.e. the residual noise, making a greater contribution. However each individual aircraft noise event, whenever it occurs, is likely to be clearly audible and distinguishable from the residual noise because, in addition to being different in character, it results in a noticeable increase in the level of the ambient noise by 10 dBA

It is possible to convert the hourly 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 three months period, an L_{den} value for the total noise of 60 dBA and of 56 dBA for the aircraft noise.

In order to place the noise climate at the site in a wider UK context the noise levels from the NMT have been compared with the results of the National Noise Index survey of noise levels in the UK in 2000, with World Health Organisation Guidelines, and with Stansted Airport aircraft noise contours.

Although 84 different aircraft types were involved in the total of 14,687 aircraft noise events, two aircraft types accounted for more than 80% of the events: Boeing 737-800: 9,021 events (61.4%), and Airbus A319: 3238 events (22.0 %), and only five aircraft types accounted for more than 90% of the events.

The average maximum noise level (L_{ASmax}) during 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. 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.

A comparison of the results with those from the 2005 survey indicates that there has not been any significant change in the noise climate at the site.

A summary of the main noise related parameters (three monthly averages) for the period from 6th July to 12th October 2010, at Thorley are shown in the Table below, together with a comparison of similar data for the 2005 survey.

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

	Thorley 2010	Thorley 2005
Survey period	6 July to 12 October	1 July to 30 September
Aircraft noise event trigger level	60 dBA	62 dBA at first and then changed to 60 dBA
Length of period	98 days	84 days of data in a 91 day period
Total Number of aircraft noise events	14,687 (average of 150 per day)	14,694 (average of 175 per day)
% of Event numbers for Arrivals and Departures events	departures 74.8% arrivals 25.2%	departures 84 % arrivals 16 %
Departure flight paths	22BZD 72.8% 22DVR 24.9% 22CLN 2.3%	22BZD 61.6 % 22DVR 25.7 % 22CLN 12.7 %
Average maximum noise level of aircraft noise events, dBL_{ASmax}	67.7 (all) 68.7 (departures) 64.6 (arrivals) 69.5 22BZD 66.6 22DVR 66.0 22CLN	67.8 (all) 68.2 (departures) 65.8 (arrivals) 68.8 (22BZD) 67.6 (22DVR) 66.0 (22CLN)
Average noise level and duration of aircraft noise events, dBL_{ASmax}	63.7dBA 29.2 seconds	64.3 dBA 27.0 seconds
Average total noise level, $L_{Aeq,T}$	day (16h): 57.2 night (8h): 51.9	day (16h): 56.9 night (8h): 51.9
Average aircraft noise level, $L_{Aeq,T}$	day (16h): 53.2 night (8h): 47.9	day (16h): 53.7 night (8h): 48.6
Average residual noise level, $L_{Aeq,T}$	day (16h): 55.1 night (8h): 49.7	day (16h): 54.1 night (8h): 49.2
Day-evening night level, dB	total noise: 60.1 aircraft noise: 56.2	total noise: 60.0 aircraft noise: 56.7
Background noise (L_{AS90}) dB	day (16h): 44.0 night (8h): 35.4	day (16h): 46.3 night (8h): 38.0
Aircraft types responsible for the majority of aircraft noise events:	Boeing 737-800: 61% Airbus A319: 22% (84 aircraft types in total)	Boeing 737-800: 51% Airbus A319: 14% (82 aircraft types in total)

1.0 Introduction

- 1.1 A mobile Noise Monitoring Terminal (NMT) has been deployed by Stansted Airport for an approximate three month period from 06 July to 12 October 2010.
- 1.2 The NMT was sited at Thorley in Hertfordshire, on the southern outskirts of Bishop's Stortford, approximately 8 km South West of Stansted Airport. It was located in the rear garden of one of a row of residential properties which extend to the railway line between Cambridge and London Liverpool Street stations. The NMT was approximately 80 metres from the railway line and approximately 65 metres from the B1383 road at the front of the properties. In addition to noise from aircraft the other main source of noise at the site was from trains (including train horns) and there was also some noise from road traffic and from domestic activities. A map showing the location (indicated by an arrow) is presented in Appendix 1. On days when aircraft are taking off from Stansted to the west, the site lies nearby aircraft departure routes.
- 1.3 An NMT had previously been deployed at the same site and with the microphone at the same location in 2005 between 1 July and 30 September.
- 1.4 The aims of this report are:
- to present the results of the three month 2010 noise monitoring survey, and
 - to interpret the results in a way that places the contribution of the noise from passing aircraft using Stansted airport in the context of the overall noise climate from all other sources, and
 - to compare the results of the 2005 and 2010 surveys;
 - To provide a baseline for comparison with any future noise surveys in this format that may be undertaken at this location.
- 1.5 A glossary of technical terms used in this report is given in Appendix 3.

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 A total of 14,687 aircraft noise events were recorded at the site during the three month period; 3,732 in July (6th to 31st), 4,665 in August, 4,546 in September and 1,744 in October (1st to 12th).
- 3.1.2 The majority of these aircraft noise events were due to departing aircraft (75%); with 25% due to arrivals. The majority of the departures (73%) were from departure route 22 BZD with 25% from departure route 22 DVR and 2% from route 22CLN.

- 3.1.3 Figure 1 shows the total number of aircraft noise events occurring each day during the 3 months period from 6th July to 12th October 2010. There was no obvious correlation between the number of aircraft noise events and the day of the week or weekend. The number of aircraft noise events per day ranged from 54 to 196, with an average of 150 events per day over the approximate three month (98 day) period. This distribution almost certainly reflects the day to day variation between easterly and westerly departure directions, determined by wind direction.
- 3.1.4 Figure 2 indicates the average distribution of numbers of aircraft noise events throughout the 24 hour day. The highest number of events per hour occurred in the morning between 06.00 and 09.00 hours, with lower peaks during the mid-day period between noon and 13.00 hours, and in the late afternoon between 17.00 and 19.00 hours, local time. During the busiest hours there were between 10 and 13 events per hour.
- 3.2 Maximum noise levels of aircraft noise events
- 3.2.1 The NMT recorded the maximum noise level (measured using the 'A' frequency weighting and the Slow (S) time weighting) produced by each aircraft noise event, (L_{ASmax}). These values ranged from 60 dBA to 91 dBA, but more than 90% of the events have maximum noise levels in the range between 62 and 72 dBA, with an overall average of 67.7 dBA.
- 3.2.2 There was a significant difference between the maximum noise levels of aircraft noise events arising from departures (average 68.7 dBA) and arrivals (average 64.6 dBA), and, among departing aircraft, for those using the different departure routes: 22BZD (average 69.5 dBA), 22DVR (average 66.6 dBA) and 22CLN (average 66.0 dBA).
- 3.2.3 Figure 3 indicates the average L_{ASmax} value of aircraft noise events recorded each day during the three month monitoring period. Figure 4 shows the variation of average hourly value of L_{ASmax} value for the three month period. Figure 5 shows a statistical distribution of L_{ASmax} values for the three month period.
- 3.2.4 It can be seen from Figure 3 that the average maximum level per day ranged between 63 dBA and 69 dBA.
- 3.2.5 The variation of average maximum value of aircraft noise events by hour of day (Figure 4) shows similar range i.e. between 64 dBA and 70 dBA. The two highest hourly averages, of 70 dBA, which occurred between 01.00 and 02.00 hours and between 05.00 and 06.00 hours in the morning correspond, according to Figure 2, to a relatively small number of events: on average less than 2 events per day between 01.00 and 02.00 hours and to less than one event per day between 05.00 and 06.00 hours each day.
- 3.2.6 Figure 5 shows that the maximum noise levels of most aircraft noise events (more than 90% of events) lie between 62 and 72 dBA, and that 99% of values are below 76 dBA. There are 199 events (out of a total of 14687) with a maximum noise level greater than 75 dBA, and 23 events with a maximum noise level greater than 80 dBA.
- 3.2.7 A comparison of the data for the 2005 and 2010 surveys indicates that the numbers of aircraft noise events, their distribution day by day and hour by hour, and their range of maximum noise levels were broadly similar in 2010 and 2005. More detailed numerical comparisons are given in the Summary Comparison Table at the end of section 4 of this Report.

3.3 Durations and average noise levels of aircraft noise events

- 3.3.1 The duration of 90% of aircraft noise events was between 10 seconds and 40 seconds, with an average value for all events of 29 seconds.
- 3.3.2 In addition to L_{ASmax} values the NMT also recorded the Single Event Noise Level (SEL) for each aircraft noise event. This parameter relates to the amount of sound energy in each event, and may be used to calculate the average noise level, or L_{Aeq} value, over the event duration. These L_{Aeq} values ranged from 59 to 80 dBA but with an average value of 64 dBA.
- 3.3.3 Thus a typical aircraft noise event might represent an average noise level of about 64 dBA for about 29 seconds, but varying within the 29 seconds, between the trigger level of 60 dBA and the average maximum value of 68 dBA.
- 3.3.4 A comparison of the data from the 2005 and 2010 surveys indicates that the durations and average noise levels during aircraft noise events were broadly similar in 2010 and 2005. More detailed numerical comparisons are given in the Summary Comparison Table at the end of section 4 of this Report.

3.4 The total noise climate at the site

- 3.4.1 The NMT also recorded the total noise level (i.e. from all sources, including aircraft and residual noise events) each hour, measured in terms of the hourly values of L_{Aeq} (representing the average noise level over the hour) and the following statistical percentile levels: L_{AS1} , L_{AS10} , L_{AS50} , L_{AS90} and L_{AS99} , where, for example L_{AS10} is the noise level (measured using the 'A' frequency weighting (i.e. in dBA) and the Slow (S) time weighting) exceeded for 10% of the 1 hour measurement time interval. Figure 6 shows these values averaged over the three month noise survey period for each hour of the day.
- 3.4.2 It can be seen from Figure 6 that the value of each index is fairly constant from about 06.00 hours to 19.00 hours but then falls off outside these times (i.e. in the late evening, night-time and early morning periods).
- 3.4.3 The average values of the various noise indices over various parts of the 24 hour day (day, evening, night etc.) are shown below. For all these periods the indices were calculated from the relevant hourly levels, using arithmetic averages in the case of the statistical levels and logarithmic averages for the L_{Aeq} indices. For comparison, values from the 2005 survey are shown in brackets (except for the L_1 values which were not available in the 2005 data).

Noise climate index	Noise level, dBA				
	Day (07.00-19.00)	Evening (19.00-23.00)	Night (23.00-07.00)	Day and Evening (07.00-23.00)	24 hours
L_1	67.8	67.5	60.9	67.7	65.4
L_{10}	59.9 (60.4)	58.7 (58.9)	49.9 (50.2)	59.6 (60.0)	56.3 (56.8)
L_{50}	50.7 (50.7)	48.4 (49.0)	42.4 (42.6)	50.1 (50.3)	47.5 (47.7)
L_{90}	47.1 (46.8)	44.6 (44.9)	37.9 (38.0)	46.4 (46.3)	43.6 (43.6)
L_{99}	44.7 (44.1)	42.2 (42.4)	35.4 (35.7)	44.0 (43.7)	41.2 (41.0)
L_{eq}	57.5 (57.1)	56.3 (56.2)	51.9 (51.9)	57.2 (56.9)	56.1 (55.8)

It can be seen from the above table that the values of the various noise climate indices were very similar for both the 2005 and 2010 surveys.

- 3.4.4 Since Figure 6 shows that, on average, the noise levels at the site do not vary much from hour to hour in the daytime they are unlikely to vary much within each hour, and so the data shown in Figure 6, and particularly the L_{Aeq} values, could be used as a good indication of 30 minute L_{Aeq} values, required in Building Bulletin 93 for the assessment of noise climates near to schools in the vicinity.
- 3.4.5 For a period of one hour the value of the L_{AS10} noise index is the noise level exceeded for 6 minutes in that hour, and value of the L_{AS90} noise index is the noise level exceeded for 54 minutes in the hour, so that noise levels at or below the L_{AS90} value occur for 6 minutes in the hour. Thus Figure 6 shows that for a typical hour in the daytime (07.00 to 19.00 hours) the total noise level over the entire hour at this site would exceed 60 dBA (L_{A10} value) for 6 minutes, and would be below 47 dBA (L_{A90} value) for 6 minutes, and would therefore be between 47 and 60 dBA for 48 minutes of the hour.
- 3.4.6 The UK Government Department, Defra, has used the 24 hour L_{den} noise index (day evening night level) for noise mapping purposes. This index is based on average levels of aircraft noise (L_{Aeq} values) throughout the day but with a weighting penalty of 5 dB applied to noise in the evening (19.00 hours to 23.00 hours) and a 10 dB penalty at night-time (23.00 hours to 07.00 hours). It is possible to convert the hourly L_{Aeq} values displayed in Figure 6 and in the above Table into an L_{den} value for the total noise at the site, of 60.1 dBA (and 60.0 dBA in 2005).

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

- 3.5.1 By using the Single Event Noise Level (SEL) for each aircraft noise event it is possible to calculate the average, or equivalent aircraft noise level (L_{Aeq}) due to aircraft noise events over a period of time (hour, day or month). Although this average noise level bears little relationship to the aircraft noise as heard, which occurs in short bursts of noise at higher levels rather than as a lower continuous average level, it is, nevertheless, a useful parameter for comparative purposes.
- 3.5.2 Since the NMT also records hourly L_{Aeq} values of the total noise from the site it is possible, by subtracting the aircraft noise level from the total noise level (using the decibel (or logarithmic) subtraction process which is appropriate in this case) to calculate the remaining component of the total noise, i.e. the residual noise level.
- 3.5.3 The residual noise is a combination of the noise from residual noise events (i.e. those captured noise events which did not match with aircraft movements) and from other residual noise, not captured as noise events, i.e. all other noise recorded by the monitor that did not exceed the trigger level for the required minimum time period.
- 3.5.4 Figure 7 shows the values of the levels of total noise, aircraft noise and residual noise averaged over the three month noise survey period for each hour of the day, together with the background noise level (L_{AS90}). The Table below shows the levels of total, aircraft and residual noise averaged over the various parts of the 24 hour day (day, evening, night etc.), with values from the 2005 survey shown in brackets.

	Average Noise level (LAeq value), dBA				
	Day (07.00-19.00)	Evening (19.00-23.00)	Night (23.00-07.00)	Day and Evening (07.00-23.00)	24 hours
Total noise	57.5 (57.1)	56.3 (56.2)	51.9 (51.9)	57.2 (56.9)	56.1 (55.8)
Aircraft noise	53.3 (54.0)	52.9 (53.1)	47.9 (48.6)	53.2 (53.7)	52.0 (52.6)
Residual noise	55.4 (54.3)	53.7 (53.4)	49.7 (49.2)	55.1 (54.1)	53.9 (53.0)

It can be seen from the Table that the values of the various noise indices were broadly similar for both the 2005 and 2010 surveys.

- 3.5.5 It can also be seen that on average over the 3 month period the level of the residual noise was about 2 dB below that of the total noise level with aircraft noise level on average a further 2 dBA below.
- 3.5.6 This shows that when the noise from aircraft noise events is cumulatively averaged over an extended period of time (of hours, days or weeks) it makes a significant but not a dominant contribution to the average level of total noise at the site, with noise from all other sources, i.e. the residual noise, making a greater contribution. However each individual aircraft noise event, whenever it occurs, is likely to be clearly audible and distinguishable from the residual noise because, in addition to being different in character, it results in a noticeable increase in the level of the ambient noise by 10 dBA or more for a period of about 29 seconds.

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

National Noise Incidence Study

- 3.6.1 The National Noise Incidence Study of noise levels in England and Wales in 2000 carried out by the Building Research Establishment for Defra gave a breakdown of the proportion of 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 Thorley are also free field values.

- 3.6.2 From the Table in paragraph 3.5.4 the 16 hour L_{Aeq} value for total noise at this site is 57 dBA, which puts the site in the 'Less than 60 but greater than 55 dBA' noise exposure band, occupied by 18 % of dwellings in England and Wales. It can also be seen that without the contribution from aircraft noise the 16 hour L_{Aeq} value for residual noise at this site was 55.1 dBA, in which case the site would (just) remain in the same noise exposure band.
- 3.6.3 The National Noise Incidence Study of noise levels was extended in 2002 to cover the entire UK and also to include 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 dBA (paragraph 3.4.6) the addition of 3dB (i.e. a facade level of 63 dBA) puts the site in 'Less than 65 but greater than 60 dBA' noise exposure band, occupied by 16 % of dwellings in the UK.

World Health Organisation and PPG 24 Guidance on Community Noise

- 3.6.5 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."
- 3.6.6 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 $L_{Aeq,8h}$.
- 3.6.7 The total noise exposure levels at this site based on the data collected during this 3 month noise survey period, (shown in the Table in paragraph 3.5.4) are an $L_{Aeq,16h}$ of 57.2 dBA in the daytime and 51.9 dBA $L_{Aeq,8h}$ at night-time. The noise levels at the site are therefore above both the WHO Guideline of 55 dBA in the daytime, and the night-time Guideline value of 45 dBA. Without the contribution from aircraft noise events the noise at the site would be the residual noise level, of 55.1 dBA in the daytime and 49.7 dBA at night-time (from Table in paragraph 3.5.4). In this case the level of residual noise at the site would be (just) above the WHO daytime guideline level for the daytime and also well above the night-time guideline level.

Aircraft noise contours

- 3.6.8 The UK government produces annual contours of predicted aircraft noise levels around various UK airports, including Stansted. The contours show the predicted values of the daytime 16 hour (07.00 to 23.00 hours) L_{Aeq} values produced by aircraft in flight, in 3 dB bands, from 73 dBA (closest to the airport) to an outer contour value of 57 dBA.
- 3.6.9 Based on research the Government has used 57dBA L_{eq} as the level of daytime noise marking the approximate onset of significant community annoyance. The relationship between noise and annoyance is of course not an exact one, and varies according to individuals and locations.

- 3.6.10 Although it is interesting to compare the Aircraft noise levels derived from the NMT data at this site with the published contours for Stansted, in making any such comparisons it must be borne in mind that the contours are based on the average summer day, where 'summer' is the 92-day period from 16 June to 15 September, and 'day' is the 16-hour period 0700-2300 (local time), whereas the aircraft noise levels in this report are for the three month period, from July to October 2010.
- 3.6.11 The published contours for Stansted Airport for 2007 and 2008 (ERCD Report 0903) show that the site at Thorley lies just outside the outermost 57 dBA contour, by less than 1kilometre. Monitoring data from this study shows that the measured 16 hour daytime aircraft noise L_{Aeq} value for the three month period (paragraph 3.5.4) was 53 dBA.
- 3.6.12 Contours of aircraft noise L_{den} were also produced for the year 2006 (ERCD Report 0708) to meet the requirements of the first round noise mapping exercise under EU Directive 2002/49/EC. These contours were produced in 5 dB steps with the lowest (outermost contour) being for L_{den} of 55 dBA and were based on data for an average day over the whole year (2006). Although it is interesting to compare the L_{den} value for aircraft noise, calculated from the values presented in this report with the published contours, it should be noted that the contours and the measured values are based on two different periods of time, for which the modal split may be different, and which will involve different numbers and types of aircraft noise events. The contour map shows that the site at Thorley lies approximately half way between the 55 dBA and the 60 dBA L_{den} contours. The value of L_{den} calculated from the values of aircraft noise level given in paragraph 3.5.4 for the three month period October to December 2009 is 56 dBA.
- 3.6.13 Contours of noise exposure for the night-time period, L_{night} ($L_{Aeq,8h}$), were also produced for 2006 at Stansted on the same basis as for the L_{den} contours. This contour map shows that the site at Thorley lies just outside the lowest 50 dBA $L_{Aeq,8h}$ contour. Monitoring data from this study shows that the measured 8 hour night-time aircraft noise L_{Aeq} value for the three month period (paragraph 3.5.4) was 48 dBA.
- 3.6.13 It is intended that the next round of noise mapping and L_{den} contours will be carried out for the year 2011.

3.7 The contribution of different aircraft types to aircraft noise at the site

- 3.7.1 Eighty four different aircraft types contributed to the total number of 14,687 aircraft noise events which occurred during the three month period, but most of the events arose from a relatively small number of aircraft types, with only two types being responsible for more than 80% of all aircraft noise events at the site:
- Boeing 737 - 800: 61%
 - Airbus A319: 22%
- 3.7.2 Figure 8 shows the numbers of events from the 26 most common types of aircraft for which there were more than 10 events in the three month period. Also shown are the numbers of a further 20 less frequent but noisier types for which the average value of L_{ASmax} was greater than 70 dBA. Each aircraft type shown in Figure 8 is described by a 3 character source code. A list of these codes is given in Appendix 4.
- 3.7.3 Figure 9 shows the average maximum aircraft noise level L_{ASmax} value for each aircraft types shown in Figure 8. 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. 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.

4.0 Summary and Conclusions

- 4.1 A total of 14,687 aircraft noise events occurred during the approximate three month (98 day) survey period. Most of these aircraft noise events were due to departing aircraft, using the 22 BZD (55 % of all events) and 22 DVR (19 %) departure routes, with arrivals accounting for 25% of the events. The number of aircraft noise events per day ranged from 54 to 196, with an average of 150 events per day. This distribution almost certainly reflects the day to day variation between easterly and westerly departure directions, determined by wind direction.
- 4.2 The numbers of aircraft noise events per day did not show any obvious correlation with day of the week or weekends. The highest number of events per hour occurred in the morning between 06.00 and 09.00 hours, with lower peaks during the mid-day period between noon and 13.00 hours, and in the late afternoon between 17.00 and 19.00 hours, local time. During the busiest hours there were between 10 and 13 events per hour.
- 4.3 The maximum noise level (L_{ASmax}) of aircraft noise events ranged from 60 dBA to 91 dBA, but for more than 90% of the events was below 72 dBA, with an overall average of 68 dBA. There were 199 events greater than 75 dBA and 23 events with a maximum noise level greater than 80 dBA.
- 4.4 The average noise level (L_{Aeq} value) during aircraft noise events, which had an average duration of about 29 seconds, was 64 dBA.
- 4.5 The total noise climate at the site may be characterised by average hourly values of various noise percentile levels, and by the average (or equivalent) noise level (L_{Aeq}). These values were fairly constant during the daytime, between 07.00 and 19.00 hours (with average values of L_{AS10} of 60 dBA, L_{AS90} of 47 dBA and L_{Aeq} of 57 dBA), but falling to lower levels in the late evening, night-time and early morning periods. The average value over the night-time period from 23.00 to 07.00 hours (L_{Aeq} values) was 52 dBA, and for the evening period from 19.00 to 23.000 hours was 56 dBA.
- 4.6 The daily average (L_{Aeq}) level of the total noise at the site is a combination of that due to aircraft noise events and that due to residual noise. On average over the 3 month period the level of the residual noise (55 dBA) was about 2 dB below that of the total noise level (57 dBA) with aircraft noise level on average a further 2 dBA below, at 53 dBA..
- 4.7 Therefore the noise from aircraft noise events, when cumulatively averaged over an extended period of time (of hours, days or weeks) makes a significant but not a dominant contribution to the average level of total noise at the site, with noise from all other sources, i.e. the residual noise, making a greater contribution. However each individual aircraft noise event, whenever it occurs, is likely to be clearly audible and distinguishable from the residual noise because, in addition to being different in character, it results in a noticeable increase in the level of the ambient noise by 10 dBA
- 4.8 It is possible to convert the hourly L_{Aeq} values into the 24 hour Lden 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 three months period, an Lden value for the total noise of 60 dBA and of 56 dBA for the aircraft noise.

- 4.9 In order to place the noise climate at the site in a wider UK context the noise levels from the NMT have been compared with the results of the National Noise Index survey of noise levels in the UK in 2000, with World Health Organisation Guidelines, and with Stansted Airport aircraft noise contours.
- 4.10 Although 84 different aircraft types were involved in the total of 14,687 aircraft noise events, two aircraft types accounted for more than 80% of the events: Boeing 737- 800: 9021 events (61.4%), and Airbus A319: 3238 events (22.0 %), and only five aircraft types accounted for more than 90% of the events.
- 4.11 The average maximum noise level (L_{ASmax}) during 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. 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.
- 4.12 A comparison of the results with those from the 2005 survey indicates that there has not been any significant change in the noise climate at the site.
- 4.13 A summary of the main noise related parameters (three monthly averages) for the period from 6th July to 12th October 2010, at Thorley are shown in the Table below, together with a comparison of similar data for the 2005 survey.
- 4.14 The information presented in this report is summarised in the table overleaf and will serve as a baseline for comparison with any future noise level surveys that may be undertaken at this location.

	Thorley 2010	Thorley 2005
Survey period	6 July to 12 October	1 July to 30 September
Aircraft noise event trigger level	60 dBA	62 dBA at first and then changed to 60 dBA
Length of period	98 days	84 days of data in a 91 day period
Total Number of aircraft noise events	14,687 (average of 150 per day)	14,694 (average of 175 per day)
% of Event numbers for Arrivals and Departures events	departures 74.8% arrivals 25.2%	departures 84 % arrivals 16 %
Departure flight paths	22BZD 72.8% 22DVR 24.9% 22CLN 2.3%	22BZD 61.6 % 22DVR 25.7 % 22CLN 12.7 %
Average maximum noise level of aircraft noise events, $dB_{L_{ASmax}}$	67.7 (all) 68.7 (departures) 64.6 (arrivals) 69.5 22BZD 66.6 22DVR 66.0 22CLN	67.8 (all) 68.2 (departures) 65.8 (arrivals) 68.8 (22BZD) 67.6 (22DVR) 66.0 (22CLN)
Average noise level and duration of aircraft noise events, $dB_{L_{ASmax}}$	63.7 dBA 29.2 seconds	64.3 dBA 27.0 seconds
Average total noise level, $L_{Aeq,T}$	day (16h): 57.2 night (8h): 51.9	day (16h): 56.9 night (8h): 51.9
Average aircraft noise level, $L_{Aeq,T}$	day (16h): 53.2 night (8h): 47.9	day (16h): 53.7 night (8h): 48.6
Average residual noise level, $L_{Aeq,T}$	day (16h): 55.1 night (8h): 49.7	day (16h): 54.1 night (8h): 49.2
Day-evening night level, dB	total noise: 60.1 aircraft noise: 56.2	total noise: 60.0 aircraft noise: 56.7
Background noise (L_{AS90}) dB	day (16h): 44.0 night (8h): 35.4	day (16h): 46.3 night (8h): 38.0
Aircraft types responsible for the majority of aircraft noise events:	Boeing 737-800: 61% Airbus A319: 22% (84 aircraft types in total)	Boeing 737-800: 51% Airbus A319: 14% (82 aircraft types in total)

Figure 1: Number of aircraft noise events at Thorley, Herts, each day from 06 July to 12 October 2010

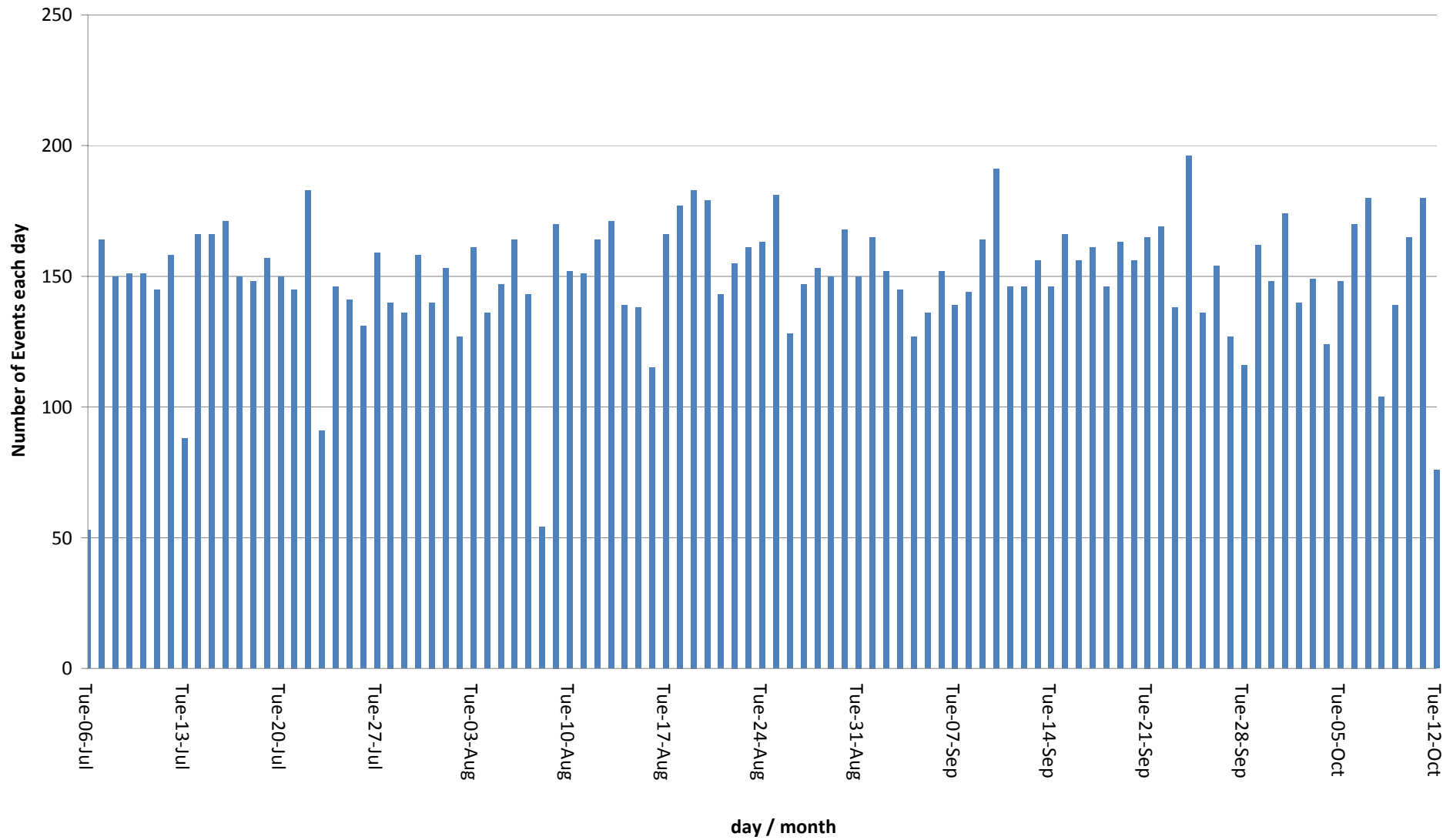


Figure 2: Average number of aircraft noise events per hour of the day at Thorley, Herts, from 06 July to 12 October 2010

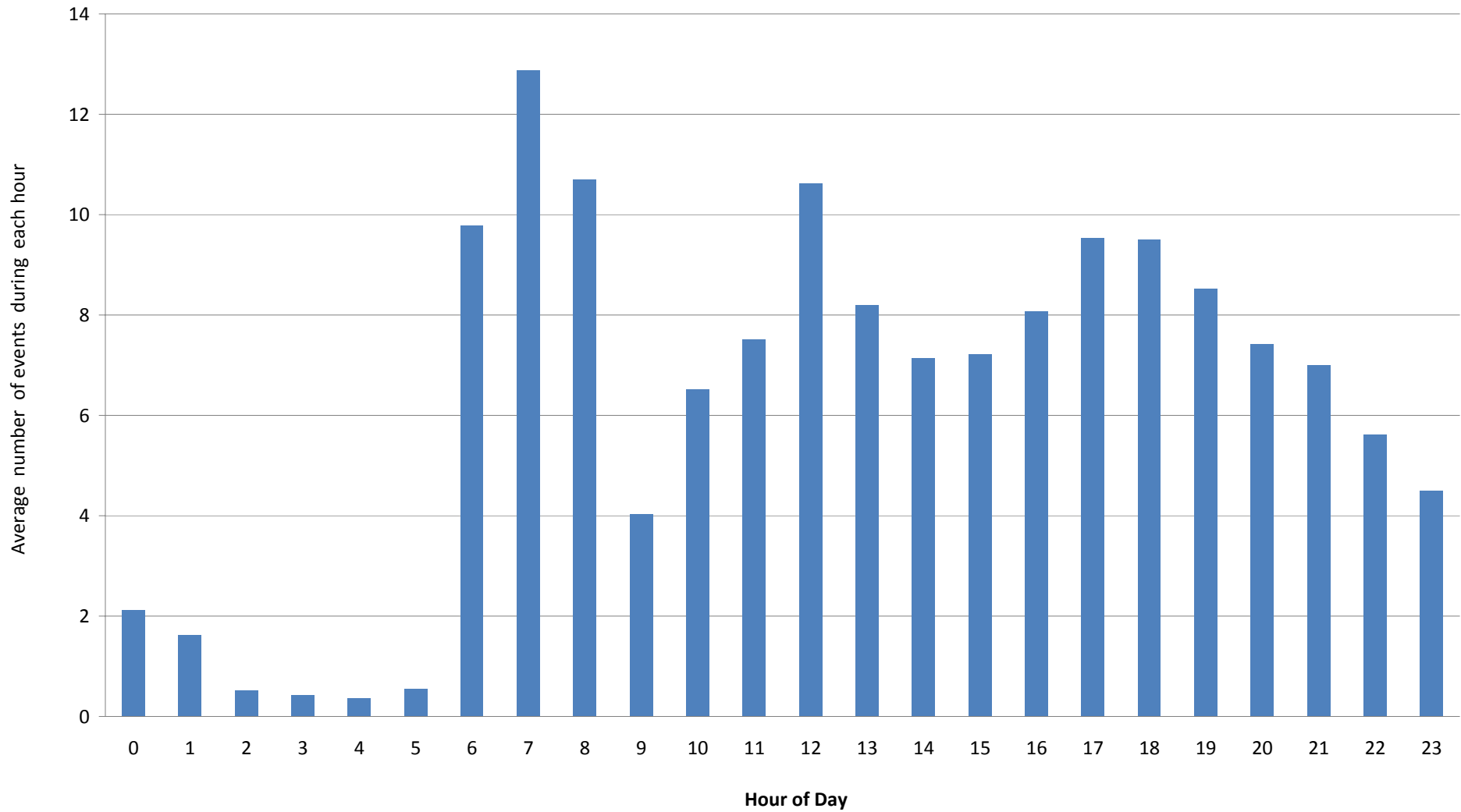


Figure 3: Average value of maximum noise levels of aircraft noise events at Thorley, Herts, each day from 06 July to 12 October 2010

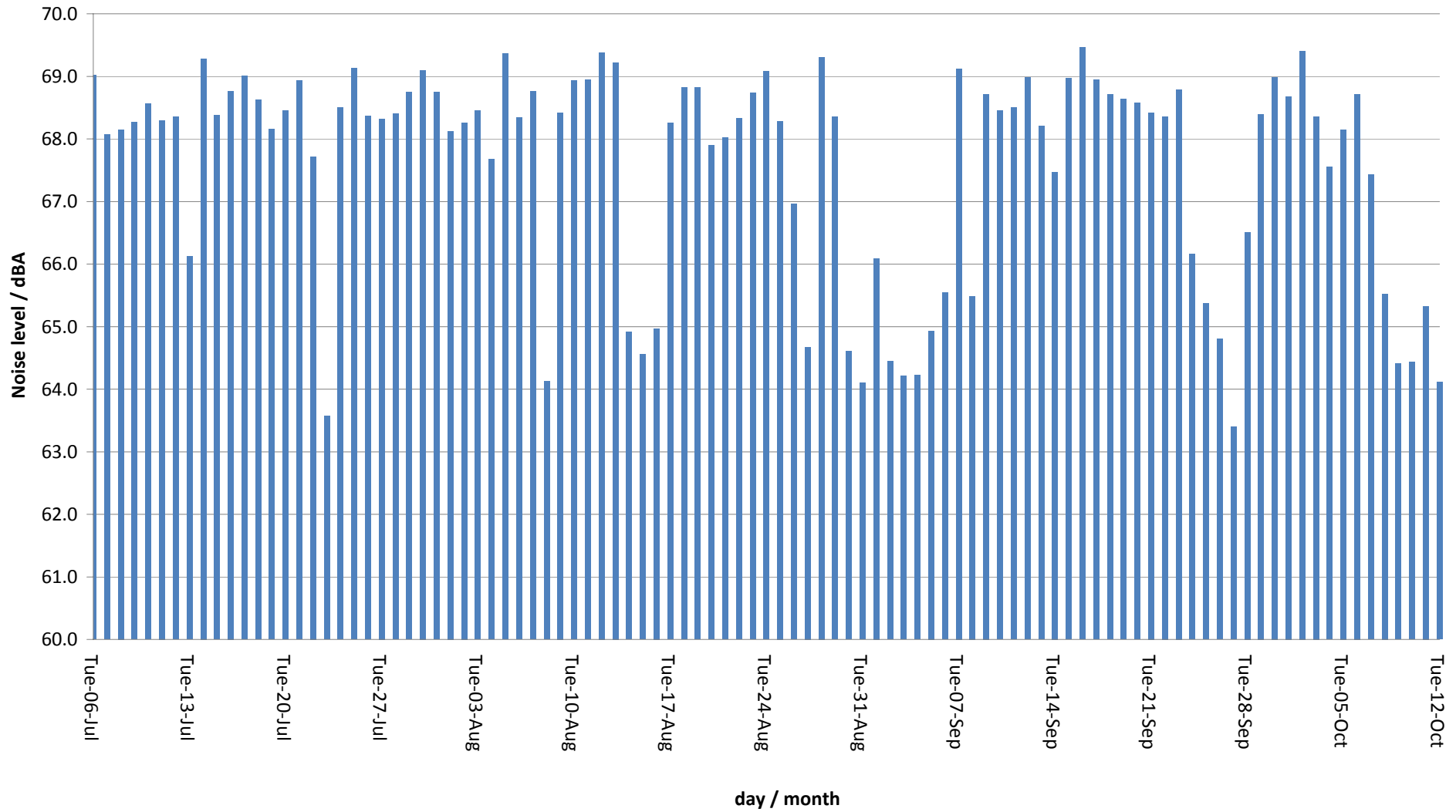


Figure 4 Average value of maximum levels of aircraft noise events per hour of day at Thorley, Herts, from 06 July to 12 October, 2010

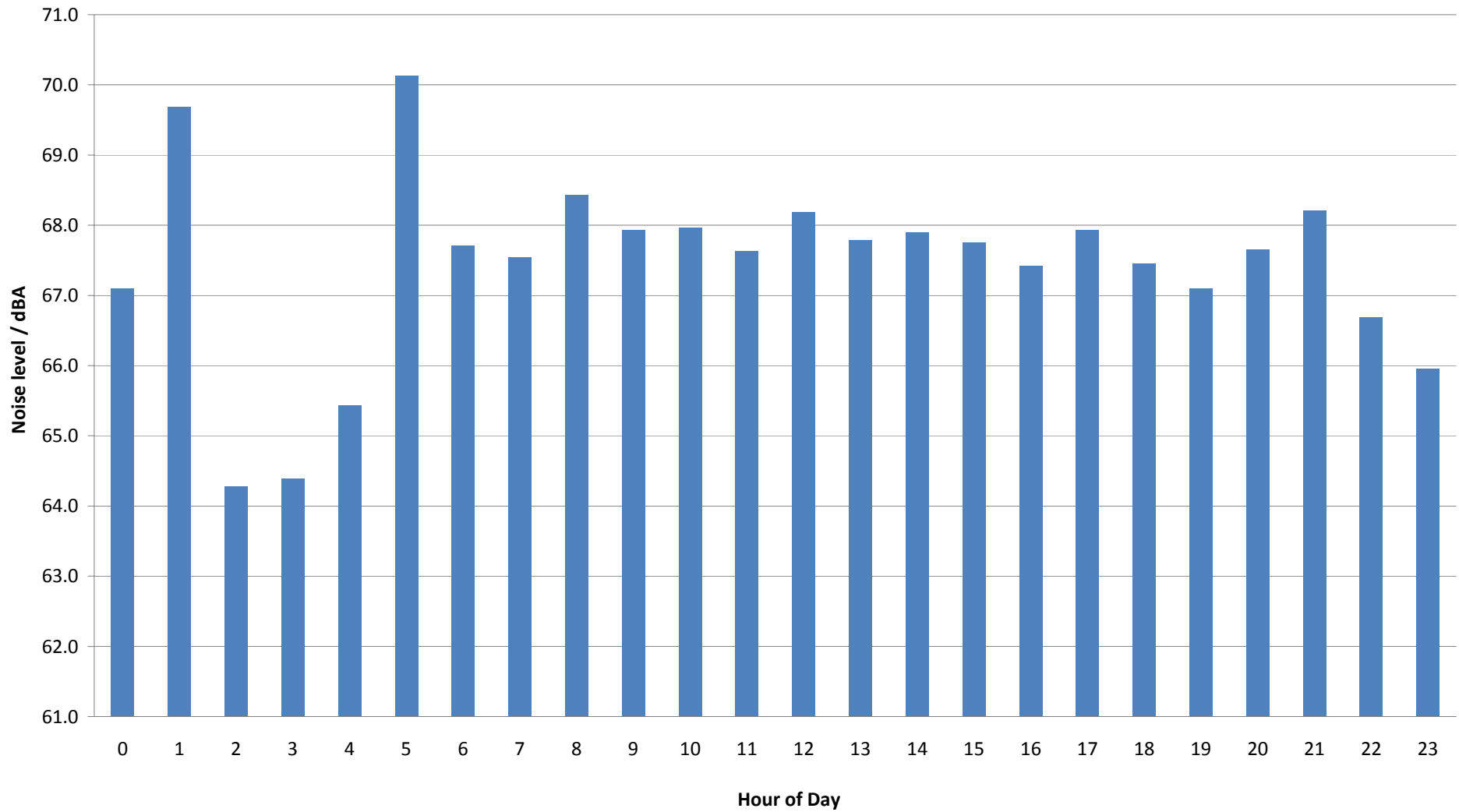


Figure 5: Statistical frequency distribution and % cumulative frequency distribution of maximum noise levels of aircraft noise events at Thorley, Herts , 06 July to 12 October 2010

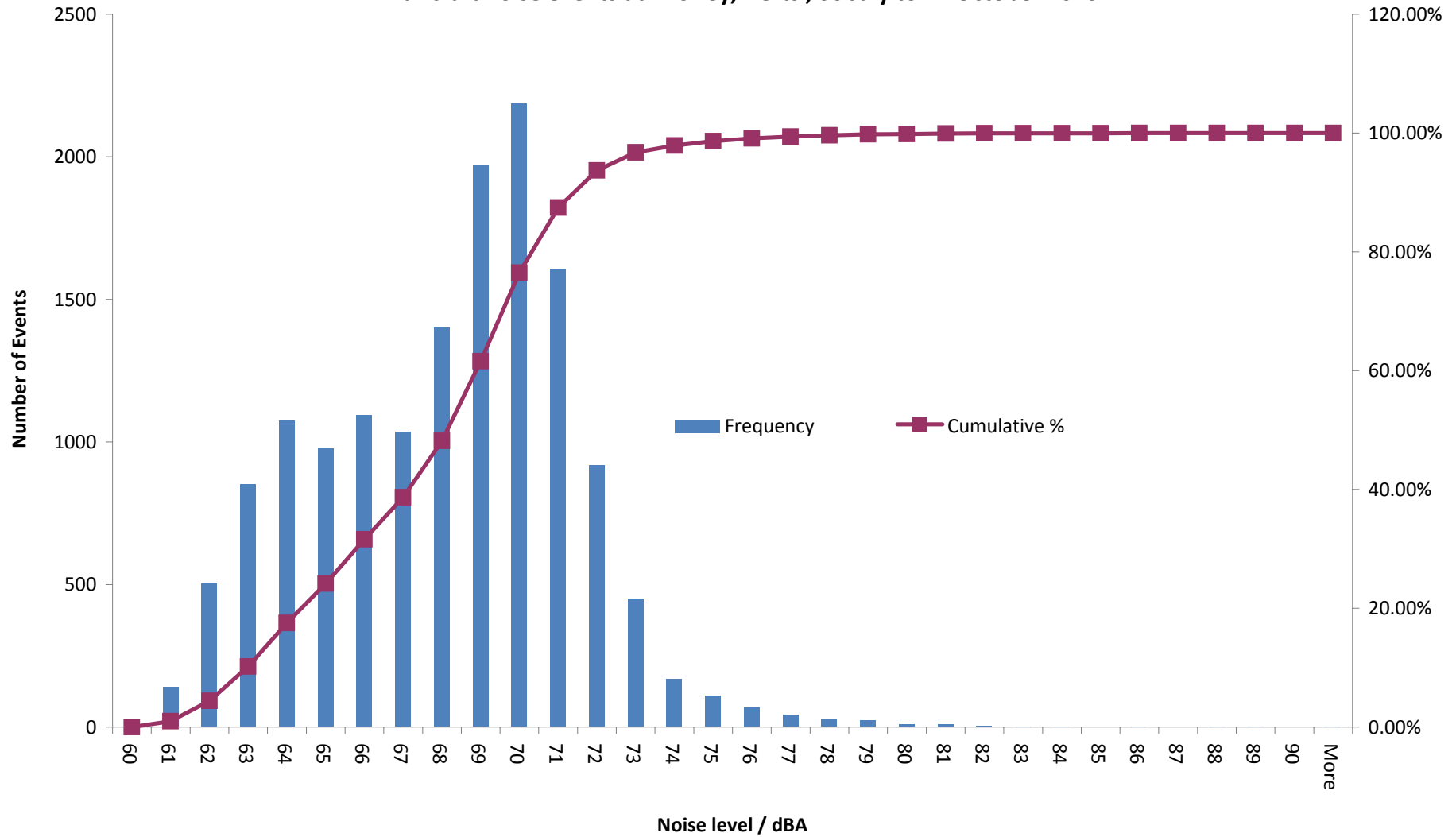


Figure 6 Noise Climate (average noise level percentile values) hour by hour at Thorley, Herts, from 06 July to 12 October 2010

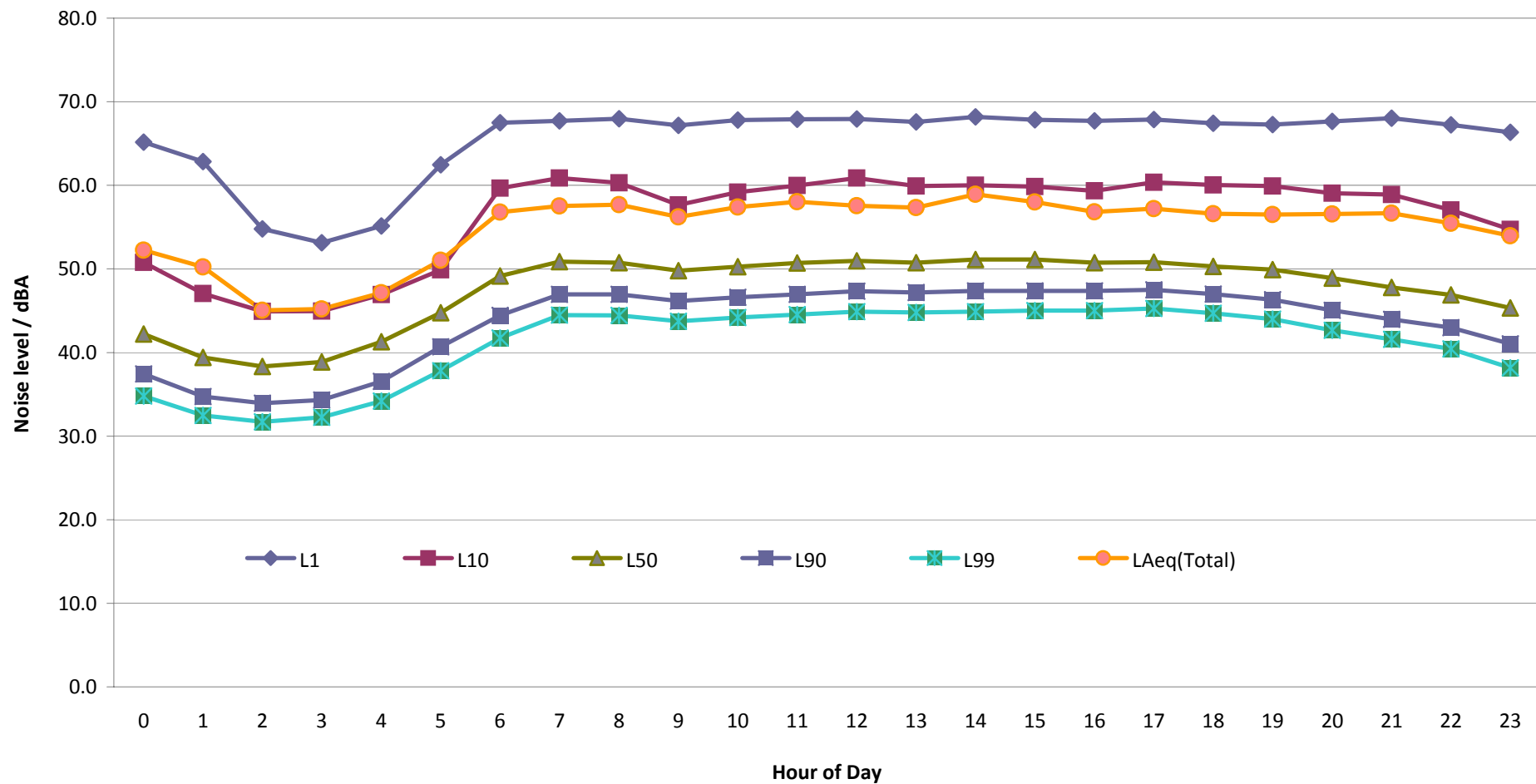


Figure 7 Noise Climate at Thorley, Herts, 06 July to 12 October 2010, showing average values for each hour of day of total noise, aircraft noise and residual noise (LAeq values)

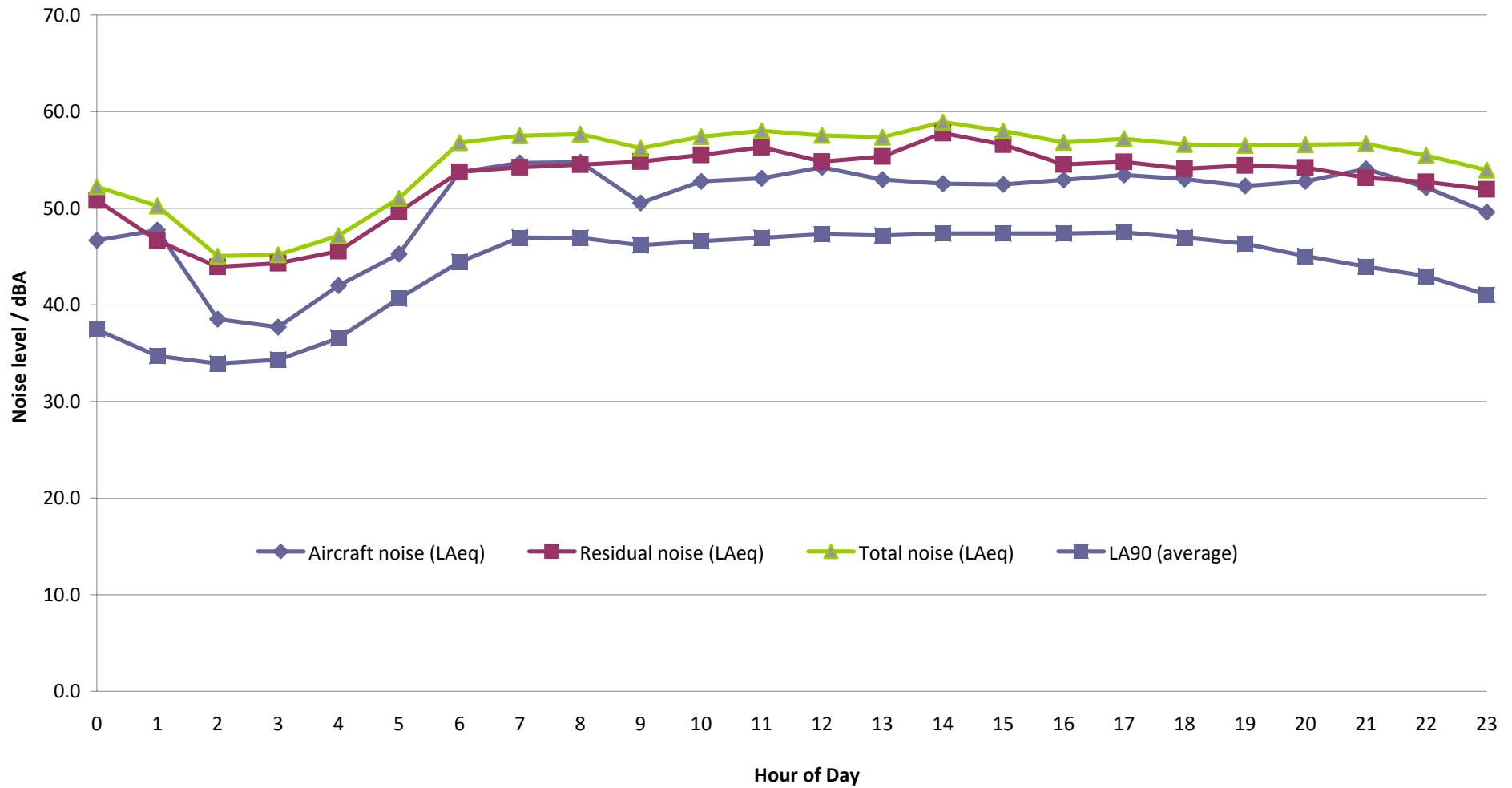


Figure 8: Numbers of aircraft noise events arising from different aircraft types at Thorley, Herts, from 06 July to 12 October 2010

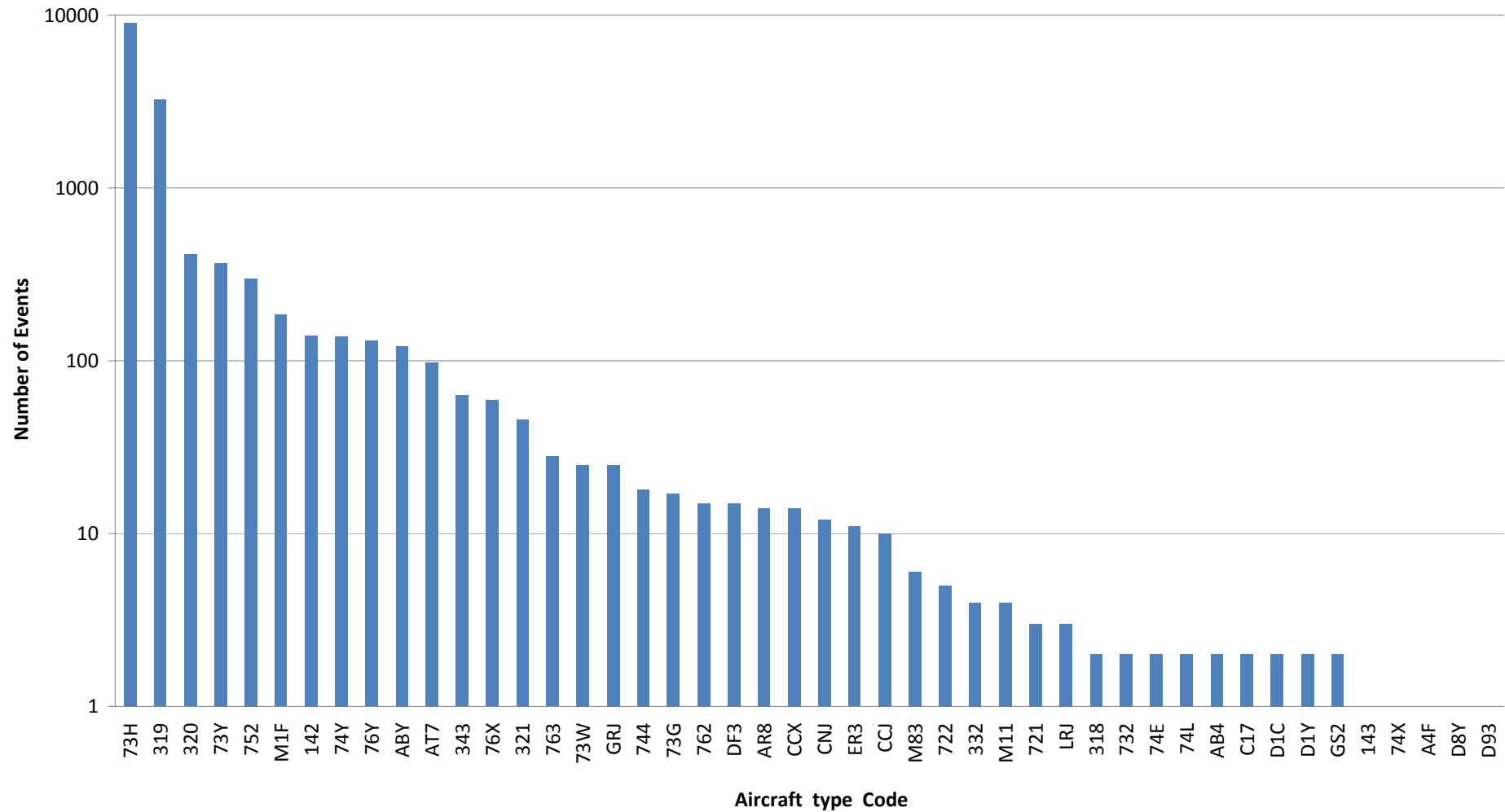
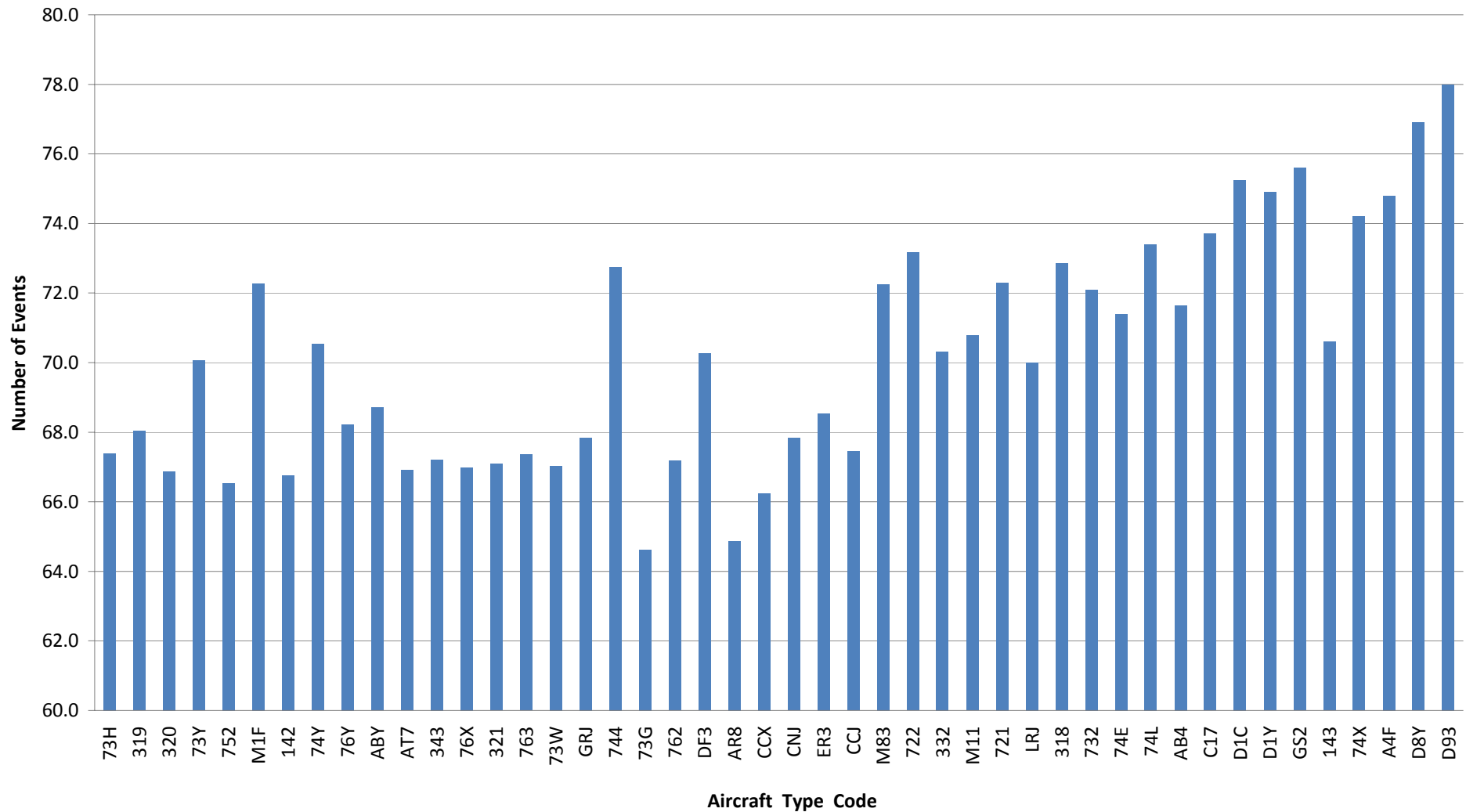


Figure 9: Average values of maximum noise levels of aircraft noise events arising from different aircraft types, at Thorley, Herts, from 06 July to 12 October 2010



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APPENDIX 1

MAP OF SITE

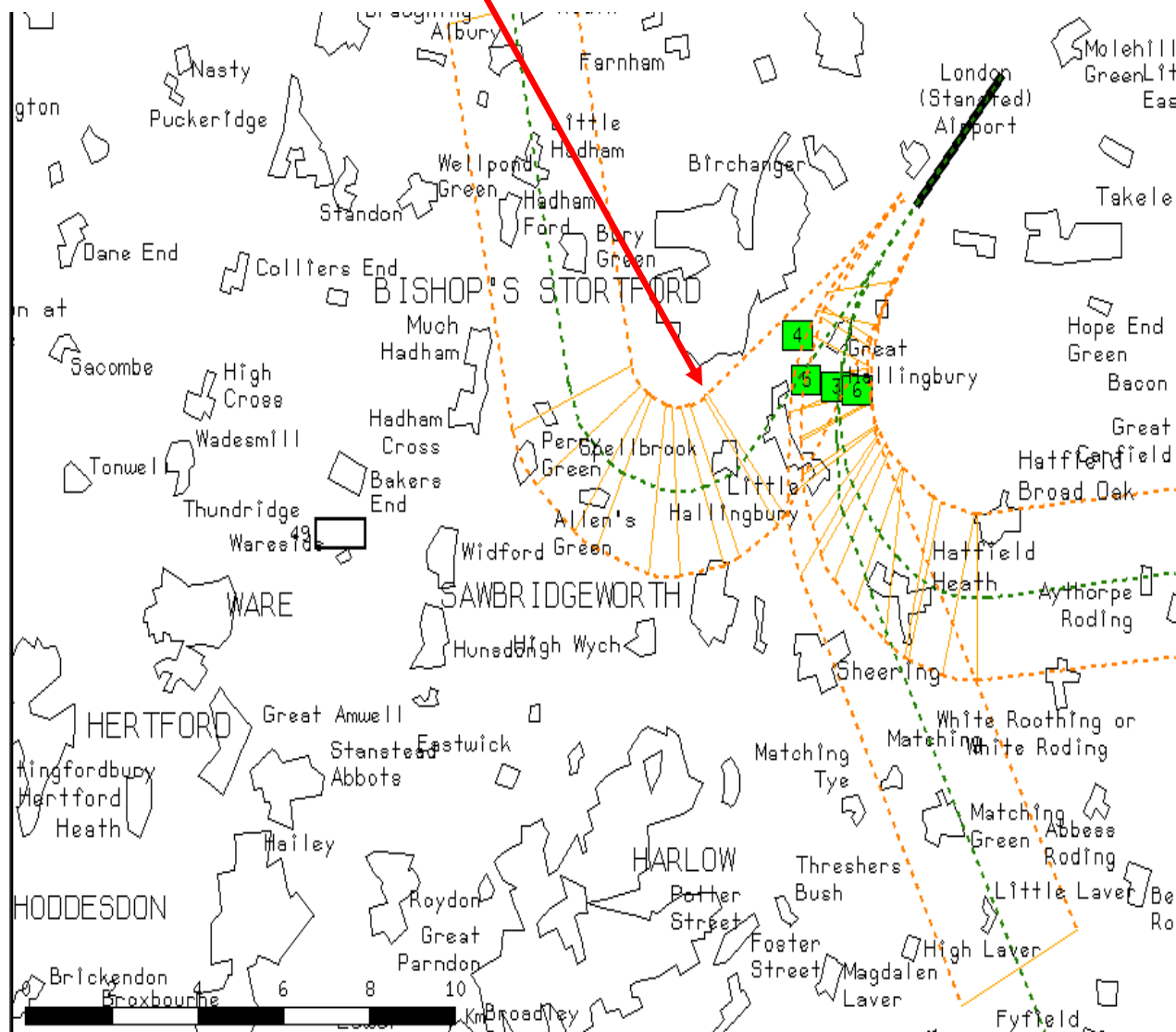
Map showing location of noise monitor at Thorley



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Map showing (approximate) location of noise monitor at Thorley, Bishops Stortford, Hertfordshire



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APPENDIX 2

DATA FROM THE NOISE MONITORING TERMINAL



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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 60 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 Stansted Airport will occasionally cause noise events to be captured.

To determine which of all those events are due to aircraft using Stansted Airport their ANOMS (Aircraft Noise Management System) 'noise to track' matching software compares all captured noise events with all Stansted 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 60 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 Stansted 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 60 dBA for a duration of at least 10 seconds was used.

The following information is recorded for each noise event: date, time, duration, L_{ASmax} 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.

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APPENDIX 3

GLOSSARY OF 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 Stansted 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).

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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 BAA 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, 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 62 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 Stansted 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.

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 is monitored

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, it is the Slow (S) time weighting that has been used, hence reference is made to L_{ASmax} and to L_{AS90} .

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APPENDIX 4

LIST OF AIRCRAFT IDENTIFICATION SOURCE CODES



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FACSIMILE: 01784 465447

List of Aircraft Identification Codes

100	Fokker 100
142	BAe 146-200
143	BAe 146-300
14Y	BAe 146-200 Freighter
14Z	BAe 146-300 Freighter
313	Airbus A310-300
318	Airbus A318
319	Airbus A319
320	Airbus A320
321	Airbus A321
332	Airbus A330-200
342	Airbus A340-200
343	Airbus A340-300
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
73G	Boeing 737-700
73H	Boeing 737-800 (winglets)
73W	Boeing 737-700 (winglets)
73Y	Boeing 737-300 Freighter
744	Boeing 747-400
74E	Boeing 747-400 Freighter
74L	Boeing 747SP
74X	Boeing 747-200 Freighter
74Y	Boeing 747-400 Freighter
752	Boeing 757-200
75F	Boeing 757-200 Freighter
762	Boeing 767-200
763	Boeing 767-300
76X	Boeing 767-200 Freighter
76Y	Boeing 767-300 Freighter
AB4	Airbus A300 (usually a Freighter)
AB6	Airbus A300-600
ABX	Airbus A300 Freighter
ABY	Airbus A300-600 Freighter
AF4	(Probably an A4F) = Antonov 124 very large freighter (Russian)
ANF	Antonov AN-12 Freighter
AR1	Avro RJ-100
AR8	Avro RJ-85
AT4	ATR-42
AT7	ATR-72
ATP	BAe ATP
BE2	Beech B200
C17	C17 Globemaster 4 engined large military freighter
C56	Cessna Citation 560 CGX = CCX = Global Express

CCJ	Bombardier Challenger
CCX	Bombardier Global Express
CGX	An old code no longer in use – should be CCX which is a Bombardier Global Express
CJ5	Cessna Citation Jet CL6 = Global Express Challenger 600 DF7 = Dassault Falcon 7x
CNJ	Cessna Citation
CR2	Bombardier CRJ-200
CR7	Canadair regional jet 700
CR9	Bombardier CRJ-900
D1C	DC10 (McDonnell Douglas)
D1Y	DC10 Freighter (McDonnell Douglas)
D8Y	DC8 (McDonnell Douglas Freighter 4 engined)
D38	Dornier 328
D93	DC9 (McDonnell Douglas DC9 -30)
DF2	Dassault Falcon (this covers various types) 76X= Boeing 767-200 Freighter 73C= Boeing 737-300 (winglets) G54= GS4 = Gulfstream IV = Gulfstream 4
DF3	Dassault Falcon 50/900
DH4	Dehavilland Dash 8-Q400
E90	Embraer 190
EM2	Embraer Brasillia
ER3	Embraer RJ-135
F50	Fokker 50
FRJ	Dornier 328 Jet
G52	GS2 = Gulfstream 2
G55	GS5 = Gulfstream 5
GRJ	Gulfstream II/III/IV/V
H25	Hawker HS-125
J31	BAe Jetstream 31
JET	Generic code used for small jet aircraft without a specific IATA code
LRJ	Bombardier Learjet 23/24/25/31/35/40/45/55/60
M1F	Boeing (McDonnell Douglas) MD11 Freighter
M11	McDonald Douglas MD11 (usually a freighter – Fedex)
M82	Boeing (McDonnell Douglas) MD82
M83	Boeing (McDonnell Douglas) MD83
M87	Boeing (McDonnell Douglas) MD87
M90	Boeing (McDonnell Douglas) MD90
PA2	Piper
PAT	Piper, Twin Propeller
S20	Saab 2000
TU5	Tupolev TU-154
YK2	Yak 42