Heathrow Community Noise and Track-keeping Report: Ickenham

This document reports on an 92-day period of continuous noise monitoring from the 1 August 2012 to the 31 October 2012 using a Larson Davies LD 870 sound monitor placed on farmland between Breakspear Road South and Harvil Road, Ickenham (positioned at 51° 34′ 10.35″ N, 0° 27′ 40.34″ W, 144 feet elevation). All timings are local.

Background

Heathrow Airport is committed to limiting the impacts of noise on communities around the Airport and publishes a Noise Action Plan in accordance with National and European Regulations. An objective of the plan is to better understand local noise concerns and priorities by establishing a Community Noise and Track Monitoring Programme. As part of this Programme, the Airport has agreed with local stakeholders, represented on the Noise and Track Keeping Working Group (NTKWG), that flight tracks and (where possible) noise levels affecting local communities would be examined through a series of 3-4 month studies. The studies are organised so that the noise and flight tracks are analysed over the monitoring period based on a 'grid' of local communities, defined and agreed with the NTKWG and shown below in Figure 1. The impact on the community within the grid square is then reported at the end of the monitoring period.

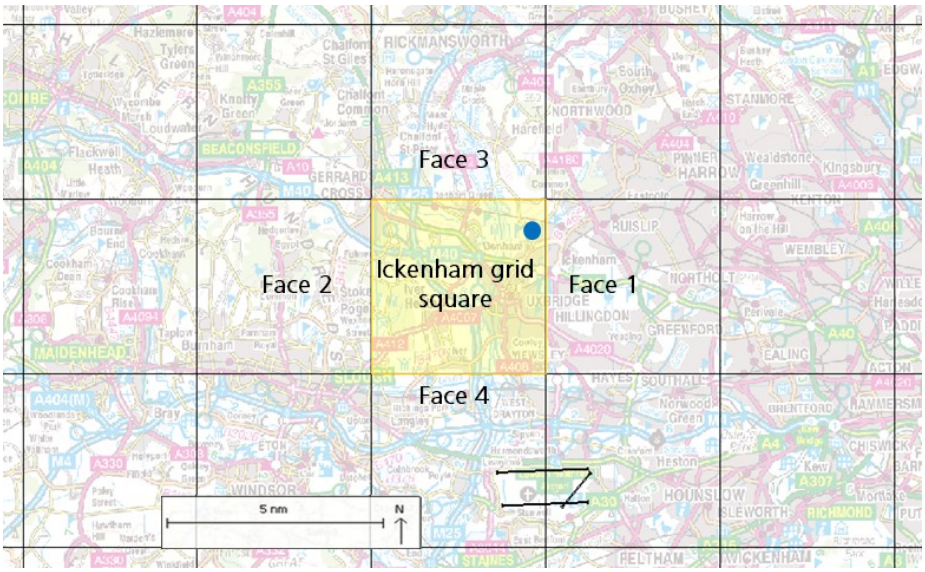

Figure 1. Map of the Heathrow area with noise monitoring grid; position of the noise monitor shown as a blue dot in the yellow shaded grid (the Ickenham community grid square area)

This report describes the noise levels and aircraft tracks affecting the 'Ickenham' grid square, shown above. Noise levels were recorded by a temporary noise monitor situated on farmland between Breakspear Road South and Harvil Road, Ickenham (position indicated by blue dot). Flight movements of air traffic through the grid square were derived from the Airport's noise and track-keeping system. Explanations of technical terms used in this report can be found on page 9.

The Ickenham grid is also overflown by aircraft arriving at and departing from RAF Northolt, and by helicopters following pre-defined routes that ensure their safe integration with aircraft from Heathrow. However, as the Community Noise reports only analyse Heathrow flights, both have been excluded from this report. The exception is a small number (5) of positioning flights which flew between Northolt and Heathrow during the monitoring period.

Flight movements

Operational background: Heathrow Airport operates in either a 'westerly' or 'easterly' direction as shown in Figure 2 on page 2. Westerly operations are typically operated when the wind comes from the west and, as a long-term annual average over 20 years, are in force for 71% of the time. Easterly operations, typically operated when the wind is in an easterly direction, are in force for the remaining 29% of the time. Shorter term fluctuations between westerly and easterly operations can vary considerably from this approximate long-term 70:30 split. During the daytime there is a preference for westerly operations. This means that during periods of light easterly winds the Airport operates in a westerly direction. This preference does not operate at night.

During westerly operations runway alternation is applied. This provides for one runway to be used for arrivals from 06:00 until 15:00 and the other runway to be used for arrivals from 15:00 until after the last departure of the day, after which landing aircraft use the first runway again until 06:00. The runway alternation pattern changes by week; in alternation pattern 1 (week commencing 2 January in 2012) the designated arrivals runway is 27R between 06:00-15:00 (Figure 2; 'Westerly operations - 1') and 27L between 15:00 and the last departure of the day (Figure 2; 'Westerly operations - 2'). In alternation pattern 2 this order is reversed.

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There is no runway alternation during the day on easterly operations due to the legacy of the Cranford Agreement, which prohibited departures from 09L, other than in limited circumstances. During easterly operations, therefore, the majority of departures use the southern runway, 09R, and the majority of arrivals tend to use the northern runway, 09L.

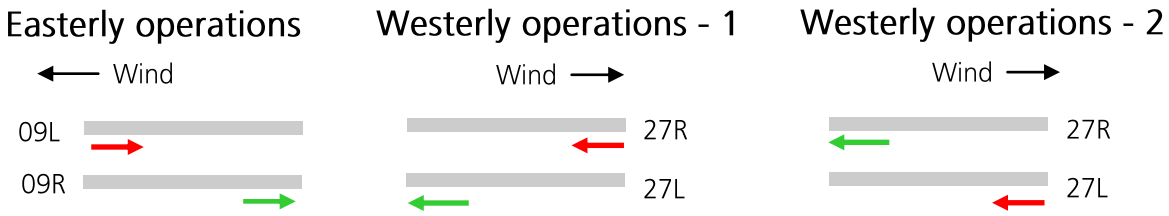


Figure 2. Illustration of the direction of easterly and westerly operations | Key: Departures → Arrivals →

Operations during the monitoring period: During the monitoring period Heathrow operated normally, handling a total of 121,007 air traffic movements (arrivals and departures) without interruption (e.g. airport closure due to meteorological activity or industrial action). Two significant events took place during the monitoring period (the Olympics and the Paralympics) however neither of these caused any significant disruption or changes to the daily flying schedule. In addition the second phase of Operational Freedoms was running during this monitoring period. During the monitoring period, westerly operations prevailed for 80% of the time - higher than the long term average. A total of 48,453 westerly arrivals and 48,497 westerly departures were recorded on the runway logs. Easterly operations were in place for the remaining 20% of the time and these accounted for 12,064 arrivals and 11,993 departures during the monitoring period.

Flight path information is derived from radar data using a flight monitor processing programme. A public version of this flight tracking software, 'WebTrak', is available on Heathrow Airport's noise website. During the monitoring period the flight monitor processing programme recorded 0.9% fewer flights than the runway logs due to technical reasons (see Additional Information on page 9). To track flights affecting the Ickenham grid square during the monitoring period, a series of monitoring 'gates' were set up on the faces of the grid square (as shown in Figure 1). The traffic count for aircraft passing through these 'faces' is given in Figure 3 (note that this table is cumulative and will count an aircraft each time it enters and exits the grid).

	Easterly				Westerly			
	Face 1 (E)	Face 2 (W)	Face 3 (N)	Face 4 (S)	Face 1 (E)	Face 2 (W)	Face 3 (N)	Face4 (S)
Arrivals	401	1155	863	43	443	11	442	42
Departures	0	0	0	0	22	93	83	25

Figure 3. Arrival and departure traffic through the faces of the grid square during the monitoring period (Face 1 – East, Face 2 – West, Face 3 – North, Face 4 – South)

Arrival flight paths: During easterly operations the grid is overflown by arriving aircraft that have left the Bovingdon and Lambourne stacks and started their approach to Heathrow's easterly runways. Aircraft from the Lambourne stack generally fly straight through the grid while those from the Bovingdon stack tend to be turning when overflying the grid. The tracks of these turning aircraft over the ground will be influenced by instructions from air traffic control, aircraft size, weight and airspeed, as well as external factors such as wind. Figure 4 overleaf shows the lateral distribution of arriving flight paths through the grid and the vertical distribution through Face 2 during easterly operations. The lateral distribution of flights shows that the majority of easterly arrivals from both stacks do not overfly the grid, and those that do tend to be concentrated in the northern half. During westerly operations the grid is overflown by arriving aircraft that have left the Bovingdon stack. Similar to easterly arrivals only a small proportion of westerly arrivals overfly the grid, and with the exception of go-arounds (see below), those that do are mainly concentrated in the north-east quadrant of the grid (see Figure 5 overleaf). The majority of arriving aircraft overfly the grid above 5,000 feet and 7,000 feet on easterly and westerly operations respectively. This reflects both the flight paths taken by aircraft arriving at Heathrow and the need for them to remain safely separated from departing traffic overflying neighbouring grids.

Departure flight paths: Very few departures overfly the grid during westerly operations as it is not located under any of Heathrow's Standard Instrument Departure (SID) routes. During the monitoring period over 90% of the departures that did overfly the grid were being vectored by ATC, either to avoid bad weather or because they had climbed above 4,000 feet and were no longer following the SID. No easterly departures overflew the grid during the monitoring period.

Go-arounds: The Ickenham grid square also experiences noise generated by aborted landings — or 'go-arounds'. During the monitoring period 38 of the 471 westerly arrivals overflying the grid were go-arounds. Another 17 go-arounds overflew the grid during easterly operations. Due to the proximity of the grid to Heathrow, and the arriving traffic above, the majority of the go-arounds overfly the grid between 2,000 and 4,000 feet.

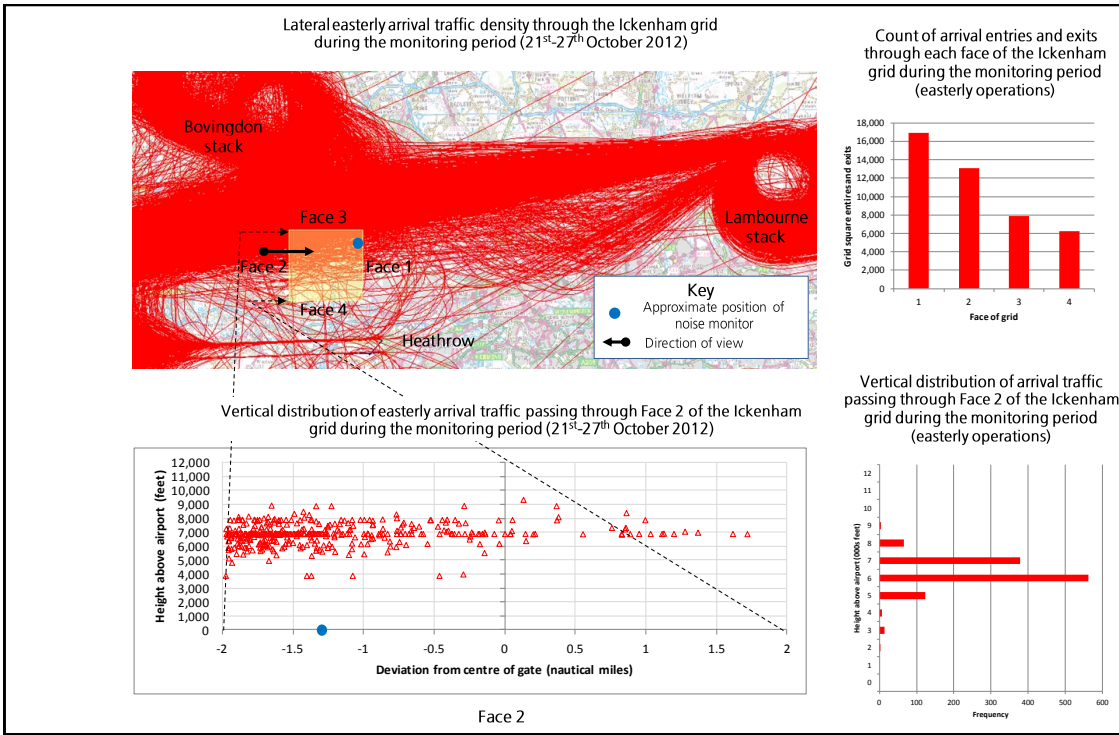


Figure 4. Lateral and vertical distribution of arriving air traffic passing through the Ickenham grid during the monitoring period (easterly operations) - representative sample (Heathrow flights only)

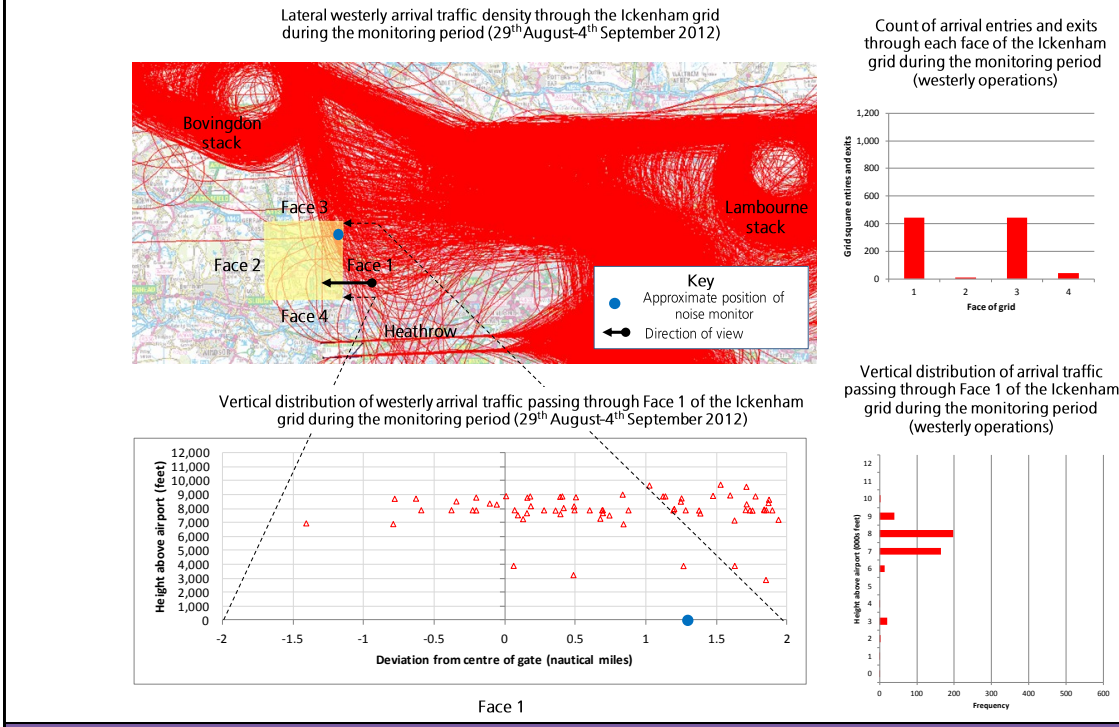
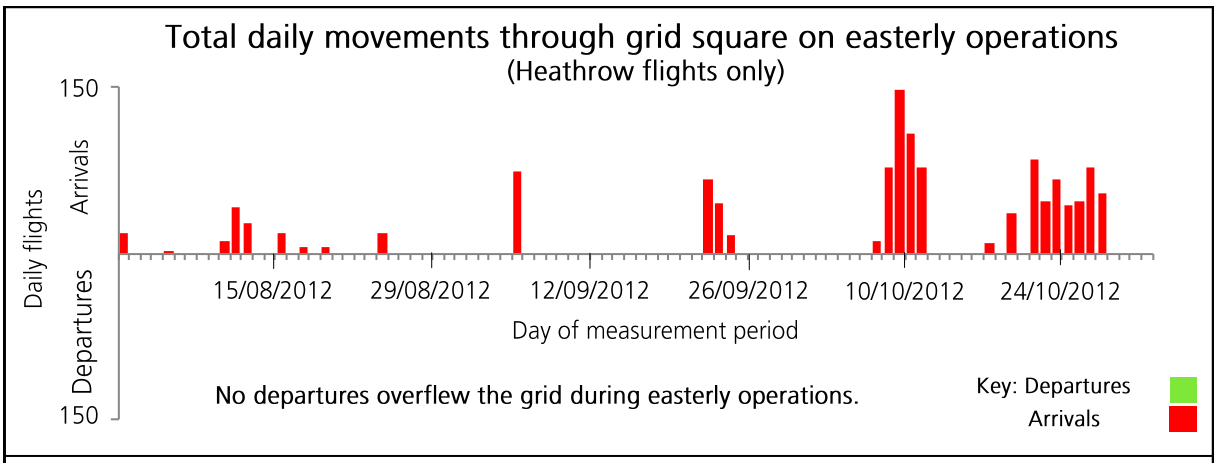
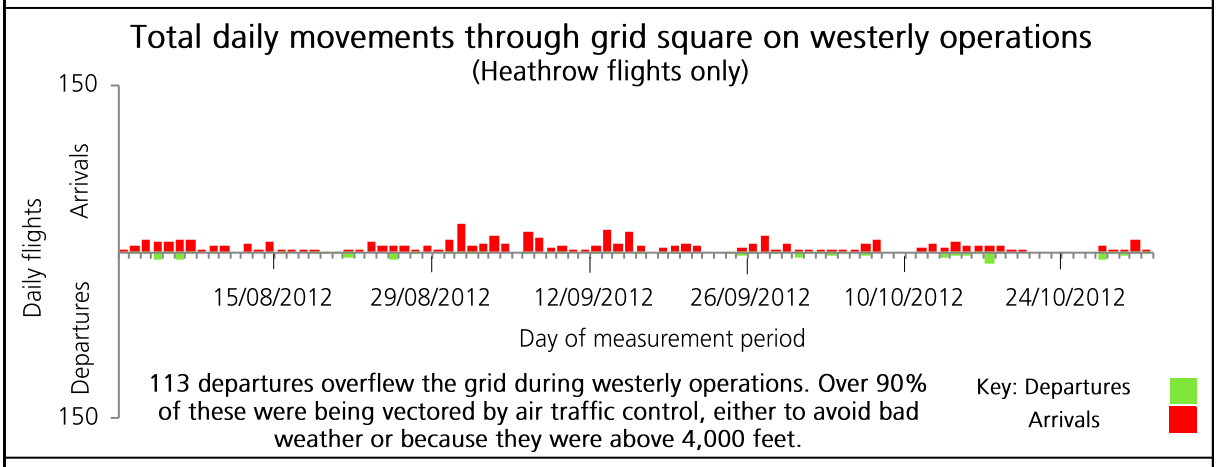
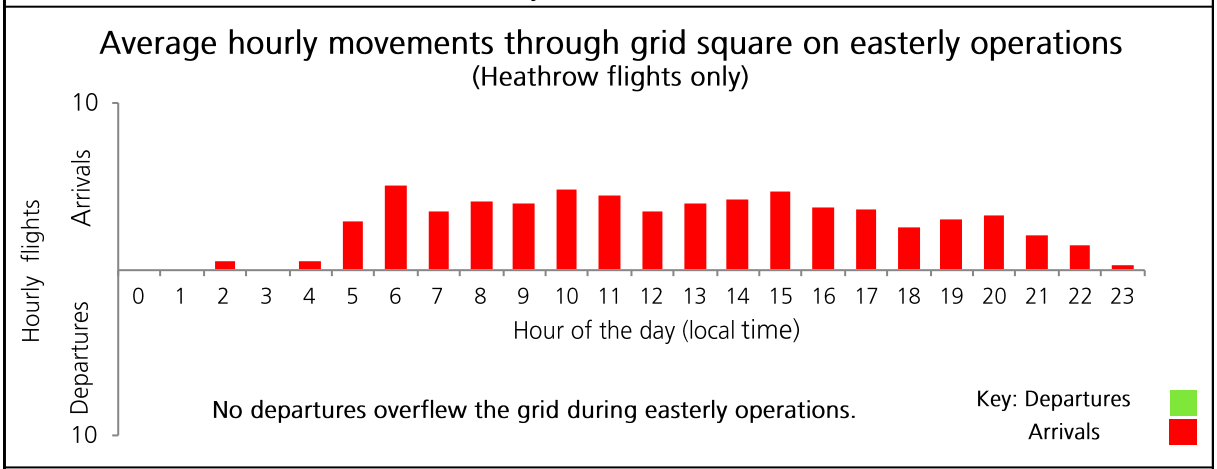


Figure 5. Lateral and vertical distribution of arriving air traffic passing through the Ickenham grid during the monitoring period (westerly operations) - representative sample (Heathrow flights only)

Figure 6 overleaf shows the proportion of aircraft that passed through the grid during the monitoring period by direction of runway operation and hour. Due to the position of the grid relative to the flight paths of arriving and departing aircraft only a small number of aircraft overfly the grid during westerly operations. The grid is overflown on a daily basis during westerly operations, but during the monitoring period there were no days where the grid was overflown throughout all of the main hours of operation. More arriving aircraft overfly the grid during the comparatively lower number of easterly days. On such days the grid will often be overflown throughout the main hours of operation. The number of easterly arrivals overflying the grid varies from hour to hour and day to day. This is because the majority of arriving aircraft from both the Bovingdon and Lambourne stacks do not overfly the grid.







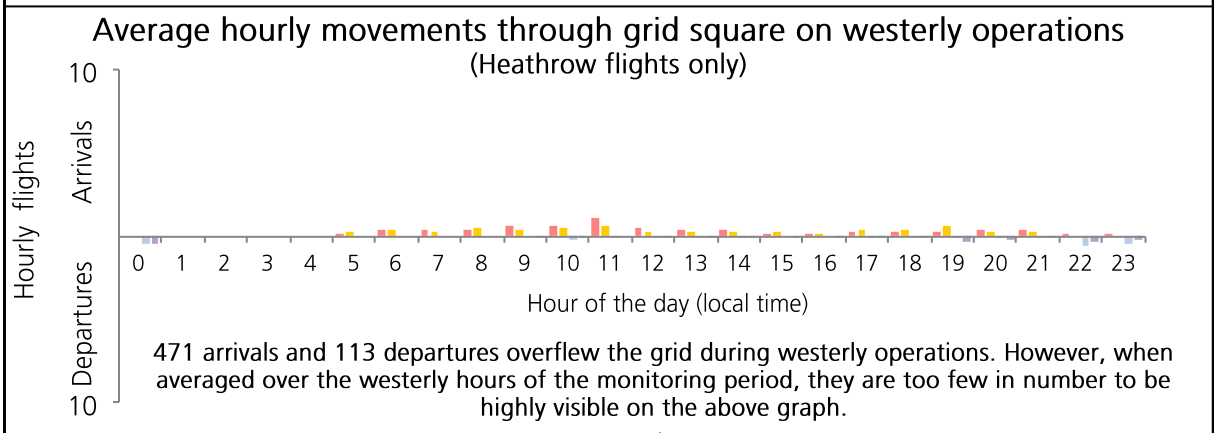


Figure 6. Daily movement totals and hourly mean averages for easterly and westerly operations through the grid square

Alternation pattern 1: Arrivals Departures
Alternation pattern 2: Arrivals Departures

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Noise — background noise

The ambient noise recorded by the monitor is generated by both aircraft and other background noise sources, including local road traffic, distant motorways and railway lines. In rural areas, the ambient level can be affected by noise sources such as farm machinery and bird song. In windy conditions, the noise generated by trees, crops and long grass can also affect the measured noise level.

Figure 7 demonstrates the average background noise level (L_{90}, dBA) recorded by the Ickenham monitor over a 24 hour period (black line). Figure 7 also shows the background noise level when separated by mode of operation, easterly or westerly; shown in two shades of orange. As can be seen, background noise levels are generally comparable for each mode of operation although, on average, slightly higher background noise levels were recorded during periods of westerly operation, when the prevailing wind direction would generally place the site downwind of the M25 and M40 motorways (and also the A40).

The overall trend in Figure 7 is largely in line with expected results; during the night-time period of 01:00-05:00 hours the average background noise level was less than 40 dBA, rising to over 45 dBA after 06:00 hours for the rest of the day until 23:00 hours. This broadly coincides with the daytime increase in overall road traffic levels. The graph also illustrates the large variation in hourly background noise level at the monitoring site; up to 15 dBA or more between the quietest and noisiest days. The overall noisiest day was Tuesday 16 October; a day with a moderate south-westerly wind, placing the site downwind of the M40 and A40. On that day, the monitor site would also have been downwind of the nearby Junction 1 of the M40 (where the motorway continues on as the A40). The quietest day was Monday 22 October; a day with a light north-easterly wind, placing the site upwind of the M40 and A40 (but downwind of the Chiltern Main Line railway).

Average hourly background L_{90} levels at the monitor

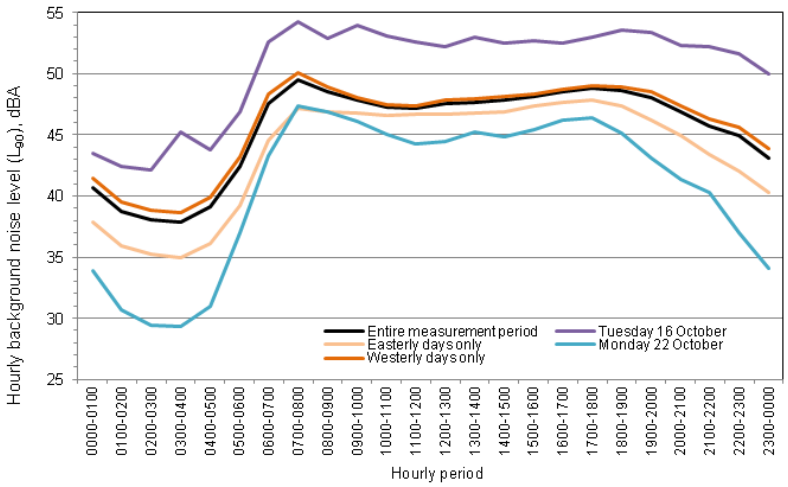

Figure 7. Hourly background L_{90} levels at the monitor averaged over 24 hour period; including Tuesday 16 October (noisiest day) and Monday 22 October (quietest day)

Noise — significant aircraft noise events

The noise and track keeping monitors are set up to record noise events above a pre-determined threshold level (i.e. aircraft generated noise above background - fully defined at the end of this report). This means that not every aircraft passing through the Ickenham grid square generates a noise event. During the monitoring period a total of 159 noise events from Heathrow operations were recorded (although not included in this analysis, it should be noted that aircraft from nearby RAF Northolt also passed through the Ickenham grid square during the monitoring period).

As indicated above, a very small number of aircraft noise events were recorded at the Ickenham site. This result is unsurprising given the monitor's location relative to the main arrival and departure routes (see page 2). Figure 8 provides a summary of aircraft noise events by operation and runway after filtering for bad weather (approximately 30% of noise events were rejected due to unacceptable weather conditions in accordance with international guidelines). Accounting for rejected events, 56 noise events were generated by westerly arrivals approaching runways 27L and 27R, and 29 noise events by easterly arrivals approaching 09L and 09R. Thus, a total of 85 arrival noise events were recorded at the Ickenham monitor after filtering for bad weather. Approximately 20% of the arrival noise events were generated by go-arounds. Of these, 13 were due to westerly arrivals and the remaining 5 due to easterly arrivals.

As the noise monitor was not located under any of Heathrow's departure routes, only a very small number of departure noise events were recorded at the Ickenham site – see Figure 8. Accounting for rejected events, 27 noise events were generated by westerly departures on runways 27L and 27R. There were no recorded noise events from easterly departures (as indicated on page 2, no easterly departures overflew the Ickenham grid square during the monitoring period).

Figure 9 indicates that medium-sized aircraft (e.g. the A320 family) and, to a lesser extent, the wide-bodied B747 and B777, dominate the overall number of arrival noise events due to the relatively high numbers of these types operating at Heathrow. As noted above, the location of the monitor relative to Heathrow's departure routes meant that only a very small number of departure noise events were recorded at the Ickenham site, the majority of which were caused by the wide-bodied A380, B747 and B777 aircraft (see Figure 9).

Figure 10 shows the average (mean) departure and arrival L_{Max} values recorded at the Ickenham monitor for each aircraft type. With the exception of the arrival result for the A320, the sample sizes are generally too small to make any meaningful conclusions from the measured data. However, despite the relatively large sample size (of 28) the result for the A320 on arrival should be treated with some caution and considered in light of the observation made below regarding the monitor threshold.

The overall distribution of noise (L_{Max}) for arrivals and departures is shown in Figure 11. Figure 12 indicates the trend in the noise distribution for arrivals and departures by time period (day, evening and night). However, with the possible exception of the arrival distribution in Figure 11, the sample sizes in each case are generally too small to make any meaningful conclusions from the measured data.

It is immediately apparent from Figure 11 that the distribution for arrivals appears skewed (asymmetrical) because it is truncated at the 56 dBA monitor threshold. The use of this threshold is explained further on page 9. The graph suggests a proportion of quieter arrival events were not recorded at the monitor, which would mean that the average measured arrival noise levels shown in Figure 10 (for the A320 at least) may be biased slightly upwards.

Departures (24% of total noise events)					Arrivals (76% of total noise events)				
09L	09R	27L	27R	Total	09L	09R	27L	27R	Total
0	0	12	15	27	27	2	21	35	85

Figure 8. Aircraft noise events by operation and runway following filtering for bad weather

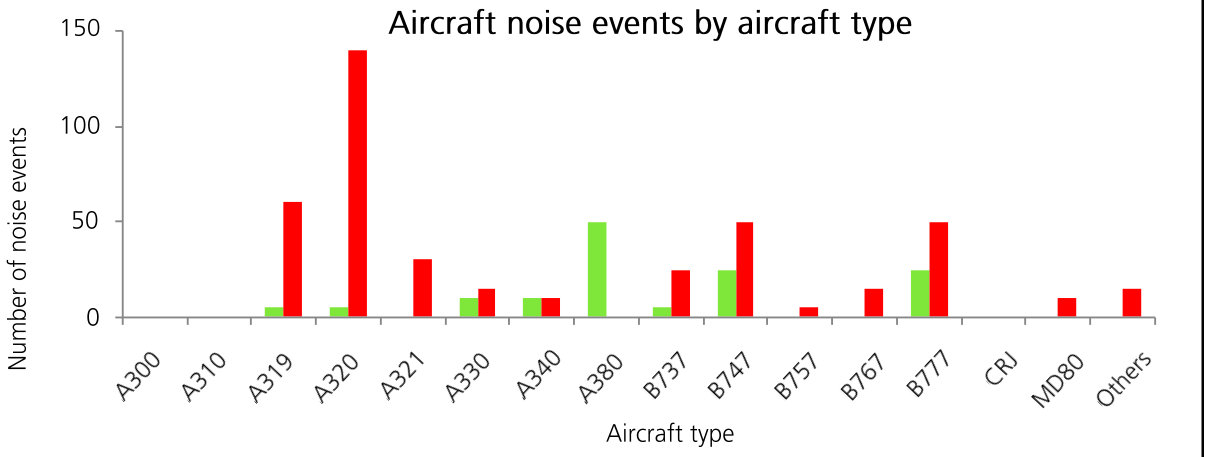

Figure 9. Number of departure and arrival aircraft noise events by aircraft type

Key: Departures Arrivals

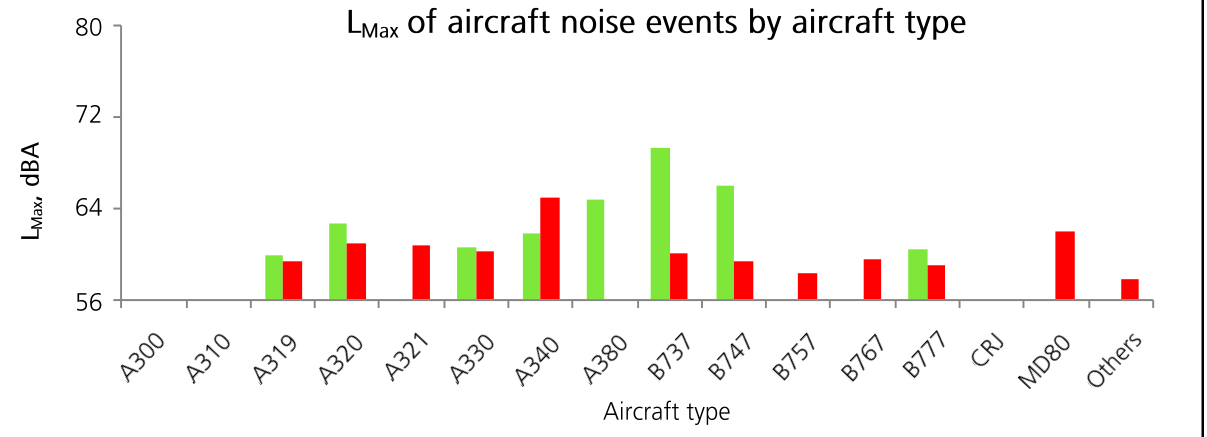

Figure 10. Average (mean) L_{Max} by aircraft type for departures and arrivals

Key: Departures Arrivals

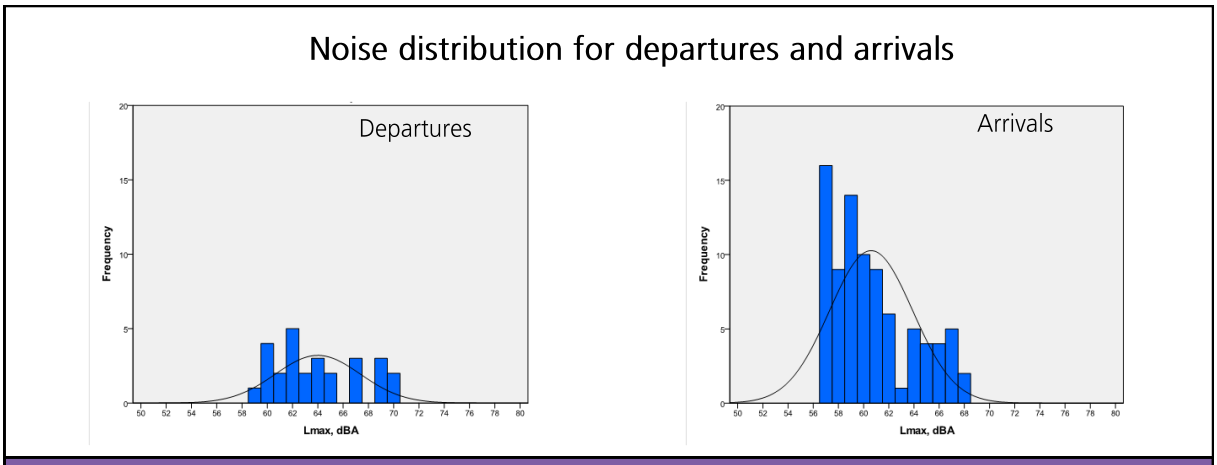

Figure 11. Above left: L_{Max} frequency distribution of departure noise levels
Above right: L_{Max} frequency distribution of arrival noise levels

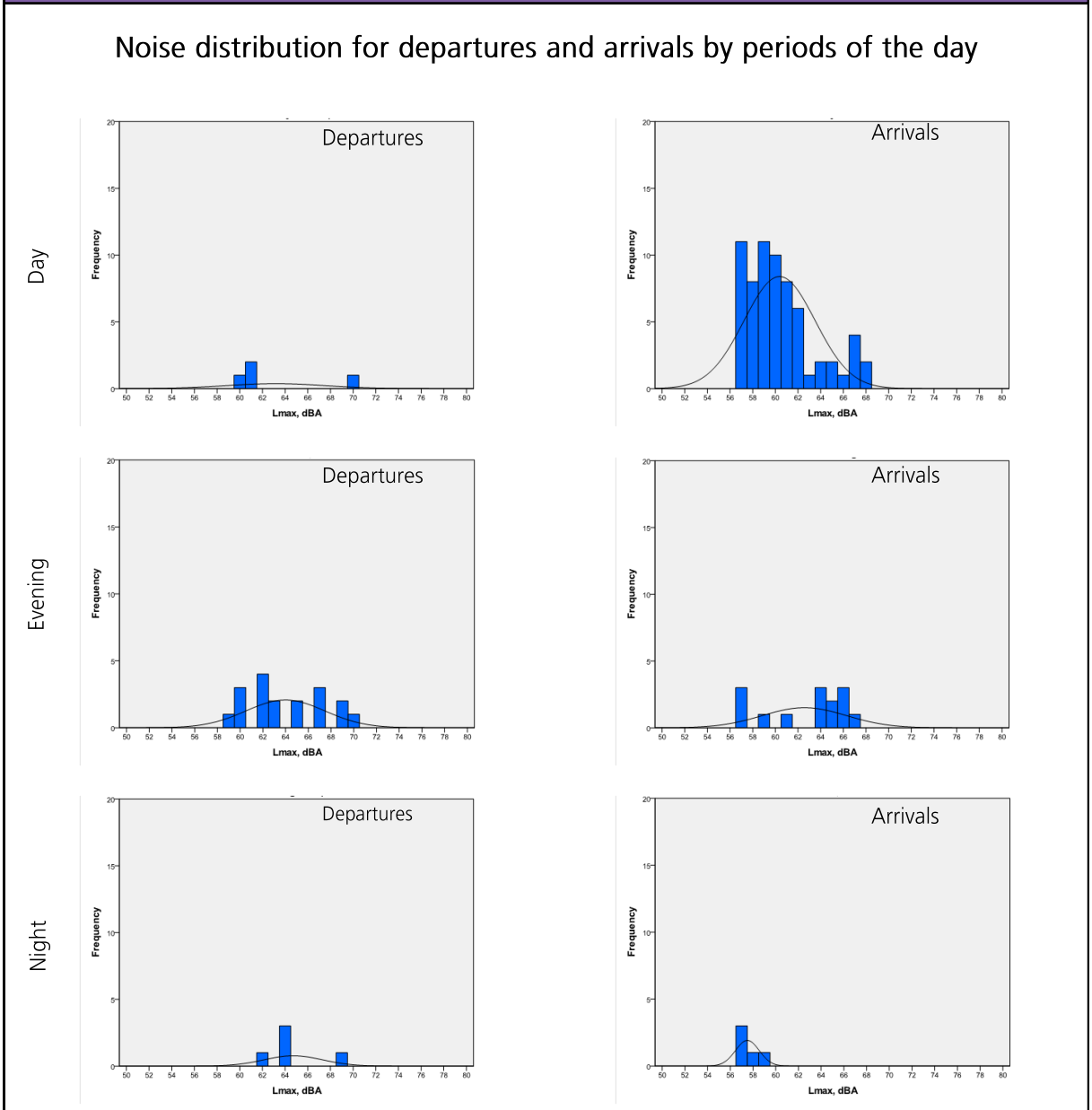

Figure 12. L_{Max} distribution of departure (left) and arrival (right) noise level recorded on the A-weighted sound level over the three averaging periods of L_{Max} (Day — 12 hour period 07:00-19:00), L_{Max} (Evening — 4 hour period 19:00-23:00) and L_{Max} (Night — 8 hour period 23:00-07:00)

Conclusions

This report describes the overflight and noise experience measured for the Ickenham grid square over a 92-day period from the 1 August to 31 October 2012. During the monitoring period the Ickenham grid square was overflown by a total of 1,821 Heathrow arrivals and departures. This number reflects the location of the grid relative to Heathrow's main arrival and departure routes. The Ickehnham grid is also overflown by aircraft arriving at and departing from RAF Northolt, however as the Community Noise reports only analyse Heathrow flights these were excluded.

During the monitoring period over 90% of aircraft overflying the Ickenham grid were arriving aircraft, typically at heights between 5,000 and 7,000 feet. The majority of arriving aircraft overflew the grid during easterly operations having left the Bovingdon and Lambourne stacks to start their approach to Heathrow. However, most of the aircraft leaving these stacks do not overfly the grid, and those that do are mainly concentrated in the northern half. During westerly operations the grid is overflown by arriving aircraft that have left the Bovingdon stack. Again only a small proportion of aircraft from this stack overfly the grid and those that do tend to be concentrated in the north-east quadrant. The Ickenham grid also experiences noise generated by aborted landings ('go-arounds') which typically overfly the grid between 2,000 and 4,000 feet. During the monitoring period approximately 8% of the westerly arrivals overflying the grid were 'go-arounds'.

During the monitoring period less than 120 departing aircraft overflew the grid, all during westerly operations. Approximately 90% of these were being vectored by ATC, either to avoid bad weather or because they had climbed above 4,000 feet and were no longer following the SID route.

More aircraft overfly the grid during the comparatively lower number of easterly days, but as the majority of arriving aircraft from both the Bovingdon and Lambourne stacks do not overfly the grid, the number will vary from hour to hour and day to day. The grid is overflown on a daily basis during westerly operations, but during the monitoring period there were no westerly days where the grid was overflown throughout all of the main hours of operation.

The profile of background noise levels throughout the day at the Ickenham noise monitoring site broadly reflect overall road traffic levels. On days of westerly operations the Ickenham site is generally downwind of the M25, M40 and A40 motorways/roads and consequently experiences slightly more background noise than on days of easterly operations.

A very small number of noise events were recorded at the Ickenham site, the majority by arriving aircraft (approximately 20% of the noise events generated by arrivals were due to go-arounds). This is unsurprising given the monitor's location relative to the main arrival and departure routes. The majority of significant aircraft noise events generated by arriving aircraft were by medium-sized aircraft (e.g. the A320 family) and, to a lesser extent, the wide-bodied B747 and B777, which reflects the traffic mix at Heathrow. For departing aircraft very few noise events were recorded. The very small number of noise events meant that it was not possible to make a meaningful conclusions about the L_{Max} of the noise events generated per aircraft type or their distribution during the day, evening and night.

The results of the Ickenham monitoring period represent a snapshot of the track and noise impact. The results generated are broadly what might be expected in the future as the freedoms used during this period as part of Operational Freedoms Phase 2 did not impact on the flights in this grid square.

As part of this programme we hope to return to this grid square in the future to conduct further community noise monitoring.

Additional information

References

- Heathrow Airport, Noise Action Plan 2010-2015 http://www.heathrowairport.com/noise
- Department for Transport — Heathrow Noise Contours https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/3933/heathrow-2011-report.pdf
- Operational Freedoms at Heathrow http://www.heathrowairport.com/noise
- South East Airports Task Force http://assets.dft.gov.uk/publications/south-east-airports-taskforce-report/south-east-airports-taskforce-report.pdf

Explanation of terms used:

- Noise can be defined as unwanted sound. Sound in air can be considered as the propagation of energy through the air in the form of oscillatory changes in pressure. The size of the pressure changes in acoustic waves is quantified on a logarithmic decibel (dB) scale, firstly because the range of audible sound pressures is very great and secondly because the loudness function of the human auditory system is approximately logarithmic. The dynamic range of the auditory system is generally taken to be 0 dB to 140 dB. The additional noise from two sources producing the same sound pressure level, will lead to an increase of 3 dB. A 3 dB noise change is generally considered to be just noticeable, a 5 dB change is generally considered to be clearly discernible and a 10 dB change is generally accepted as leading to the subjective impression of a doubling or halving of loudness. 'A-weighting' accounts for the acoustic sensitivity of the human ear to a range of sound levels. Its application to dB produces the 'dBA' scale.
- The L_{Max} value is the maximum value that the A-weighted sound pressure level reaches during a given measurement period of time. For the measurement of aircraft noise, it is usual practice to measure L_{Max} using the sound level meter's slow (S) response setting.
- L_{90} is the noise level exceeded for 90% of the measurement period and is used to quantify the background level of noise.
- A trial of 'Operational Freedoms' started at Heathrow on 1 November 2011, to explore if the runways and the airspace around the airport can be used in a more efficient and flexible way. The trial took place in two phases, the first from 1 November 2011 to 29 February 2012, the second from 1 July 2012 to 28 February 2013. This trial is a recommendation of the Government's South East Airport Taskforce which was set up in 2010 to look at how to make London's airports 'better, not bigger'. The trial looked at whether new procedures can be used to bring benefits to the local community through less late-running flights; to passengers, by providing a more punctual service; and to the environment, by reducing aircraft stacking times and reducing emissions. This trial will not result in an increase in the number of flights operating into or out of Heathrow.

Noise monitoring details:

- To ensure that as far as possible only genuine aircraft noise 'events' are measured (i.e. noise peaks caused by aircraft movement), the noise monitors are set up to record noise events above a pre-determined threshold level. The Ickenham monitor was set with a threshold of 56 dBA, meaning that noise events below 56 dBA L_{Max} were not recorded by the monitor (Note, the choice of monitor threshold does not affect the measurement of L_{90}). The choice of threshold level is often a compromise between (i) losing a proportion of quieter aircraft events and (ii) recording a large number of spurious non-aircraft events. At locations such as Ickenham, where the background noise level is frequently varying (for example, due to road traffic noise or railway noise), it becomes difficult to select an appropriate threshold level that is low enough to capture a suitable number of lower-level aircraft noise events, but high enough to ensure that extraneous noise is not recorded. Despite the relatively low threshold of 56 dBA, the results shown in Figure 11 indicate that a proportion of quieter arrival events could still not be recorded at the monitor site. This meant that, unavoidably, the average measured noise levels for the majority of aircraft types at this location may be biased slightly upwards.
- Approximately 30% of all measurements were rejected due to unacceptable weather conditions, i.e. wind speeds greater than 10 m/s or during periods of precipitation (in accordance with recommended international guidance on aircraft noise monitoring).

Differences between the runway logs and the flight monitor processing programme

- Occasionally and infrequently felling of radar plots occurs. This happens when the number of radar returns captured by the radar for monitoring purposes, exceeds its capacity. Consequently some of the radar returns are dropped. The NTKWG are aware of this and Heathrow Flight Performance log these instances.

Report prepared for Heathrow Airport by Helios and the CAA. For further information please visit the Heathrow Airport noise website www.heathrowairport.com/noise; alternatively please contact the Heathrow noise action line (on 0800 344 844) or Heathrow Flight Performance directly (Second Floor Meridian, The Compass Centre, Nelson Road, Heathrow Airport, Hounslow, TW6 2GW, UK).