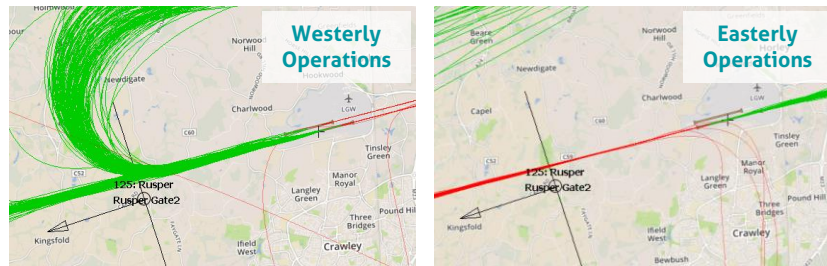


# Community Noise Information Report Rusper

1<sup>st</sup> April – 31<sup>st</sup> August 2019

Rusper lies approximately 5km to the west of Gatwick Airport. Due to the prevailing wind, the area is affected by westerly departures approximately 75% of the time and easterly arrivals for the remainder.

A mobile noise monitoring terminal (NMT) was installed by Gatwick Airport near Rusper in 2014. This report presents an analysis of both operational and noise data over a period between 1<sup>st</sup> April and 31<sup>st</sup> August 2019, together with operational data from the equivalent period in 2015 for comparison.



The report is set out as follows:

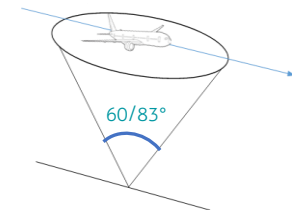
- **Section 2 – Summary** presenting key findings from Sections 3 & 4.
- **Section 3 – Operations and Trends** provides an overview of how the airport and aircraft have operated during the monitoring period. This analysis has been performed by drawing an imaginary 2D plane in space (the analysis gate) centred on the noise monitor and recording the position and details of any flight that passes through the gate. As flight track data have been collected for many years in the airport's noise and track-keeping (NTK) system, it has been possible to analyse and compare data collected in 2019 with the equivalent period during the previous

four years. Since Cowden is close to both easterly departures and westerly arrivals, this section has two parts.

- **Section 4 – Noise Monitor Data** presents an analysis of aircraft noise event and overall community noise levels as measured at the noise monitor. Noise data are analysed only for the monitoring period. Comparison with a historic period is not possible as monitoring has not previously taken place at the same location.
- **Section 5 – Appendix** presents information related to the pre-processing of the noise monitor data. A number of noise events are excluded from the analysis; the appendix details how many events have been excluded and the corresponding reasons.

**Overhead aircraft** – At various points in this report, reference is made to overhead aircraft. Defining whether an aircraft is overhead or not is a subjective matter however in February 2017 the CAA published guidance ([CAP 1498](#)) recommending the use of an imaginary cone over the receiver with an apex of 60 or 83 degrees as shown below.

Flights are considered overhead if the aircraft pass within cone above the noise monitor



If an aircraft passes within this cone, it is deemed overhead. Wherever this report refers to overhead aircraft, the 83° cone has been used.

## Operations and the community

Rusper is affected by departures on westerly operations and arrivals on easterly operations. The 10-year average suggests that approximately 74% of operations out of Gatwick are westerly.

On days of 100% westerly operations in 2019, 443 departures, on average, pass near Rusper; an 8% increase on 2015. On days of 100% easterly operations in 2019, 423 arrivals, on average pass near Rusper; a 7% increase on 2015.

There has been a slight change in the concentration of aircraft near Rusper on westerly operations with the main concentration of flights heading north moving approximately 200m to the north. The concentration of flights on easterly operations has not changed.

During daytime hours (07:00-23:00) on westerly operations, there are between approximately 13 and 30 departures passing near Rusper each hour. On easterly operations, there are between approximately 19 and 26 arrivals passing to the north of Rusper each hour. During night-time hours (23:00-07:00), there is, on average, 44 movements through the gate on westerly operations and 62 on easterly operations.

In 2019, departing aircraft on westerly operations are on average passing over Rusper at 2,500ft; approximately 2% lower compared to 2015. Arriving aircraft on easterly operations pass over Rusper at 1,000ft; this has not changed over the last 5 years.

## Noise levels in the community based on measurements at Rusper noise monitor

The vast majority (~98%) of noise events recorded at the Rusper noise monitor are from departing aircraft on westerly operations. The remainder are from arriving aircraft on easterly operations. Approximately 3% of noise events are recorded from overhead aircraft.

During days of 100% westerly operations, there were, on average, 332 aircraft noise events recorded per day. During days of 100% easterly operations there was an average of 11 aircraft noise events per day.

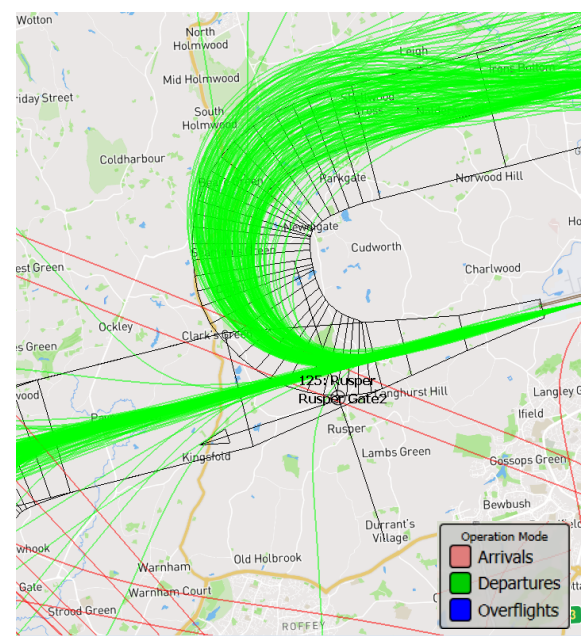
Based upon aircraft passing overhead (on westerly deaprtures), the B777 and A330 are the loudest aircraft types at Rusper. The average levels of the remaining common aircraft types are generally within 2-3dB of each other

Whilst on westerly operations, there are, on average around 25 aircraft noise events recorded between 06:00 and 07:00. This generally decreases through the day however the number of louder events ( $>70\text{dB } L_{A\text{Max}}$ ) reaches a maximum between 11:00 and 12:00. This is reflective of the greater proportion of larger aircraft operating in this hour.

The direction of operation at the airport has an affect on the overall average noise levels (from all sources) at the Rusper noise monitor. The average day time level ( $L_{Aeq,16hr}$ ) is 58dB on westerly operations and 54dB on easterly operations. The average night-time level ( $L_{Aeq,8hr}$ ) is 51dB on westerly operations and 49dB on easterly operations.

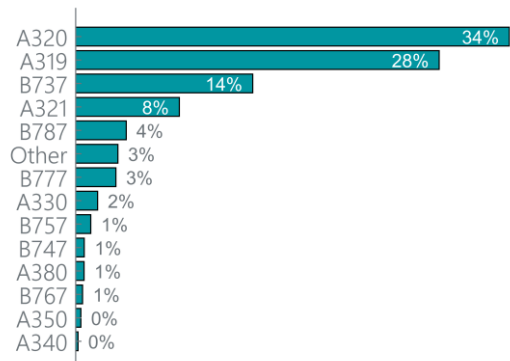
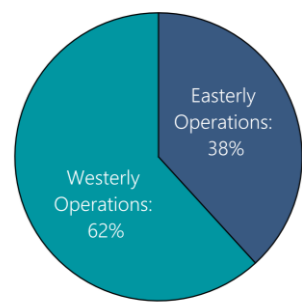
# Overview of Flight Track Data Westerly Operations

Dates of analysis:  
1st April – 31st August 2015 & 2019

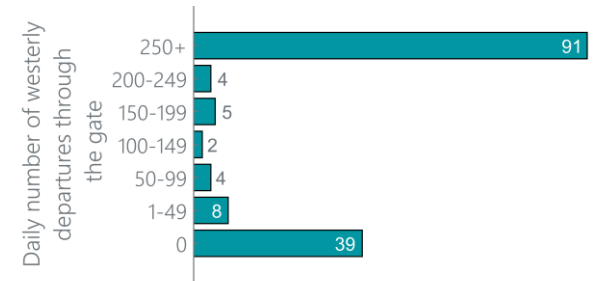


Position of gate and an example day of arrival and departure aircraft tracks in the vicinity of Rusper during westerly operations

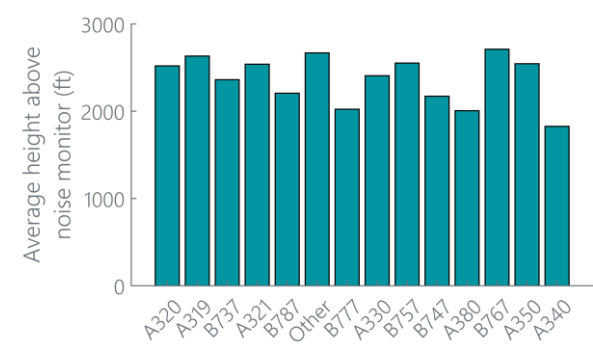
Total **132,330** operations into Gatwick



Proportion of aircraft types passing through the gate



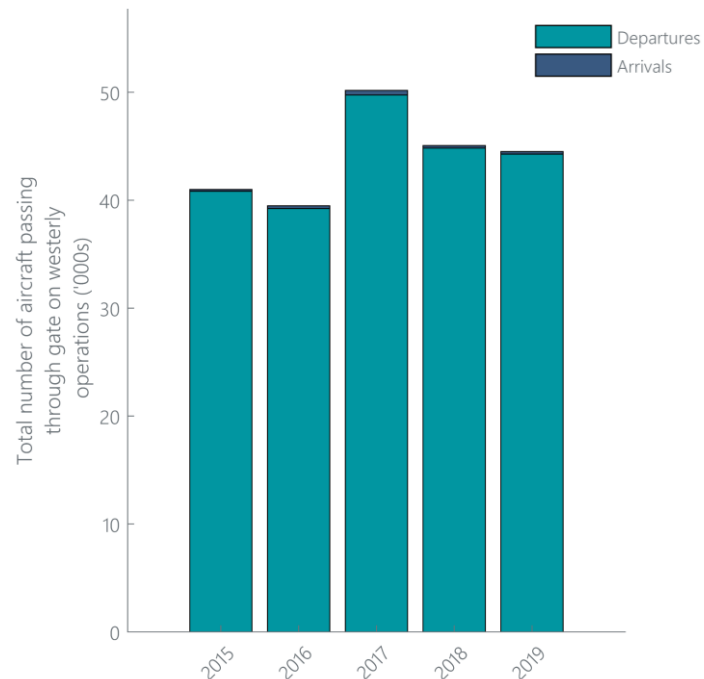
Number of westerly departures per day (24hr period) passing through the gate (153 days in total)



Average height of departing aircraft as they pass through the gate

# How many aircraft pass through the gate on westerly operations?

- The figure to the right shows the total number of movements that passed through the gate (on westerly operations) in the period from 1<sup>st</sup> April to 31<sup>st</sup> August from 2015 to 2019.
- Whilst on westerly operations, between around 40,000 and 50,000 movements passed through the gate during the monitoring period each year. The vast majority of these operations were departures passing approximately 1km to the north of the noise monitor.
- Since Rusper is relatively close to the airport, year to year changes can be attributed to fluctuations in the proportion of westerly operations (determined by wind direction) and total numbers of movements operating into the airport.
- Route usage would not affect these figures since all westerly routes pass through the gate at this location.
- In 2017, there was an unusually high proportion of westerly operations which is reflected in the greater number of movements through the gate.
- The table indicates that the proportion of westerly operations in the 2015 period was 71%, in 2019 62%. The 10 year average runway split is 74% westerly/26% easterly.
- On a day of 100% westerly operations;
  - There was an 8% increase in departures through the gate in the 2019 period compared to 2015, this corresponds to a overall increase in traffic operating in Gatwick over the same period.
  - However, the number of departures passing overhead at the monitor has decreased by more than a quarter over the same period (as indicated by the numbers in parentheses).

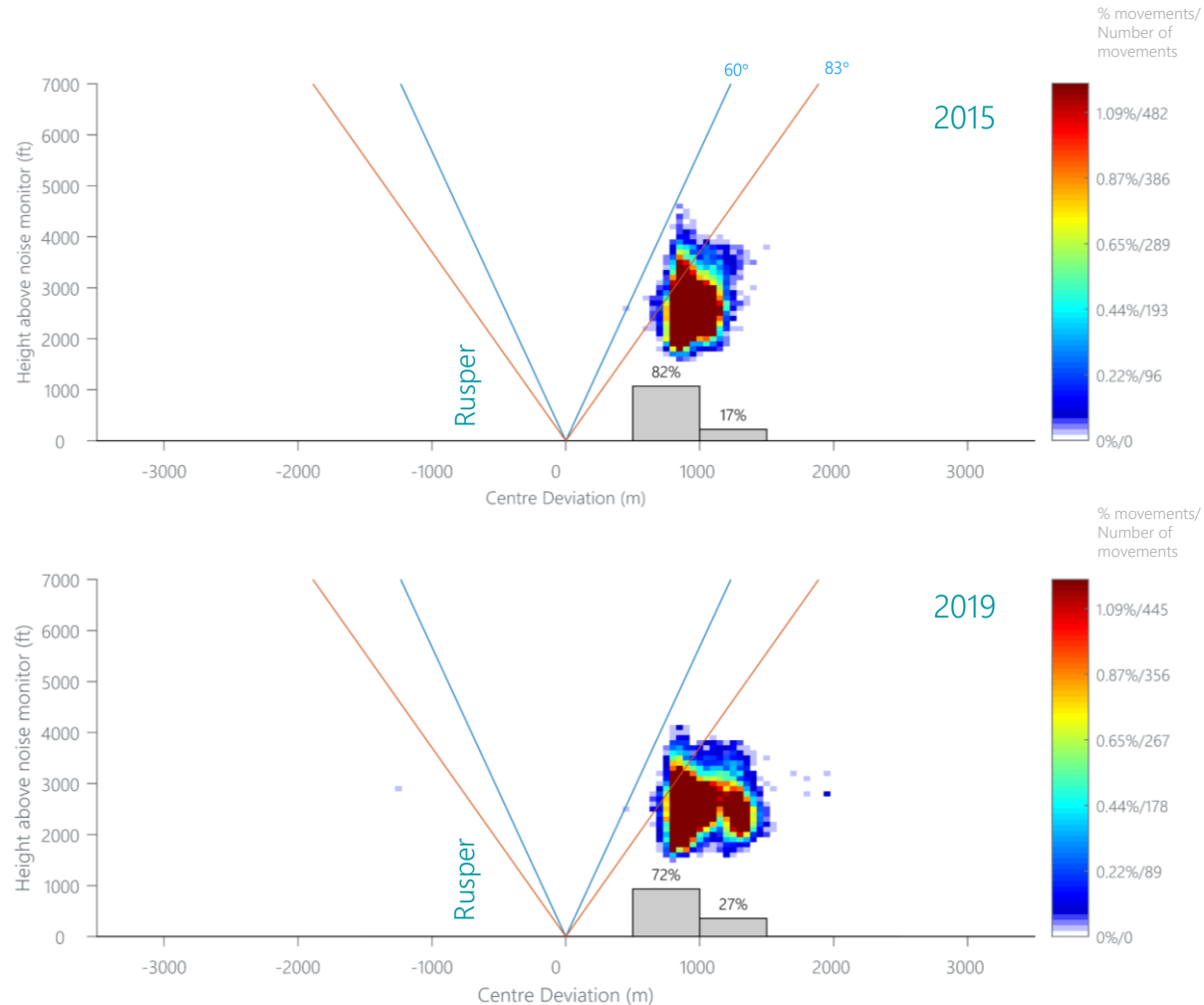


	2015	2019	Change	Change (%)
Proportion of westerly operations (all Gatwick flights)	71%	62%	-9%	N/A
Average number of westerly departures passing through the gate during days of 100% westerly operations.	409 (25)*	443 (18)*	+35 (-7)	+8% (-28%)

\* Figures in parentheses indicate the number of flights passing through the 83° overhead cone.

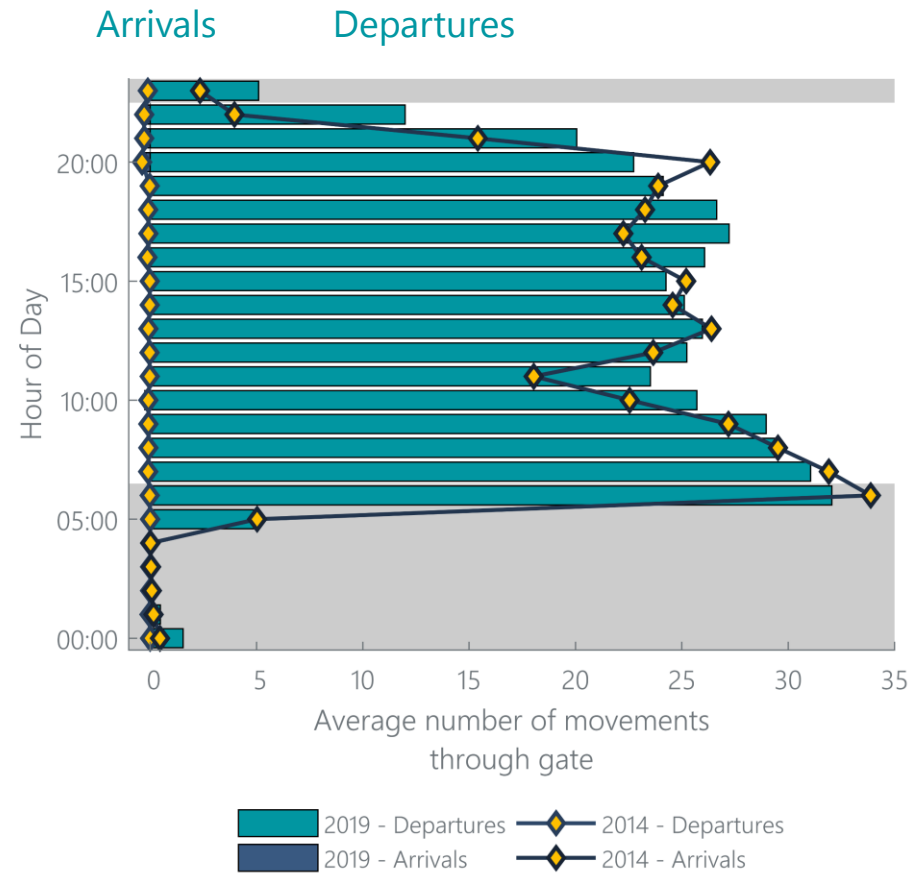
# How concentrated are aircraft as they pass through the gate on westerly operations?

- The figures to the right are heat maps showing the 2D concentrations of departing aircraft as they pass through the gate during the 2015 (the upper figure) and 2019 (the lower figure) monitoring period.
- The image should be interpreted by the reader imagining themselves facing in a west-south-west direction (in the direction of the arrow on the map on Page 4).
- In addition, the concentration at different distances from the centre along the length of the gate is shown by the grey bars.
- The gate has been designed to be approximately perpendicular to the westerly departure paths.
- In 2015, almost all the routes passed through a swathe with the main concentration of flights between 600 and 1400m north of the noise monitor.
- In 2019, there are two distinct centres of concentration, with the routes heading north moving approximately 200m to the north.
- The overall effect is that the flights are distributed over a wider area and are slightly less concentrated in 2019 compared to 2015.



# How does the number of flights over the area vary across the day on westerly operations?

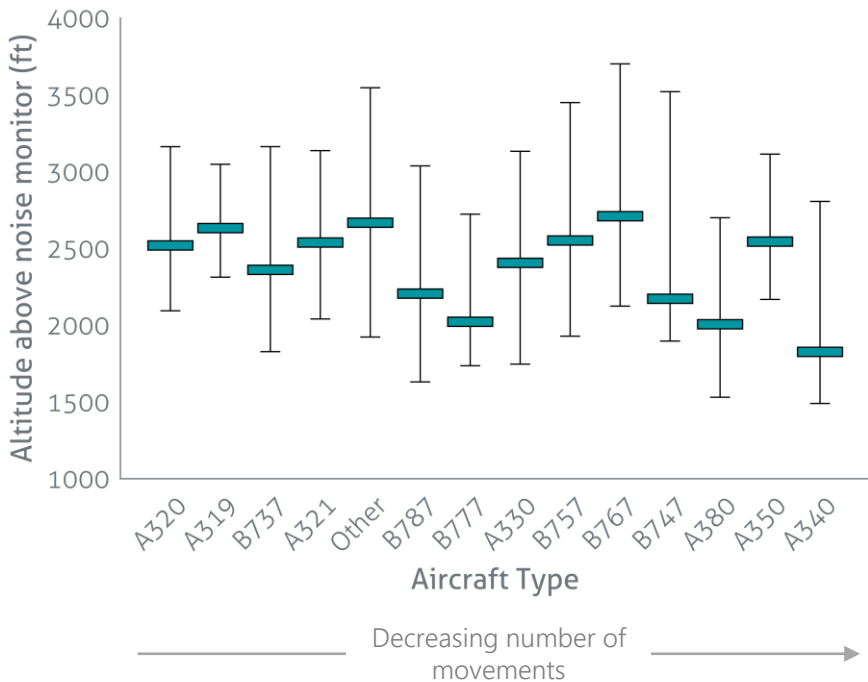
- The figures to the right present the average number of departures through the gate per hour in 2015 and 2019 during days of 100% westerly operations
- The figure shows that the first movements through the gate are between 05:00 and 06:00; in 2015, there were on average 5 movements per day in this hour. This did not change in 2019.
- During daytime hours (07:00 -23:00), there are, on average, between 13 and 30 departures through the gate.
- In both years, the busiest hours are between 06:00 and 10:00. The maximum was 34 movements an hour between 06:00 and 07:00; this reduced slightly in 2019.
- The hour between 11:00 and 12:00 was relatively quiet with an average of 17 movements through the gate in 2015. In 2019, this had increased to 23.
- The period between 21:00 and midnight was busier in 2019 compared to 2015 with an average of 37 movements passing through the gate compared to 22 in 2019.
- During night-time hours (23:00- 07:00), there was, on average, a total of 44 events passing through the gate; most of these occur in the hour 06:00-07:00.
- Of the total 153 days in the 2019 monitoring period, 61 days (40%) were 100% westerly operations and 37 days (24%) were on 100% easterly operations. The remainder had a mixture of easterly and westerly operations as the wind direction changed during the day.



# What is the altitude of aircraft as they pass through the gate on westerly operations?

- The table to the right presents the average height of departing aircraft above Rusper as they pass through the gate on westerly operations.
- This indicates that departing aircraft above Rusper were, on average, 50ft (~2%) lower in 2019 compared to 2015.
- The figure presents the average altitude of the departing aircraft passing through the gate on westerly operations along with the corresponding 5<sup>th</sup> and 95<sup>th</sup> percentile\*.
- It shows that, on average, the A340, a quad engine aircraft, is the lowest aircraft over Rusper at 1,630ft however, it should be noted that A340s do not operate regularly at Gatwick. Along with the A380 and B747, quad engine aircraft comprise three of the four lowest aircraft types.
- The A320 family (A319, A320 and A321) which constitute the majority of movements at the airport generally fall between 2,200ft and 2,400ft.
- The range of aircraft altitudes above Rusper on westerly departures is generally from 1,600ft to 4,000ft.

	2015	2019	Difference
Average height of departures through the gate on westerly operations	2,550ft	2,500ft	-50ft

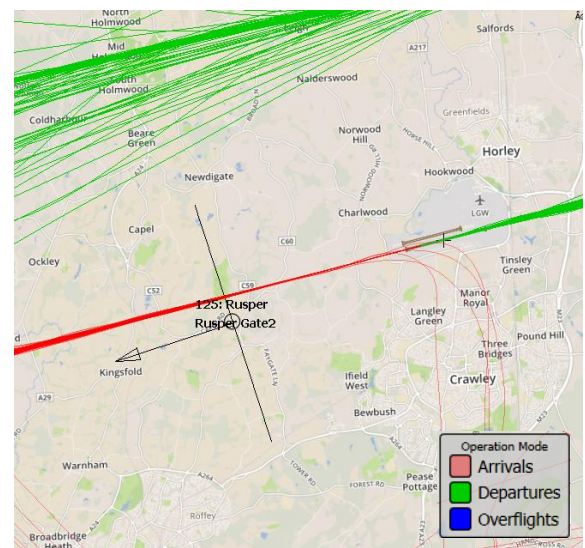


\* A percentile is a measure which indicates the value below which a given percentage of observations fall. In this case, the 5<sup>th</sup> percentile indicates the altitude under which 5 percent of movements of a given aircraft type would fly through the gate.



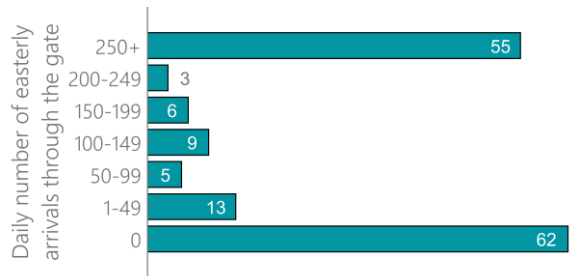
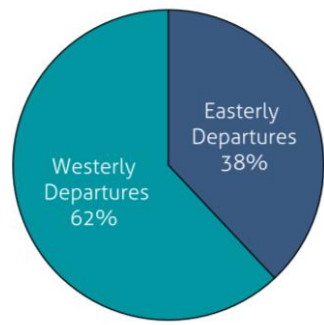
# Overview of Flight Track Data Easterly Operations

Dates of analysis:  
1st April – 31st August 2015 & 2019

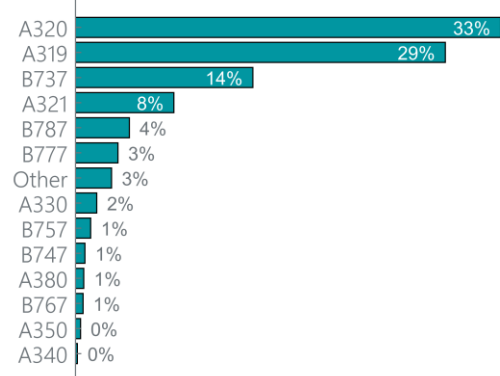


Position of gate and example day of arrival and departure aircraft tracks in the vicinity of Rusper easterly operations

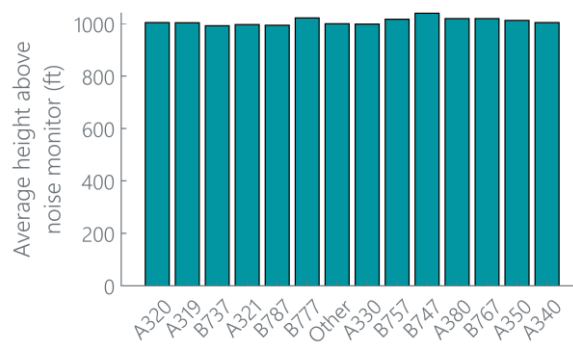
Total **66,160** departures from Gatwick



Number of easterly arrivals per day passing through the gate (153 days in total)



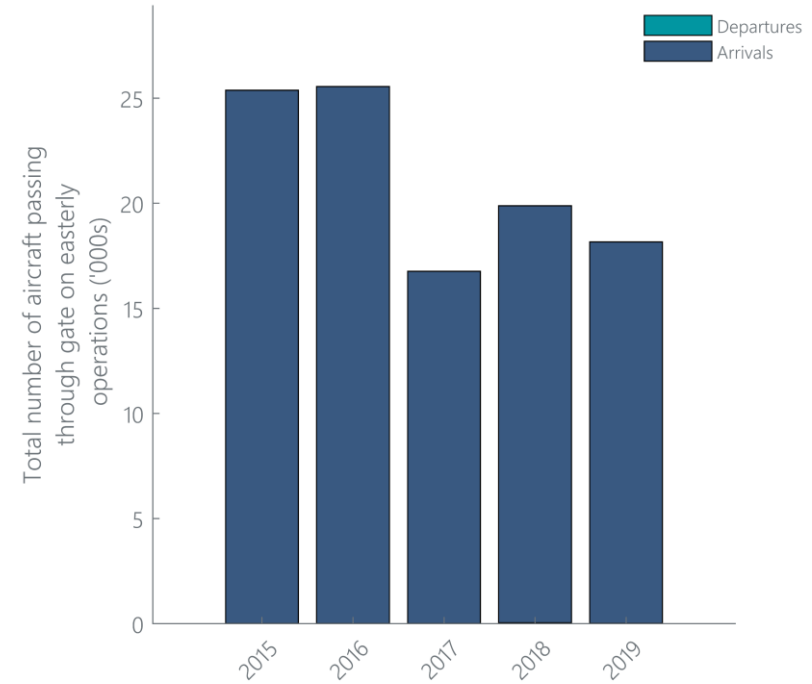
Proportion of aircraft types passing through the gate



Average height of arriving aircraft as they pass through the gate

# How many aircraft pass through the gate on easterly operations?

- The figure to the right shows the total number of movements that passed through the gate (on easterly operations) in the period from 1<sup>st</sup> April to 31<sup>st</sup> August from 2015 to 2019.
- Whilst on easterly operations, between around 16,000 and 25,000 movements passed through the gate during the monitoring period each year. The vast majority of these operations are arrivals passing approximately 1km to the north of the noise monitor.
- Since all arrivals on easterly operations pass through the gate, year to year changes can be attributed to fluctuations in the proportion of easterly operations (determined by wind direction) and total numbers of movements operating into the airport.
- The table indicates that the proportion of westerly operations in the 2015 period was 29%, in 2019 38%.
- On a day of 100% easterly operations;
  - There was an 7% increase in departures through the gate in the 2019 period compared to 2015.
  - However, almost none of the arrival aircraft passed directly over the monitor (as indicated by the numbers in parentheses).

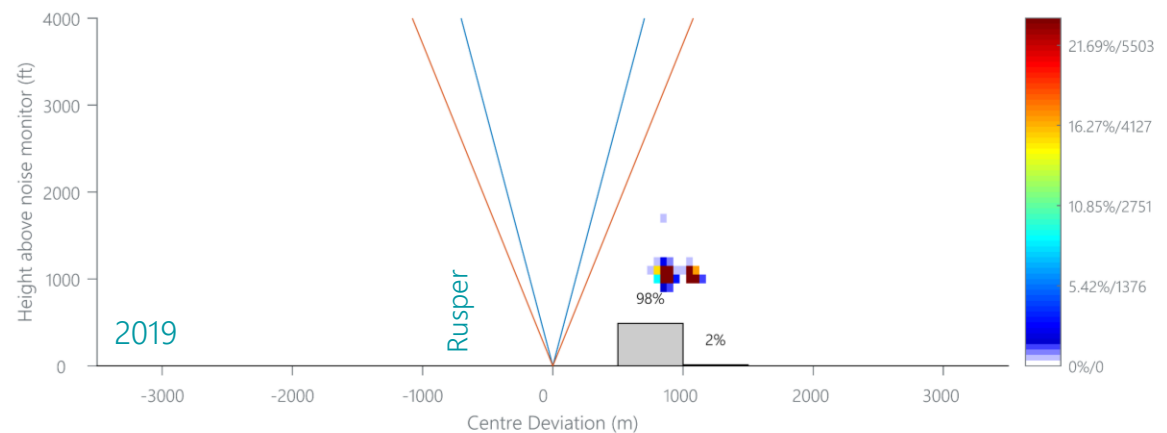
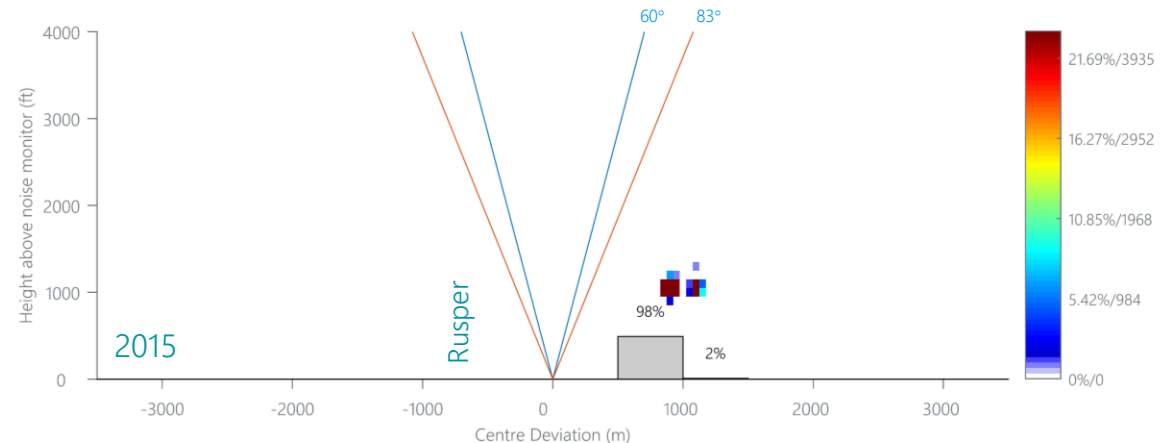


	2015	2019	Change	Change (%)
Proportion of easterly operations (all Gatwick flights)	29%	38%	+9%	N/A
Average number of easterly arrivals passing through the gate during days of 100% easterly operations.	394 (<1)*	423 (<1)*	+29 (-)*	+7% (-)*

\* Overhead aircraft as determined by the 83° cone described on Page 2

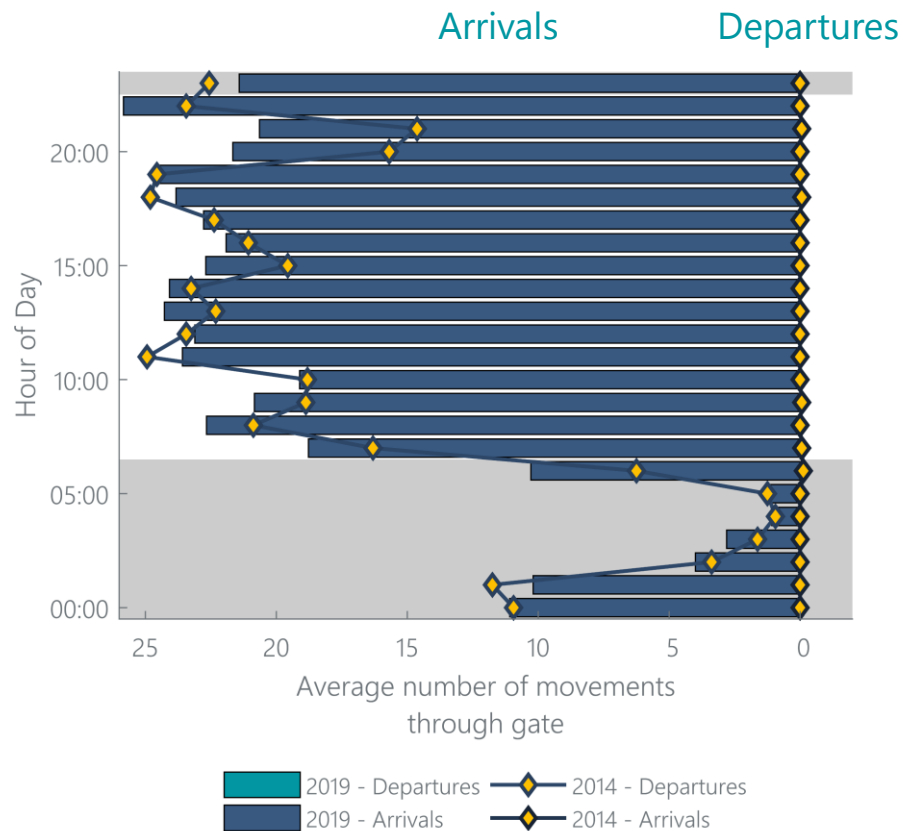
# How concentrated are aircraft as they pass through the gate on easterly operations?

- The figures to the right are heat maps showing the 2D concentrations of departing aircraft as they pass through the gate during the 2015 (the upper figure) and 2019 (the lower figure) monitoring period.
- The image should be interpreted by the reader imagining themselves facing in a west-south-west direction (in the direction of the arrow on the map on Page 9).
- In addition, the concentration at different distances from the centre along the length of the gate is shown by the grey bars.
- The gate has been designed to be approximately perpendicular to the easterly arrivals path.
- In both 2015 and 2019, the arrival paths pass through the gate approximately 1km north of the noise monitor at an altitude of approximately 1000ft.
- There is no significant difference in the position of the arrival paths between 2015 and 2019. This would be expected since the arrival path should be in line with the runways and most aircraft should be on the 3 degree glideslope on approach to the airport.
- A small number (~2%) of arrivals used the northern runway (08L) during the monitoring period. These movements are indicated by the cluster of flights on the right, north of the main swathe.



# How does the number of flights over the area vary across the day on easterly operations?

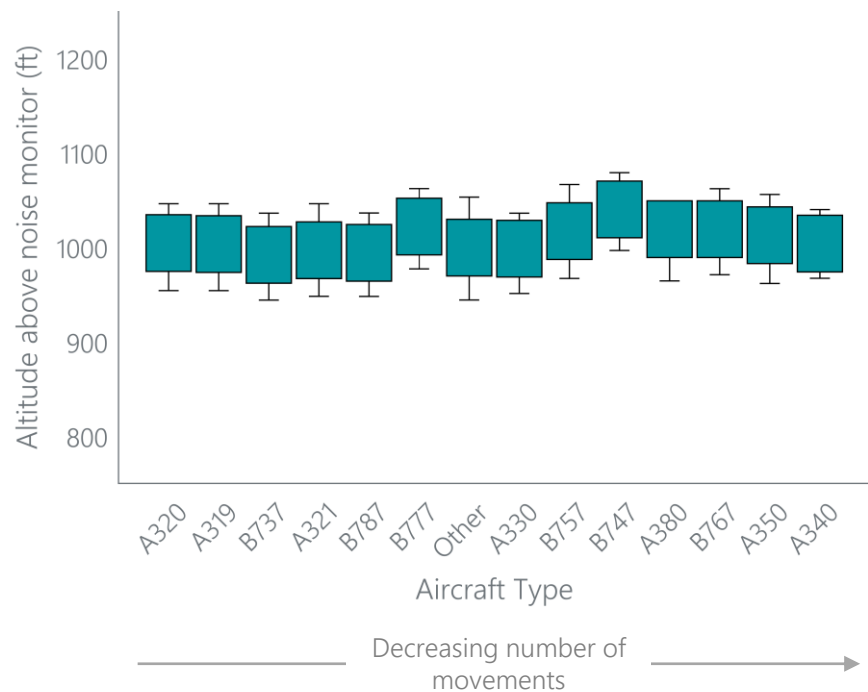
- The figures to the right present the average number of departures through the gate per hour in 2015 and 2019 during days of 100% easterly operations
- The figure shows that during daytime hours (07:00 – 23:00) there are between 19 and 26 arrivals passing through the gate in each hour.
- In 2019, the busiest hour was between 22:00 and 23:00.
- There is at least one arrival passing through gate in each hour during the night period with the quietest period falling between 04:00 and 06:00.
- The table on Page 10 showed that there were, on average, 29 extra arrivals passing through the gate on a day of easterly operation in 2019 compared to 2015. About half of these additional movements occurred between 20:00 and 23:00 while the remainder were spread across the day.
- During the night period (23:00- 07:00), there was, on average, a total of 62 events passing through the gate.
- Of the total 153 days in the 2019 monitoring period, 61 days (40%) were 100% westerly operations and 37 days (24%) were on 100% easterly operations. The remainder had a mixture of easterly and westerly operations as the wind direction changed during the day.



# What is the altitude of aircraft as they pass through the gate on easterly operations?

- The table to the right presents the average height of arriving aircraft above Rusper as they pass through the gate on easterly operations.
- This indicates that the altitude of arriving aircraft near Rusper is on average 1,000ft and has not changed between 2015 and 2019.
- The figure presents the average altitude of the arriving aircraft passing through the gate on westerly operations along with the corresponding 5<sup>th</sup> and 95<sup>th</sup> percentile\*.
- Since most aircraft will have joined the Instrument Landing System (ILS) which provides pilots with horizontal and vertical guidance on approach, the range of altitudes and differences between aircraft types is relatively small.
- The difference between the 5<sup>th</sup> and 95<sup>th</sup> percentile for each aircraft type is generally less than 100ft.

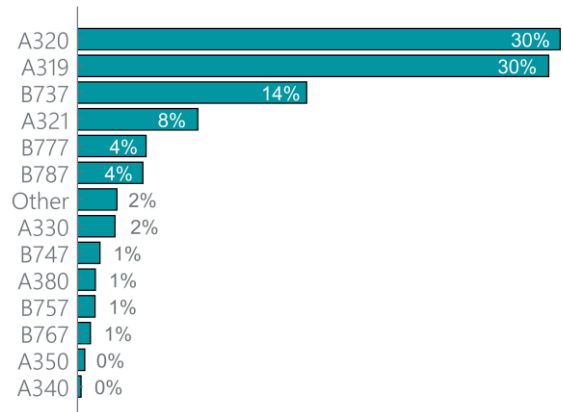
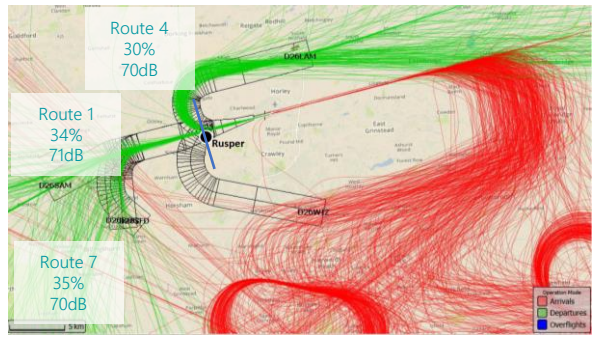
	2015	2019	Difference
Average height of arrivals through the gate on easterly operations	1,000ft	1,000ft	-



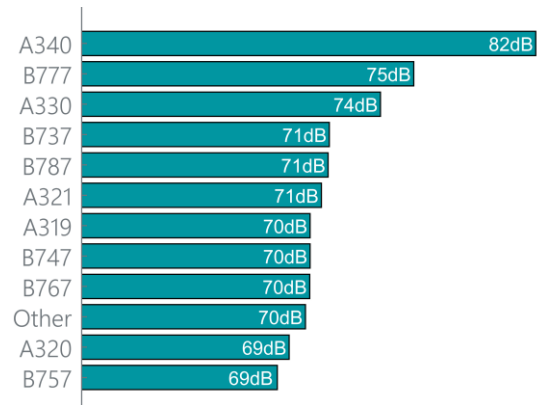
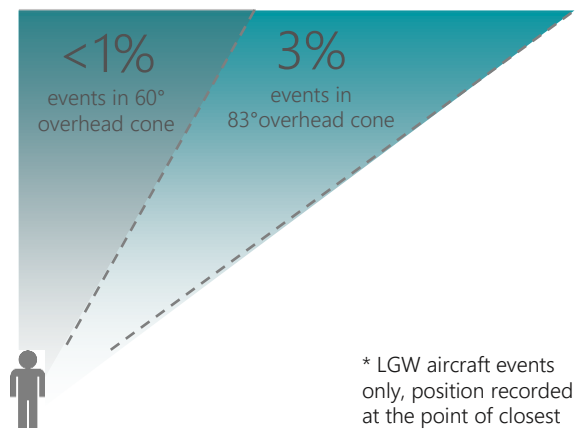
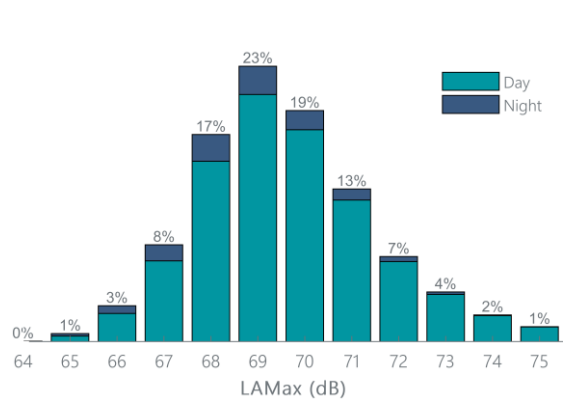
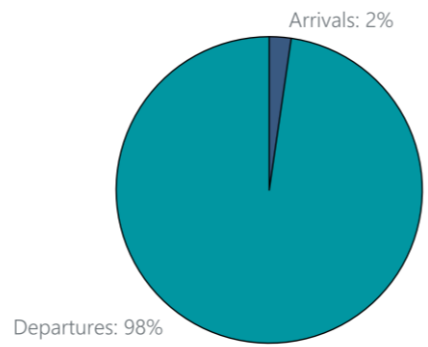
\* A percentile is a measure which indicates the value below which a given percentage of observations fall. In this case, the 5<sup>th</sup> percentile indicates the altitude under which 5 percent of movements of a given aircraft type would fly through the gate.

# Overview of Noise Monitor Data

Dates of analysis:  
1st April – 31st August 2019

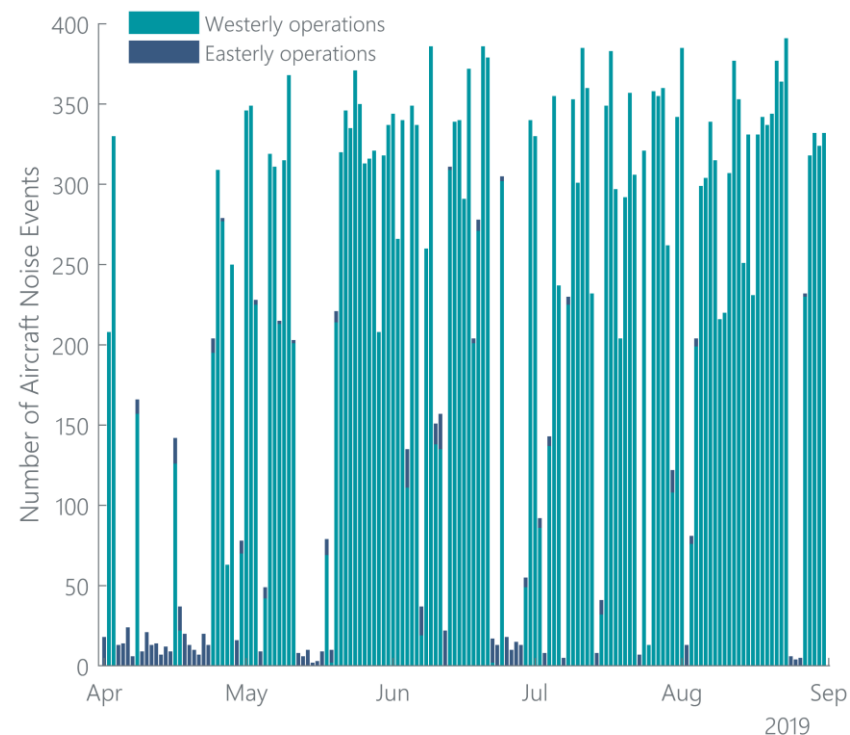


31,040 Aircraft Noise Events



# How does wind direction affect the number of aircraft noise events?

- An aircraft noise event is recorded when the noise level at the noise monitor exceeds a pre-determined threshold for a given duration and can be matched to a passing aircraft. In this case the threshold set at 60dB.
- The vast majority of noise events recorded at the monitor are caused by aircraft operating into Gatwick are almost entirely during periods of westerly operations.
- During the monitoring period, 61 of the 153 days (40%) were 100% westerly operations and 37 days (24%) were on 100% easterly operations. The remainder had a mixture of easterly and westerly operations as the wind direction changed during the day.
- During days of 100% westerly operations, there were, on average, 332 aircraft noise events triggered per day.
- During days of 100% easterly operations there was an average of 11 aircraft noise events per day.
- 3% of measured aircraft noise events were recorded by aircraft passing within the 83° overhead cone.
- In April 2019, there was a high proportion of easterly days resulting in less than 2,500 events being registered. In contrast, there was a high proportion of westerly operations in August 2019 during which more than 8,200 aircraft noise were measured.
- It is noted that an absence of aircraft noise events does not mean that aircraft would not necessarily be audible or even visible. There may be aircraft further away that are audible but have not triggered the noise event detection threshold.

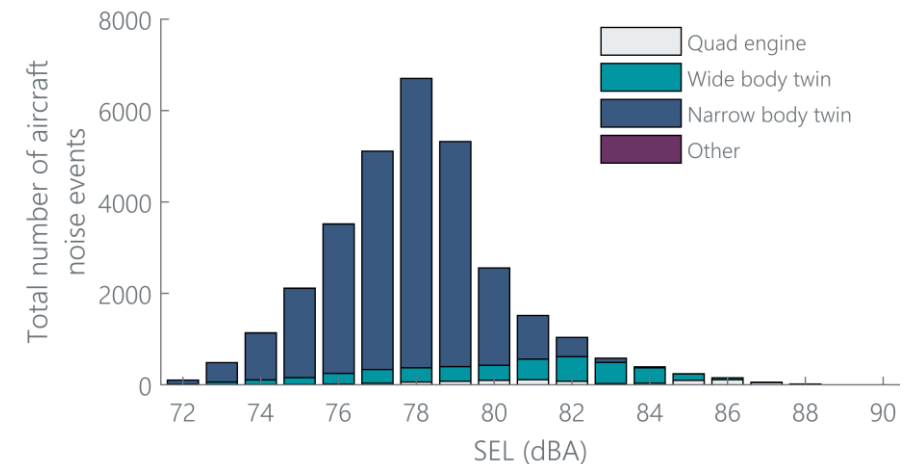
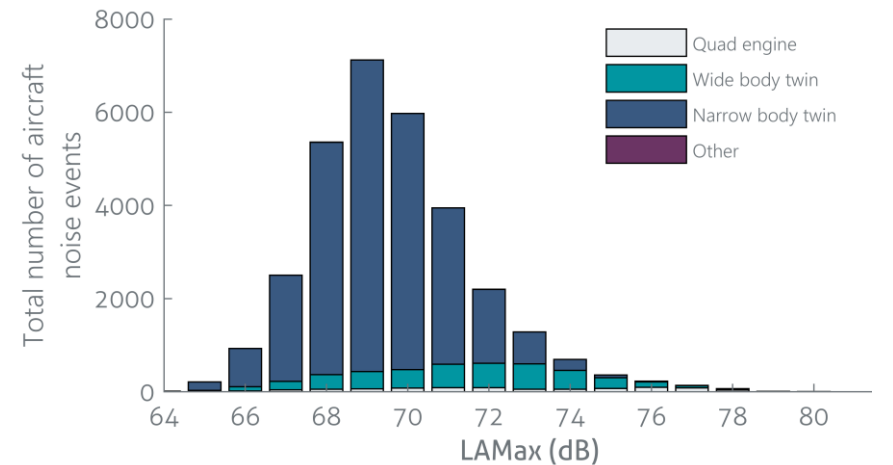


# What are the noise levels of measured aircraft noise events?

- The figures to the right present the range of  $L_{Amax}$  (top) and SEL (bottom) noise levels for all aircraft noise events measured at the Rusper monitor. An explanation of metrics is given in Appendix B on Page 22.
- The table below presents the average\*  $L_{Amax}$  and SEL for each aircraft type group.
- The average  $L_{Amax}$  and SEL of all aircraft events are 70.1 and 78.5 dB respectively. The distribution of the noise levels is dependent on aircraft size with the larger aircraft generally recording louder events with the exception of the large twin engine aircraft being a little quieter than the medium twin engine aircraft.

Aircraft group	Average $L_{Amax}$	Average SEL, dBA
Quad engine	73.1	82.4
Wide body twin engine	71.8	80.6
Narrow body twin engine	69.8	78.1
Other	69.7	77.8

- As this analysis considers ALL events measured at this monitor regardless of distance or route these results cannot be used to compare the relative noise levels of aircraft types. An analysis of aircraft type noise levels is presented on Page 17.





# What are the average noise levels of different aircraft types?

$L_{Amax}$

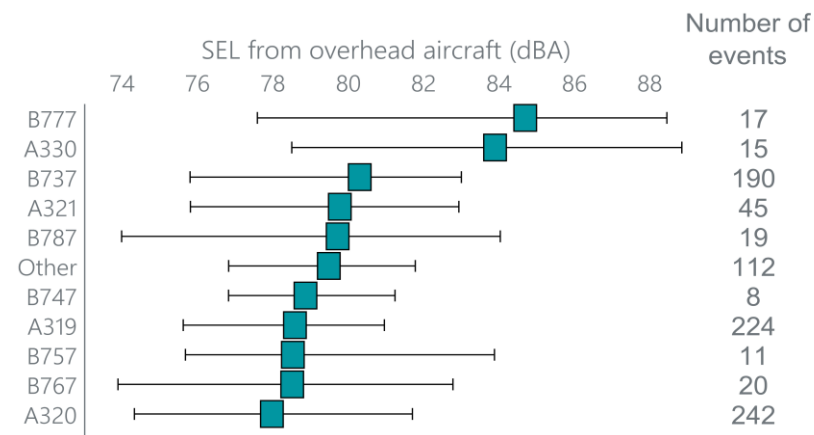
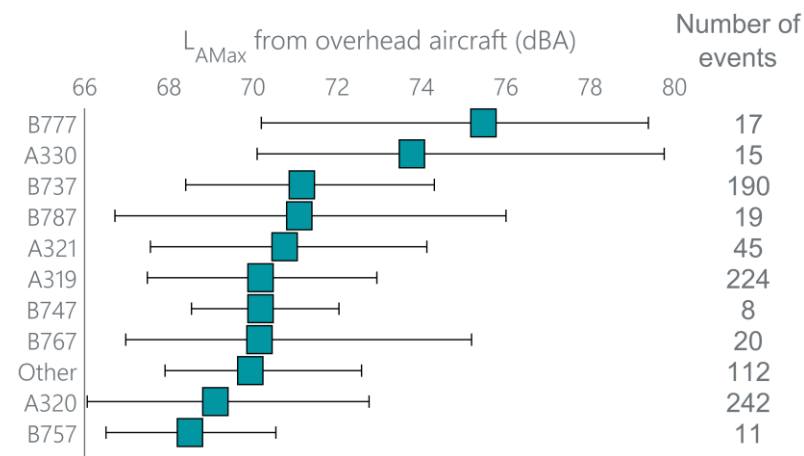
The plot in the top right show the average (arithmetic mean)  $L_{Amax}$  of each aircraft type in addition to the 5<sup>th</sup> and 95<sup>th</sup> percentile within the 83° **overhead** cone.

- The loudest aircraft type, on average, passing over the Rusper monitor on westerly departures is the B777 at just over 75dB followed by the A330 at 74dB.
- Most other common aircraft types operating at Gatwick fall between 70 and 71dB.
- There is typically a range of around 4 to 10dB in the  $L_{Amax}$  values of each aircraft type.
- The A320 and B757 are the quietest aircraft types; the  $L_{Amax}$  values of both being less than 70dB.

SEL

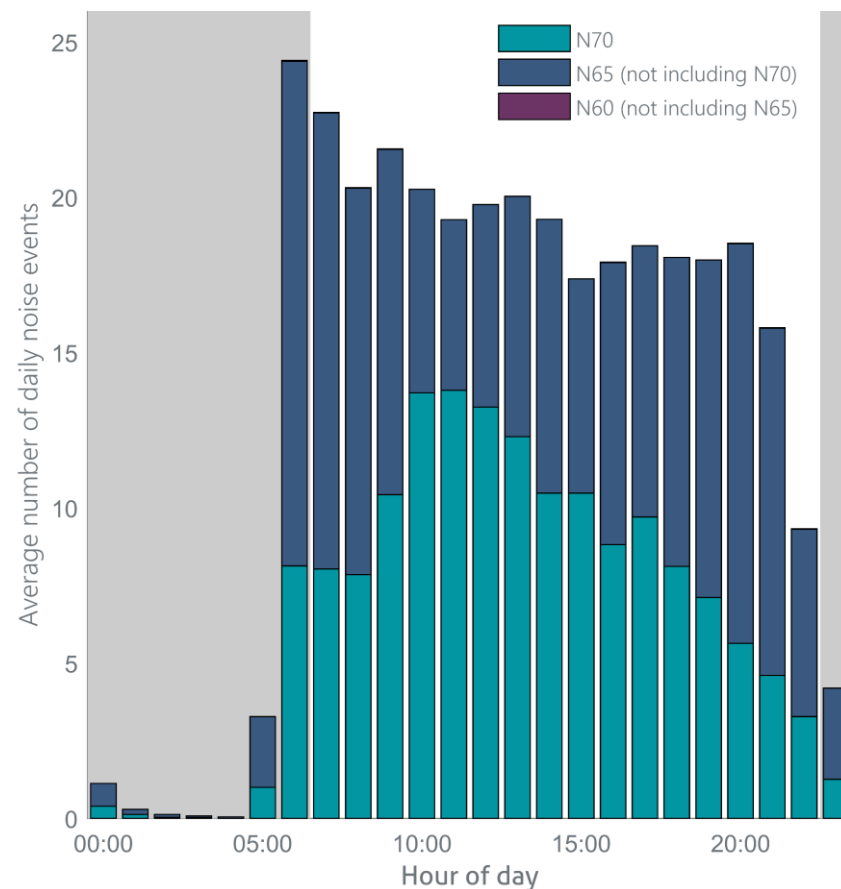
The plot in bottom right corner shows the average SEL of each aircraft type. The SEL takes into account all the energy within a noise event and is therefore also a function of event duration.

The relationship of aircraft types is similar to that seen in the  $L_{Amax}$  plot although there are some small differences such as the A320 being the quietest when ranked by SEL.



# How does the number of Nabove events vary across the day?

- It is recognised that the response to aircraft noise is related to more than average noise levels alone. The number of events and their individual levels are becoming increasingly recognised as a useful indicator of community response to aircraft noise.
- The  $N_{\text{above}}$  metrics describe the number of events in a period where the  $L_{\text{Amax}}$  exceeds a given value. For example, an  $N65_{1\text{hr}}$  of 10 means that ten aircraft generated a maximum noise level greater than 65dBA in a single hour.
- The figure to the right shows the average hourly N60, N65 and N70 values across an average 24hr day for days of 100% of westerly operations.
- The first noise events from scheduled movements occur between 05:00 and 06:00 before peaking between 06:00 and 07:00 during which there are typically around 25 noise events.
- After 07:00, the number of noise events above an  $L_{\text{Amax}}$  of 65dB generally decreases throughout the day to about 16 events in the hour 21:00 to 22:00.
- The number of louder events (above 70dB) peaks between 11:00 and 12:00 comprises about 75% of all recorded events in this hour.
- On an average westerly day, the N65 during the 16h day period (07:00-23:00) was 298; the N60 during the 8h night (23:00-07:00) was 34.
- The N60 during the night period on westerly days was predominantly made up of early morning operations before 07:00.



# How does the number of aircraft noise events vary across the day?

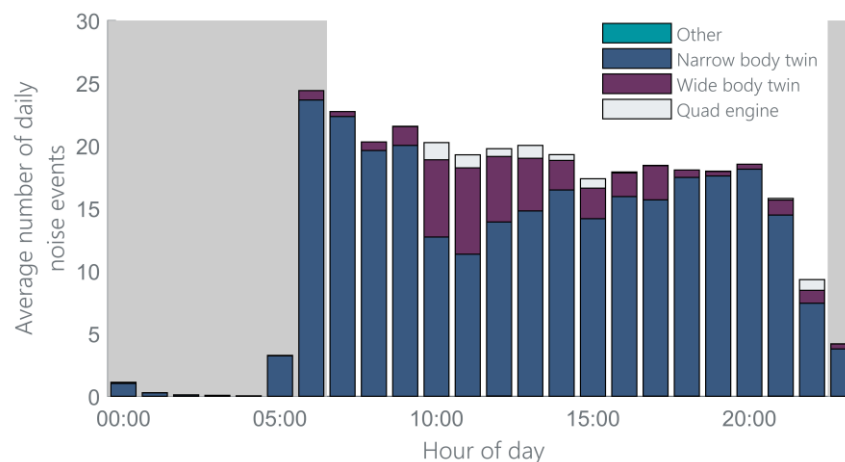
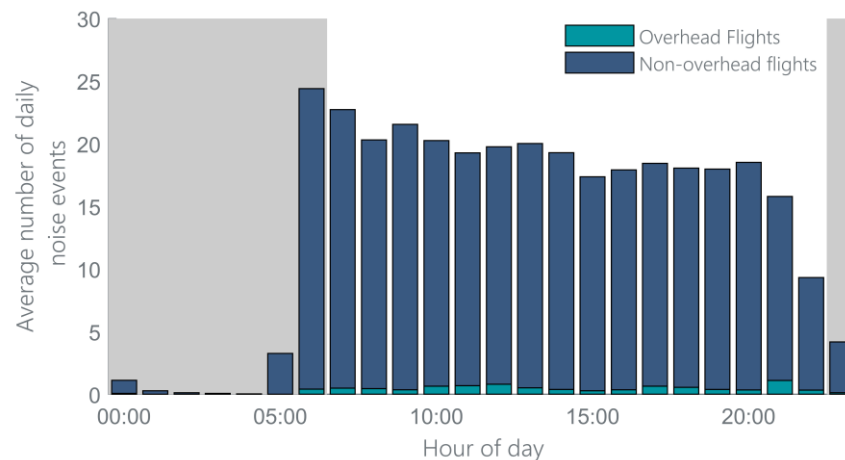
The top right figure shows the proportion of noise events from overhead aircraft during each hour of the day on days of 100% westerly operations.

- During the daytime period (07:00 to 23:00), there were typically between 10 and 24 aircraft events recorded on average per hour at the noise monitor.
- Between 06:00 and 07:00 approximately 25 events were recorded on average.
- The proportion of noise events from aircraft deemed as overhead\* is low throughout the day, however, the maximum occurs between 21:00 and 22:00 at just over one.

The lower figure shows the same data broken down by aircraft size.

- At all hours through the day, narrow body twin-engine aircraft are responsible for the majority of noise events.
- However, between the hours of 10:00 and 06:00, the proportion of noise events measured from larger aircraft (quad engine and wide body twin engine aircraft) increases with a maximum of around 8 events occurring from 11:00 to 12:00. This is reflected in the greater proportion of N70 events in the same hour reported on the previous page.

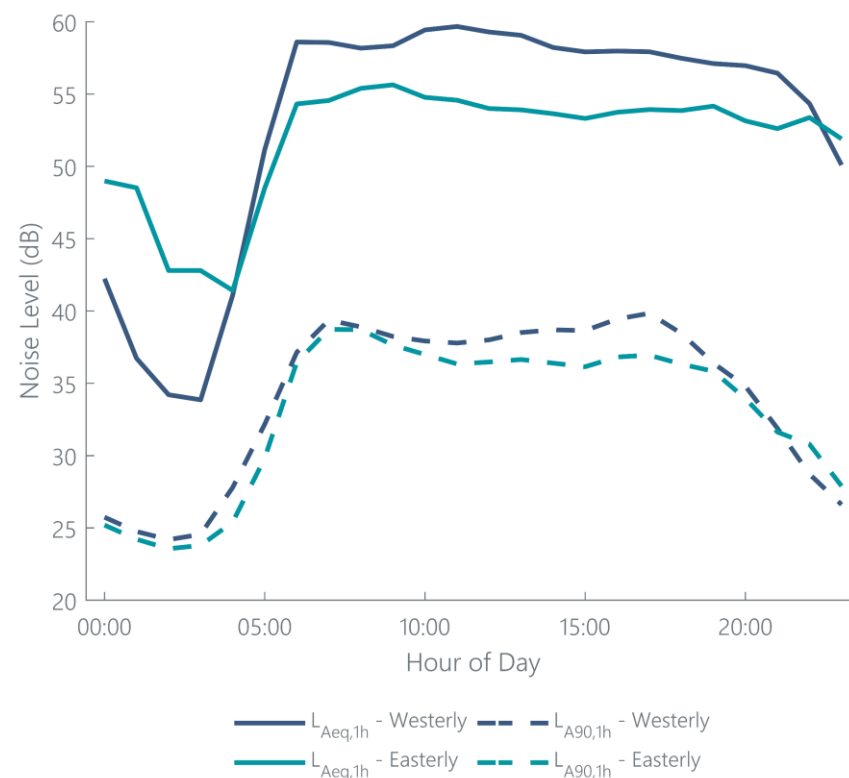
\* Defined as those aircraft passing through the 83° cone above the noise monitor



# What are the overall ambient noise levels at the noise monitor?

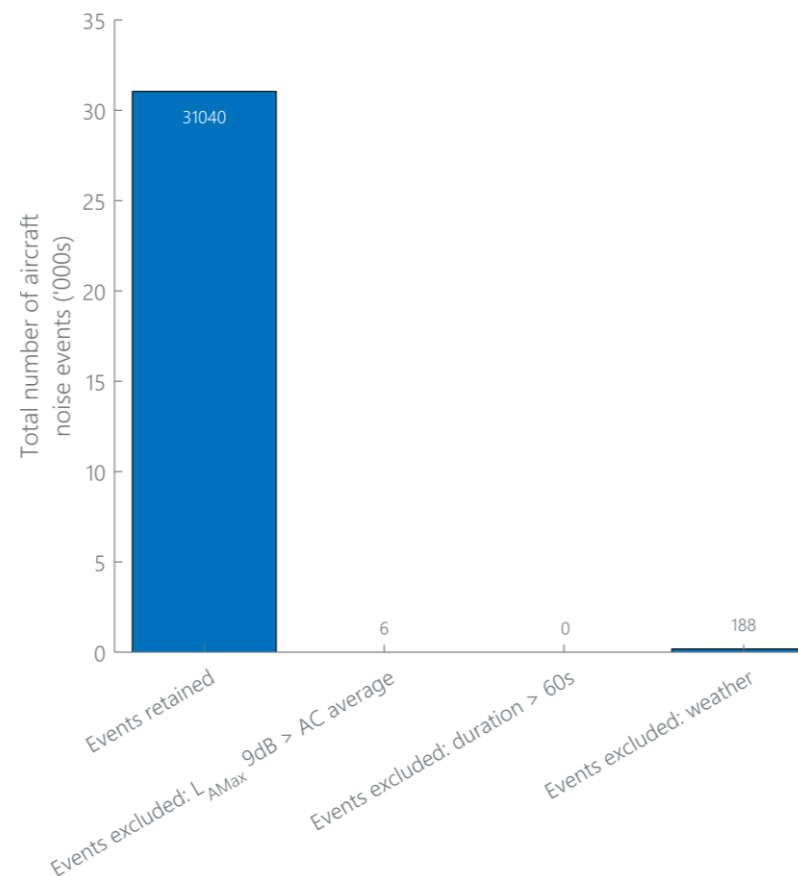
- The figure to the right shows the average (arithmetic mean) hourly  $L_{Aeq,1h}$  and  $L_{A90,1h}$  (a measure of background noise) on days of either 100% westerly or easterly operations. It should be noted that these metrics describe the overall noise environment including all noise sources, not just aircraft noise related to Gatwick.
- Between the hours of 06:00 and 22:00 on days of 100% westerly operations average  $L_{Aeq,1h}$  values fall between 56 and 60dB.
- During the daytime, each hour is between 3 and 5dB higher on a westerly day compared to the corresponding hour on an easterly day.
- The highest average hourly noise level, 59.7dBA, occurs between 11:00 and 12:00 corresponding to the hour during which larger aircraft were responsible for the greatest proportion of noise events.
- On easterly operations the  $L_{Aeq,1hr}$  reaches 55.6dB in the hour between 09:00 and 10:00.
- During the period the monitor was in place, the average daytime  $L_{Aeq,16h}$ \* between 07:00 and 23:00 was 58dB on westerly operations and 54dB on easterly operations from all noise sources.
- During the night, the average  $L_{Aeq,8h}$  between 23:00 and 07:00 was 51dB on westerly operations and 49dB on easterly operations.

\* It should be noted that the  $L_{Aeq,16h}$  has been calculated using the average of the hourly values for easterly and westerly days during the monitoring period. This is different to the published annual contours which calculate the  $L_{Aeq,16hr}$  over a 92 day period over the summer.



# Appendix A – Pre-processing of noise data

- The matching of noise events to aircraft movements is carried out in a Noise and Track Keeping (NTK) system. This relies on the time synchronisation between the noise monitor and radar. The NTK software determines whether an aircraft passed within a user-defined area around the monitor at the time of  $L_{A\text{Max}}$ . If an aircraft is found, the software correlates the event with that particular flight.
- When recording aircraft noise events, it is impossible to guarantee that events are not contaminated by noise sources other than those generated by aircraft. Through careful placement of the noise monitoring terminal (NMT), it is possible to minimise the influence of other noise sources such as passing cars for example however weather conditions should be taken into account where possible.
- Although a weather station was not installed at the Rusper NMT, data were being collected at nearby Russ Hill at 15 minute intervals. This data has been used to reject aircraft noise events from the analysis in instances where;
  - Average wind speeds exceed than 5m/s over the 15 minute interval.
  - Precipitation exceeds 0.5mm over the 15 minute intervals.
  - Event duration exceeds 60 seconds.
  - Individual aircraft event levels ( $L_{A\text{Max}}$ ) are greater than 9dB above the average for the same aircraft type.
- Applying the above criteria resulted in less than 1% of aircraft noise events being omitted from the analysis in this report.



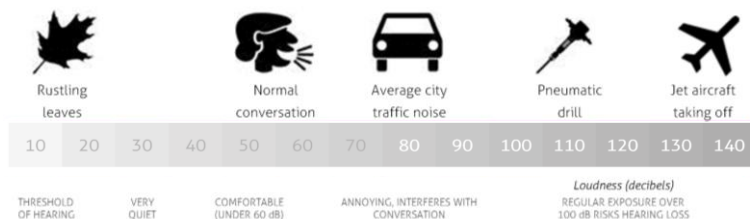
# Appendix B – Noise Terminology

## Sound vs Noise

- **Sound** can be measured by a sound level meter or other measuring system. **Noise** is related to a human response, and is routinely described as unwanted sound. In most reference documents, however, and, indeed, in common parlance, 'sound' and 'noise' are used interchangeably. Consequently, just because 'noise' is used doesn't necessarily mean a negative effect exists or will occur.

## How is sound measured?

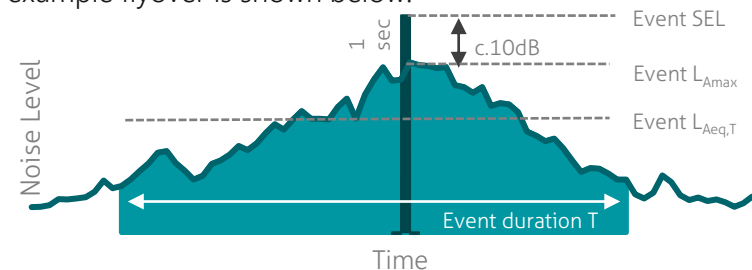
- There is a million to one ratio between the threshold of hearing and the highest tolerable sound pressure. Sound is therefore measured using a logarithmic scale, to account for this wide range, called the decibel (dB) scale. Typical levels of everyday sounds are shown in the figure below.



- The human ear (subject to age and health) is capable of detecting sound over a range of frequencies from around 20 Hz to 20 kHz; however, it does not respond equally to all frequencies, being most sensitive to sounds in the mid frequency range around 1 kHz to 5 kHz. Typically, therefore, measured sound levels are weighted across the frequency bands to broadly represent the sensitivity of the ear. The most commonly used mechanism is the A-weighting scale, hence levels are denoted as  $L_{Aeq}$  or dBA or dB(A), for example. All units in this report are A-weighted.

## How is aircraft sound/noise measured and described?

- As an aircraft passes over a location, sound levels slowly increase from ambient levels, reach a maximum, and decrease back down to ambient levels. The levels and durations involved depend on a number of factors, including the level of ambient sound. An example flyover is shown below.



- There are a number of metrics that can then be used to characterise a noise event; the following being the most common:
  - The  $L_{Amax}$  is the highest sound pressure level during the event (based on a 'fast' response time of 1/8th of a second).
  - The  $L_{Aeq,T}$  is the equivalent continuous sound pressure level over the period, T. It is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound. It is in effect the average noise level over the time of the event or period of interest.
  - The SEL (sound exposure level or single event level) is the sound pressure that would arise if all the energy of the event were to be delivered in 1 second. Which means if two events resulted in the same  $L_{Aeq}$  level, but one lasted longer, the SEL for the longer event would be higher. Thus it is a means of normalising event levels for comparison and some modelling purposes.