

Noise data for the first three years of Airbus A350 operations at Heathrow Airport

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Summary

This report presents summary information on monitored departure and arrival noise levels for the first three years of operation of the Airbus A350 at Heathrow. Noise measurements for the A350 are compared to equivalent measurements for other aircraft types of similar size whose operations are likely to be replaced by the A350 in the coming years.

At the monitor locations around Heathrow, the analysis has shown that the Airbus A350 is significantly quieter than the Airbus A330, Airbus A340 and Boeing 777. The A350 is on average up to 6 dB quieter on departure than the A330 and 777, and up to 9 dB quieter than the A340. The results also confirm that the A350 is up to 3 dB quieter on arrival than the aircraft types it is intended to replace.

Chapter 1

Introduction

The Airbus A350 is a long-range, wide-bodied, twin-engine aircraft which entered worldwide commercial airline service with Qatar Airways on 15 January 2015. Finnair became the first European operator of the all-new aircraft on 7 October 2015 and shortly after, on 16 October, became the first commercial A350 operator to fly into Heathrow. Over the following three years several other airlines also introduced the aircraft into regular service at Heathrow.

The A350-900 was the first variant of the A350 to be produced and is intended to replace existing 250-300 seat aircraft such as the twin-engine Airbus A330 and the four-engine Airbus A340, although some airlines have introduced the A350-900 on routes previously flown by larger aircraft such as the Boeing 747-400, Boeing 777-300ER and Airbus A380.

Qatar Airways also became the first airline worldwide to operate the stretched (and slightly heavier) A350-1000 variant, with the first flight landing at Heathrow on 24 February 2018. Virgin Atlantic will be the first European operator of the A350-1000 in early 2019 and British Airways is also expected to receive its first A350-1000 delivery later in the year.

As a result of improved aerodynamics, new generation engines and the use of lightweight materials, the A350 has been designed to be 25 percent more fuel efficient and significantly quieter than previous generation competitor aircraft.

The A350-900 meets the London airports' QC/0.5 night noise classification on departure, with the larger A350-1000 variant meeting QC/1 on departure, compared to QC/2 (typically) for the older A330 and A340 aircraft. On arrival, both A350 variants meet QC/0.5, compared to QC/0.5 or QC/1 for the A330 and A340 depending on the particular variant.

This report presents information and analysis on monitored noise levels for the Airbus A350 and compares them to the noise levels for other aircraft types of similar size operating at Heathrow Airport. An analysis of flight tracks and height profiles is also provided. However, a review of possible differences in measured noise level between each A350 operator was outside the scope of the study.

Chapter 2

Data collection

For this study, noise measurements and radar data were extracted from the Heathrow Noise and Track Keeping (NTK) system for the three-year period October 2015 to September 2018. Noise data were taken from suitably positioned permanent (fixed) and mobile noise monitors that were deployed during the study period.

In addition to the Airbus A350, data have also been extracted and analysed for variants of the Airbus A330 and A340, as well as for the Boeing 777-200 (which is similar in size to the A350 variants), as summarised below:

Aircraft type	Entry into service	Maximum take-off / landing weight ¹ (tonnes)	Typical seating (three-class configuration ²)
Airbus A350-900	2015	280 / 207	325
Airbus A350-1000	2018	316 / 236	366
Airbus A330-200	1998	242 / 187	247
Airbus A330-300	1994	242 / 187	277
Airbus A340-300	1993	277 / 192	277
Boeing 777-200	1995	298 / 213	312

Figures 1 and 2 show the locations of noise monitors deployed during the study period that were used to measure departure noise and arrival noise respectively. Further details of the noise monitoring locations, including the particular periods of deployment, are provided in Appendix B.

Note that some of Heathrow's permanent and mobile noise monitors are not shown in Figures 1 and 2, as they have been excluded from this assessment because they are considerably to the side of the flight paths used by the A350. This is to enable a more robust comparison to be made between the A350 monitored data and other aircraft types.

Approximately 13 percent of the noise measurements were rejected due to unacceptable weather conditions, i.e. wind speeds greater than 10 m/s (20 knots) or during periods of precipitation, in accordance with recommended international guidance³ on aircraft noise monitoring.

¹ Data taken from European Aviation Safety Agency (EASA) Type Certificate Data Sheet for Noise database (TCDSN)

² Based on data from Airbus (www.airbus.com) and Boeing (www.boeing.com)

³ ISO 20906:2009, Acoustics - Unattended monitoring of aircraft sound in the vicinity of airports

Figure 1 Departure noise monitor locations

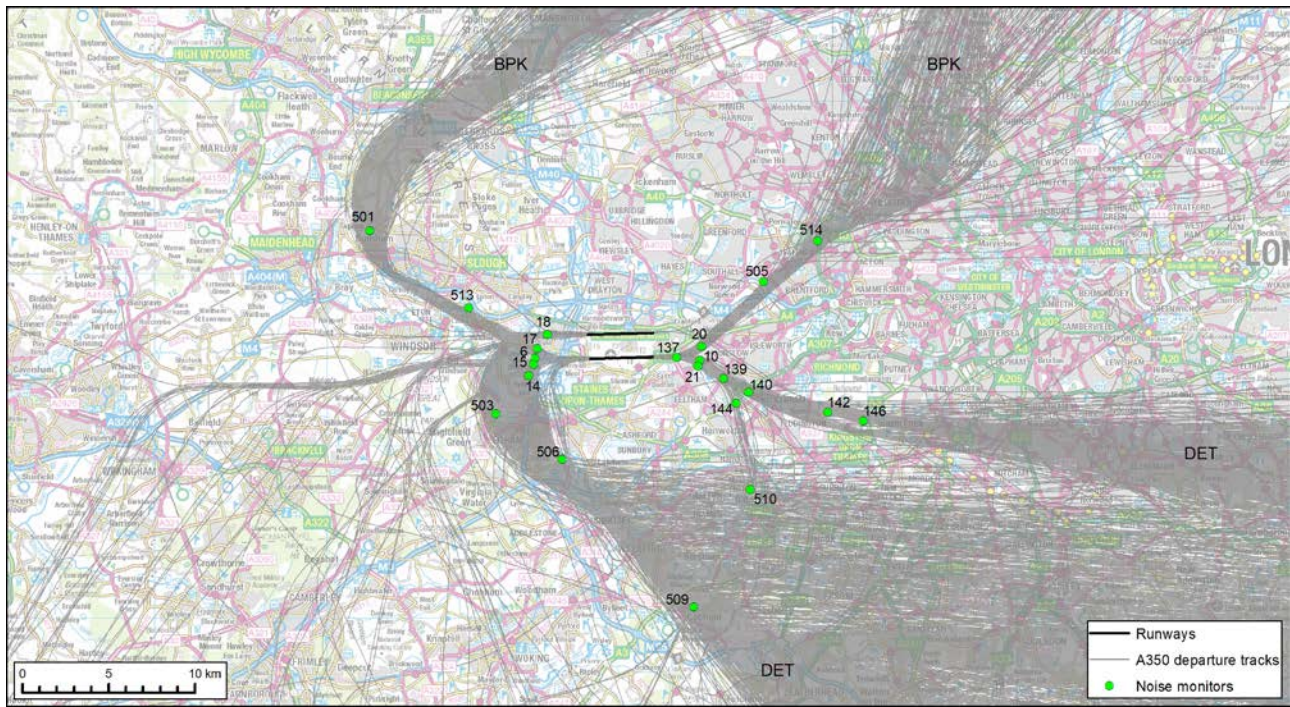
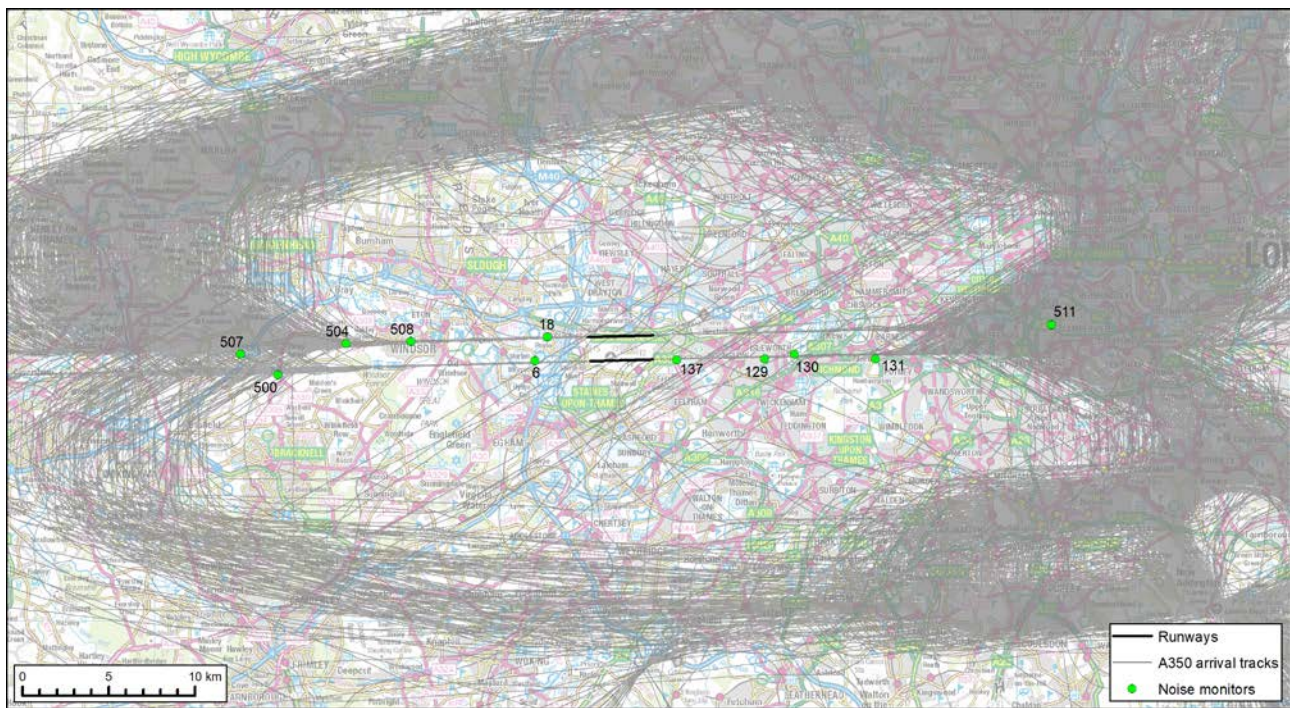


Figure 2 Arrival noise monitor locations



Figures 1 and 2 also show the A350 flights tracks for the study period, October 2015 to September 2018. In Figure 1, the significant majority of A350 departures can be seen using one of two Standard Instrument Departure (SID) routes and the associated Noise Preferential Routes (NPRs). The SID used on departure is largely dictated by the destination, with A350 departures to Africa, the Middle East and some Asian destinations tending to use Detling (DET), and departures to Northern Europe and other Asian destinations tending to use Brookmans Park (BPK).

In Figure 2, the percentage of arrivals joining the extended runway centrelines from the north and the south (which is generally determined by the route flown from the airport of origin) is approximately 85 percent and 15 percent respectively.

Chapter 3

Departure noise monitor data

The average departure noise levels for the Airbus A350, A330, A340 and Boeing 777 aircraft types described in Chapter 2 have been calculated at each noise monitor. Data for the A330 and 777 variants have also been separated by engine type for the two most common engine models operating at Heathrow, although this was not necessarily in anticipation of any significant noise differences.

Results are reported in terms of the Sound Exposure Level (SEL) metric, which accounts for the duration of the noise event as well as its intensity. A full set of tabular results are provided in Appendix C for information, alongside the corresponding results for the L_{Amax} metric. The average distance from start-of-roll (SOR) to each noise monitor has been calculated using radar data extracted from the NTK system.

Figure 3 plots the Airbus A350-900 and A350-1000 departure noise measurements against data for the two most common A330-200 variants at Heathrow. Figures 4, 5 and 6 plot the same A350 departure data against similar measurements for the Airbus A330-300, A340-300 and 777-200 respectively. In each diagram, the 95 percent confidence intervals of the mean levels are shown as vertical error bars⁴.

The results indicate that the A350-900, despite having a higher maximum take-off weight than the A330-200 and A330-300, is on average up to 6 dB quieter on departure, although there is some variation by engine type and from monitor to monitor. The results also indicate that the A350-900 is on average up to 9 dB quieter than the A340-300 and up to 6 dB quieter than the 777-200 across all noise monitors on departure.

As stated previously, the stretched A350-1000 variant is slightly heavier than the A350-900 (316 tonnes vs. 280 tonnes). The noise results indicate that the A350-1000 is, on average, 1 dB noisier than the A350-900 across all noise monitors. This is as expected, since the heavier variant has a higher QC classification on departure (QC/1 vs QC/0.5). However, it should be noted that the A350-900 is operated by a number of different airlines, whereas A350-1000 operations at Heathrow are currently limited to one airline - see Chapter 5.

Noting also that the A350-900 on departure is classified as QC/0.5 compared to QC/2 (typically) for the A330, A340 and Boeing 777, and that the midpoints of successive QC bands are 3 dB apart, the measured differences are in general agreement with the differences in QC classification⁵.

⁴ Results with 95 percent confidence intervals greater than ± 1 dB are not shown in the figures.

⁵ It was not the objective of this study to confirm the QC classification of the Airbus A350, which would have required analysis of EPNL (Effective Perceived Noise Level) measurements.

Figure 3 Comparison of A350 and A330-200 departure SEL noise measurements

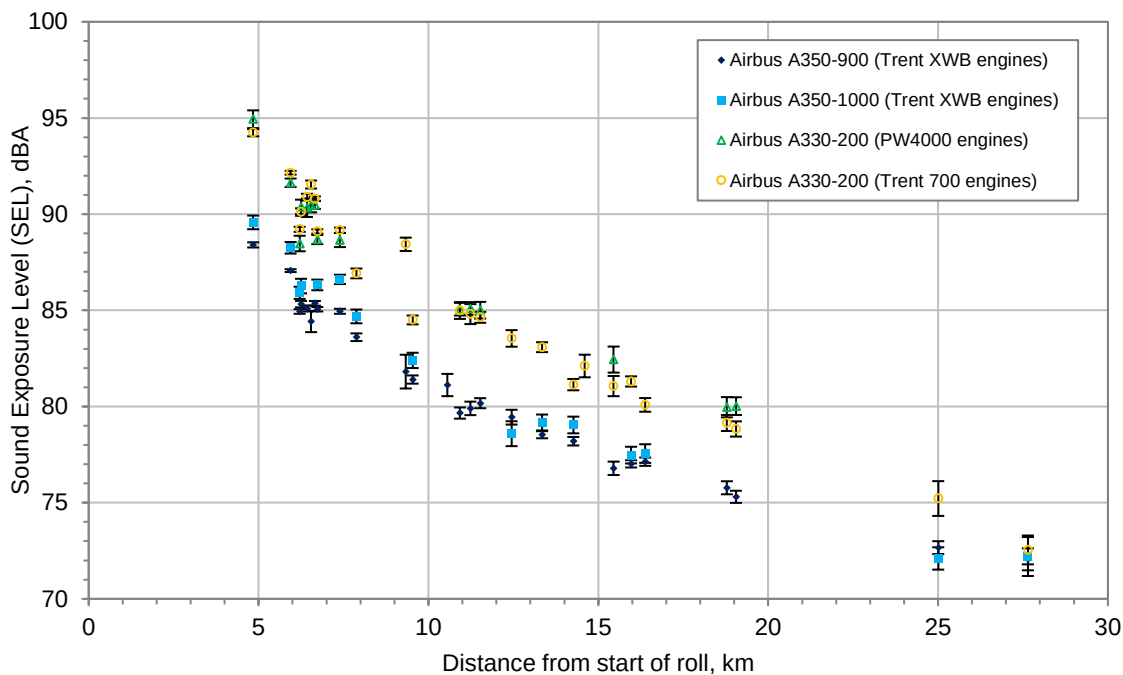


Figure 4 Comparison of A350 and A330-300 departure SEL noise measurements

