Bickerdike Allen Partners
Architecture
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LONDON CITY AIRPORT

2022 REVIEW OF AIRCRAFT NOISE CATEGORISATION SCHEME (ANCS)

Report to

London City Airport
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Contents

Page No.

1.0 INTRODUCTION

Planning Condition 18a of the CADP1 planning permission (July 2016) for London City Airport (LCA) required a new Aircraft Noise Categorisation Scheme (ANCS[1]) to be submitted to and approved by the Local Planning Authority (LPA) prior to the first beneficial use of the development. The ANCS was approved in December 2017 and implemented in January 2018. The ANCS was first reviewed after 1 year of operation and that review[2] was formally approved by the London Borough of Newham (LBN) on 29 March 2019 (planning reference 19/00548/AOD). The ANCS superseded the Noise Factored Scheme that was previously in place at the airport, both having been run in parallel prior to approval of the 1 year review.

Planning Condition 19 requires that the scheme shall be reviewed not later than the 1st and 4th year after its introduction and every 5th year thereafter. The reviews are required to be submitted to the London Borough of Newham (LBN) within 3 months of the review dates.

This report records the second review of the ANCS, following the first four years of the operation of the ANCS.

Section 2.0 provides a non-technical summary of this report. Section 3.0 summarises the ANCS which has been in operation at the airport since January 2018. Section 4.0 sets out the topics that form part of this review process and considers each of these in turn.

Appendix 1 contains a glossary of acoustic and aviation terms, and Appendix 2 contains a guide to the proposed operation of the ANCS going forward. Appendix 3 contains a summary of the other noise controls in place at LCA.

[1] London City Airport (October 2017), Proposed Aircraft Noise Categorisation Scheme (ANCS). Available at: https://www.londoncityairport.com/corporate/noise-and-track-keeping-system/aircraft-noise-categorisation-scheme [accessed 17/11/2021]

[2] Bickerdike Allen Partners LLP (March 2019), Review of Aircraft Noise Categorisation Scheme (ANCS). Available at: https://pa.newham.gov.uk/online-applications/files/C8DB67165498D108829C286D7DCA40A5/pdf/19_00548_AOD-REPORT_VERSION_2-2573873.pdf [accessed 17/11/2021]

2.0 NON-TECHNICAL SUMMARY

2.1 Summary of ANCS

The ANCS comprises two main aspects; firstly it determines which aircraft are permitted to use the airport and secondly it defines a Quota Count (QC) classification system, similar to that in operation at other UK airports (such as Heathrow, Gatwick and Stansted), which is used to limit the total amount of noise that airport is permitted to produce. The ANCS is described in more detail in Appendix 2.

At most other UK airports the QC system is used to control night-time noise, typically between 23:30 and 06:00. However, as flights in this period are not permitted at LCA, the ANCS is used to control daytime noise. This makes it among the most stringent noise control mechanism employed at a UK airport today.

2.2 Summary of other noise controls

The ANCS sits alongside a number of other noise controls currently in place at LCA. These are set out in the planning conditions and the Noise Management and Mitigation Strategy (NOMMS), and summarised in Appendix 3.

2.3 Review of ANCS

The ANCS has been reviewed after 4 years of operation in accordance with the requirements of Condition 19 of the CADP1 planning permission.

This review has included consideration of the noise modelling methodology, the maximum permissible noise levels of aircraft, and the operation of the QC scheme including the annual budget.

The review does not recommend changes to the noise modelling methodology, maximum permissible noise levels of aircraft or the annual QC budget of 22,000.

The review recommends changes to the procedure for determining the arrival QC values for jet aircraft so that it includes consideration of certificated noise levels. This will allow for a more accurate classification of aircraft which are not included the AEDT database such as new aircraft.

Finally, the review recommends formalisation of the procedure to assign QC values to light propeller aircraft, which has been previously discussed by LCA and LBN.

3.0 SUMMARY OF ANCS

This section includes a brief description of the ANCS. A guide explaining the basic elements of the ANCS[1], including an example of how it is proposed to work, is contained in Appendix 2.

The ANCS comprises two main aspects; firstly it determines which aircraft are permitted to use the airport and secondly it defines a Quota Count classification system, similar to that in operation at other UK airports, which is used to limit the total amount of noise that airport is permitted to produce.

3.1 Permitted Aircraft

Under current legislation[3], it is a requirement that any airport noise control scheme that limits the noisiness of aircraft operations does so based on noise certification data for individual aircraft. The noise certificate provides noise levels for three reference locations, denoted as flyover, sideline and approach, and classifies an aircraft in accordance with a chapter of Annex 16[4]. To be permitted to operate at LCA, an aircraft must:

- Comply with the requirements of Chapter 4 of Annex 16,
- Have a flyover level not exceeding 88.0 EPNdB,
- Have a sideline level not exceeding 93.5 EPNdB,
- Have an approach level not exceeding 98.0 EPNdB, and
- Have a sum of its three certificated noise levels not exceeding 271.0 EPNdB.

In some cases, there may be some aircraft of a given type which comply with the limits, and some which do not (for example those over a certain weight). In this situation, only those specific aircraft which comply with the limits would be permitted to operate.

3.2 Quota Count (QC) Classification System

The ANCS utilises a Quota Count (QC) system based on the principles of the Night Noise Quota Count system used at other UK airports such as Heathrow, Gatwick and Stansted.

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[3] The Aerodromes (Noise Restrictions) (Rules and Procedures) Regulations 2003
https://www.legislation.gov.uk/uksi/2003/1742

[4] Annex 16 to the Convention on International Civil Aviation, Environmental Protection, Volume 1, Aircraft Noise

Under a QC system, each aircraft arrival or departure is assigned a QC score. The total QC score for all aircraft operating within the assessment period must remain within a QC budget.

Unlike the QC system in place at most other UK airports, which only apply at night (typically 23:30-06:00), at LCA the QC system applies throughout the operational hours of the airport. For the purposes of an annual assessment of the QC total, the calendar year applies.

Each aircraft in operation at LCA is allocated a separate QC score (or 'count') for arrival and departure operations. For departures, an aircraft's QC score is based on its certificated noise levels. For arrivals, the standard certification uses a 3 degree glide slope, whereas a 5.5 degree glide slope is in operation at LCA. For arrivals by jet aircraft (e.g. turbofans or jets), an aircraft's QC score is based on the modelled noise level at the certification reference point when using a 5.5 degree glide slope. For arrivals by propeller aircraft (e.g. turboprops) an aircraft's QC score is based on its measured noise levels at LCA. This process is explained in more detail in Appendix 2. This approach was agreed following extensive discussions between LCA and LBN.

The aircraft QC scores are categorised into 1 dB bands (rather than 3 dB bands under the previous Noise Factored Scheme (NFS) at LCA and Night Noise Quota Count Schemes at the designated airports).

The QC score is then multiplied by the number of arrivals and departures by the aircraft in question to give the QC total. For example, the Embraer E170 typically has a QC score of 0.4 for departures and 0.063 for arrivals. If this aircraft carried out 1,000 arrivals and 1,000 departures over the year, then it would contribute 463 to the QC total.

In accordance with Planning Condition 18d (v), the ANCS includes an overall QC budget which has been approved by LBN as:

i) 22,000 per calendar year; and

ii) 742.5 in any one week

Each year's total quota count is determined based on the log of actual aircraft movements for the year and established QC scores for individual aircraft. The results are compared against the QC budget.

The annual QC total for the first 4 years of operation of the scheme are given in Table 1 below. This shows that LCA have operated within the current budget. The totals for 2020 and 2021 are significantly lower due to the impact of the Covid-19 pandemic.

Year	QC Total
2018	15,581
2019	16,242
2020	3,832
2021	2,798

Table 1: Annual QC totals 2018-2021

3.3 Reporting Requirements

3.3.1 Quarterly Report

A report on the ANCS is submitted to LBN on a quarterly basis which sets out the daily and weekly quotas attributable to the actual aircraft movements at the airport. The values are compared with the permitted weekly and annual quota budgets (as set out in Section 3.2 above) to identify if and when any limits are approached or exceeded.

A summary of this report is also presented to the London City Airport Consultative Committee (LCACC) through the Airspace and Environment Sub-Committee (AESC).

3.3.2 Annual Noise Monitoring Report

The noise monitoring results are reviewed at the end of each calendar year and submitted to LBN by the 31st March for approval in writing. They are also presented to LCACC through the AESC. A check is made on whether, year on year, there has been any change in the average results for each aircraft type and associated airline. This information from the noise monitoring system is used to undertake assessments, as occurs at other airports operating similar quota count systems, to check whether the quota count classifications used for each aircraft type are appropriate. No changes in quota count classification are permitted without written approval from LBN. In the first 4 years of operation of the scheme, no changes in quota count classification have been required.

A report is also produced as part of the Annual Performance Report that records the results of the assessments undertaken as part of the quota count regime, including but not limited to:-

- The quota counts used for each aircraft type during the calendar year in question;
- The total annual quota arising from aircraft operations during the calendar year;

- The results of noise monitoring undertaken during the calendar year, expressed for each aircraft type and airline as averages in relation to sideline[5], flyover and approach noise levels as determined in accordance with Section 3.1 of the ANCS;
- The quota counts to be used for each aircraft type for the forthcoming calendar year; and
- The expected total annual quota for the forthcoming year.

3.3.3 New Aircraft Type Reports

Section 2.4.3 of the ANCS requires that:

> *"Before any aircraft would be permitted to operate at LCA, evidence of compliance with the above requirements shall be submitted to and approved in writing by the LBN."*

The "above requirements" in this context are those set out in Section 3.1 of this report.

It has been agreed between LCA and LBN that a formal report demonstrating compliance shall be submitted for approval before a new aircraft type operates commercial flights (i.e. carrying passengers or operating on a commercial basis). This report will also give details of the expected QC score for that aircraft type as well as any limitations on its operation, for example if aircraft above a certain weight would not be permitted to operate.

It was further agreed that a formal report is not required to be approved before any non-commercial flights (e.g. flights trials) can take place, although there is a requirement for LCY to notify LBN and confirm that the aircraft's noise certificate indicates it will meet the requirements.

[5] The terms "sideline", "flyover" and "approach" appear in this ANCS but do not always carry the same meaning, depending on context. They are widely used to describe the ICAO certification points, but in the context of LCA are also used to describe the various noise monitor locations. Appendix 4, Annex 1 of the ANCS (footnote 1) provides a more detailed explanation of these terms.

4.0 REVIEW CONSIDERATIONS

The following items are considered as part of this review of the ANCS:

- Noise modelling methodology

  The AEDT software package is currently used to determine the approach noise levels. The review considers whether this remains the best approach.

- Maximum permissible noise levels of aircraft

  An aim of the ANCS is to ensure that no noisier aircraft than currently operate at LCA will do so in the future and to achieve parity with the NFS. A check on the aircraft types currently operating has been carried out.

- Procedure for determining approach noise levels

  The approach noise levels are currently determined by computer modelling software and take no account of the noise certificate of the individual aircraft. The review considers whether this remains the best option.

- Classification of light propeller aircraft

  Light propeller aircraft are certificated to a different ICAO standard which does not involve the same measurement points as other aircraft. The review seeks to formalise the procedure for assigning these aircraft a QC score as previously discussed with LBN in relation to the Piaggio P180.

- Quota Count Budget

  This section addresses the quota count budget that is in place currently and explores whether it is appropriate going forward or whether any adjustment is required.

- Reporting Requirements

  This section considers the reporting requirements.

4.1 Noise Modelling Methodology

Historically noise modelling work at LCA used the Integrated Noise Model (INM) software, developed by the Federal Aviation Administration (FAA). This software was widely used at several UK and international airports for a number of years.

In 2015, the FAA published a new software package, the Aviation Environmental Design Tool (AEDT) which superseded INM. This new package uses largely the same noise calculation

procedure as INM, (there were some minor updates), but now also includes the capability to model fuel burn and emissions.

As it is the current model, another difference is that new or updated aircraft data will be added to the AEDT database. For example, the Bombardier Global Express which operates at LCA exists in the AEDT database whereas with INM it had to be modelled using a similar aircraft type. As INM is no longer supported, over time there will be more aircraft types that exist in AEDT but not INM. As AEDT is updated on an ad hoc basis, any new or updated aircraft data are taken account of when it comes available.

As part of the first review of the ANCS, it was agreed by LCA and LBN to use AEDT going forward. This software is still current, and it remains widely used across the industry. It is considered appropriate to continue to use AEDT, updating to the latest versions (currently 3d) as they become available.

4.2 Maximum Permissible Noise Levels of Aircraft

Given the effects of the Covid-19 pandemic activity at LCA has been greatly reduced in 2020 and 2021. Consideration has therefore been given to 2019 where noise certificates are available for 194 of the aircraft that have operated at LCA. All of the aircraft currently operating comply with the ANCS limits. The closest aircraft to the limit (a Falcon 50) has a sum of its three certificated noise levels of 270.9 EPNdB, compared with the limit of 271.0 EPNdB. There are also multiple different aircraft within 1 EPNdB of the various limits. This shows that aircraft noisier than the existing fleet would not be permitted to operate, and also that any reduction in limits would prevent existing aircraft from operating, which would go against the aim of the ANCS to achieve parity with the NFS.

UK legislation[3] does not permit the introduction of operating restrictions which affect civil subsonic aeroplanes that comply with the noise standards of Chapter 4. This follows from the ICAO balanced approach, and in particular resolution A39-1[6] which:

> *"Further urges States not to permit the introduction of any operating restrictions aimed at the withdrawal of aircraft that comply, through either original certification or recertification, with the noise standards in Volume I, Chapter 4 and Chapter 14 of Annex 16 and any further stringency levels adopted by the Council."*

The interpretation of this is that aircraft which currently operate should not be prevented from doing so if they comply with Chapter 4. LCY's current limits are already more stringent than

[6] https://www.icao.int/environmental-protection/Documents/Resolution_A39_1.PDF

Chapter 4 but do not fall foul of this general concept as they continue to permit all aircraft currently operating. Until the legislation changes it may not be possible to reduce the limits, unless some of the current aircraft types cease operating at LCY.

4.3 Procedure for determining approach noise levels

Turbofan and turboprop aircraft are treated differently when determining the approach noise levels. The procedures are discussed in the following sections.

4.3.1 Turbofan aircraft

The current procedure for determining the approach noise levels of turbofan aircraft is as follows:

- For turbofan aircraft, the approach noise level for the specific type of aircraft is calculated by modelling the aircraft in AEDT, with a glide slope of 5.5 degrees and the matching built-in aircraft database entry, at the approach noise certification point described in ICAO Annex 16. The resulting value is equivalent to the noise certification level for that particular turbofan aircraft type, but for a 5.5 degree approach.

This procedure provides a reasonable representation of the noisiness of the aircraft, particularly for the most common types currently operating. However the reliance on the built-in aircraft database for AEDT raises a potential issue, as in some cases aircraft which operate at LCA do not have a corresponding entry in the database. In these cases AEDT generally recommends a substitute.

This is particularly an issue for new aircraft, such as the Airbus A220-100 (Airbus A221) and Embraer E190-E2. These aircraft are not contained in the current AEDT database with the software (version 3d) recommending they are modelled using older aircraft types, such as the Boeing 737-700. This means that in terms of the arrival QC score the quieter performance of the new aircraft is not recognised.

Some existing aircraft types are also not included in the AEDT database, for example the Avro RJ85 (which is unlikely to be added given the advancing age of the aircraft) is instead modelled as a BAe 146-200. While these aircraft are similar, reviewing the EASA database[7] finds that the RJ85 is around 2 dB louder than the BAe 146-200 on approach and therefore is assigned a lower QC score than it would be if the certificate value was used.

[7] https://www.easa.europa.eu/domains/environment/easa-certification-noise-levels

A number of business jet aircraft may also be affected by this issue although this is likely to have a relatively small impact on the overall QC total due to the smaller number of these operations.

The recommended solution is to amend the procedure for turbofan aircraft to the following:

- For turbofan aircraft, the approach noise level for the specific type of aircraft is calculated by modelling the aircraft in AEDT using the matching or recommended built-in aircraft database entry at the approach noise certification point described in ICAO Annex 16. This is done separately with a glide slope of 3 degrees and 5.5 degrees and the difference computed. This difference is then applied to the certificated (3 degree) approach noise level of the individual aircraft, obtained using the same criteria as for the departure noise level (see Appendix 2). The resulting value is equivalent to the noise certification level for that particular turbofan aircraft type, but for a 5.5 degree approach.

This would retain an allowance for noise levels being different with a 5.5 degree glide slope, as is used at LCA, compared to a 3 degree glideslope as is used in certification tests, but would also use the noise certification information which means the resulting QC score would more accurately reflect the noise produced by the individual aircraft.

Worked examples of the proposed procedure are included in Appendix 2.

4.3.2 Turboprop aircraft

The current procedure for determining the approach noise levels of turbofan aircraft is as follows:

- For turboprop aircraft, the approach noise level for the specific type of aircraft is calculated as above with the additional step of firstly adjusting the noise profile of the most appropriate aircraft type within AEDT to match the approach noise level as measured at LCA during a 5.5 degree approach.

The reason for the use of measured noise levels is that the relationship between the noise from 3 degree and 5.5 degree approaches is not necessarily consistent for turboprops. This is understood to be as the characteristics of the propellers can be affected by the aircraft angle.

This procedure which relies on measurements taken at LCA is still considered appropriate.

4.3.3 Assessment of proposed change

In order to assess the impact of the proposed change to the procedure for turbofan aircraft, a comparison of the current and proposed procedures has been carried out on the basis of the data from 2019. This considers only flights by passenger turbofan aircraft for which certificates

have been provided, to ensure the most reliable comparison. In total (arrivals and departures) passenger turbofan aircraft comprised 75% of the flights and 83% of the total QC in 2019, which was 16,242.

A summary of the 2019 data is presented in Table 2 below.

Turbofan Aircraft Type	No. 2019 Arrival Movements with Certificates	Existing Procedure		Proposed Procedure	
		QC Value	Total QC[1]	Average QC Value[2]	Total QC[1]
Airbus A221	1378	0.0500	69	0.0315	43
Airbus A318	254	0.0800	20	0.0500	13
Avro RJ85 / BAe 146	1941	0.0630	122	0.0997	194
Embraer 170	4602	0.0630	290	0.0630	290
Embraer 190	20312	0.0500	1016	0.0500	1016
TOTAL:	**28487**	**-**	**1517**	**-**	**1555**

[1] Values rounded to the nearest whole number. Totals are based on unrounded data.

[2] Rounded to 4 decimal places. This does not always align exactly to a single QC value as not all aircraft within the same type have identical noise certificates.

Table 2: Effect of proposed procedure for determining turbofan arrival noise levels

As can be seen from the above table, the proposed change would in general have had little effect, although it would have resulted in a small increase in the total QC for 2019. This is due to the Avro RJ85 being assigned a higher QC score under the proposed procedure. Conversely the Airbus A221 would be assigned a lower QC score under the proposed procedure as under the existing procedure it is assigned the noise level of the louder Boeing 737-700.

For aircraft without a certificate, in line with the procedure for departures, the worst-case of the available data in the EASA database[7] would be used. Arrival noise levels for a given aircraft type do not tend to vary significantly, as there is not much variation in aircraft weights. Therefore it is expected that for aircraft without a certificate this procedure would give similar changes as for those with a certificate, although for some aircraft types they may be classified as being in a higher QC band than is actually the case.

In total, the 2019 arrivals by the passenger turbofan aircraft for which certificates are not available contributed 156 QC points, which would rise slightly to 160 if assessed under the new procedure.

Overall this change is recommended as it would give more accuracy to the QC assessment and assist with the incentivisation of the use of quieter aircraft.

4.4 Classification of light propeller aircraft

For most aircraft, the QC value is derived from the noise levels on the aircraft's noise certificate. However, light propeller aircraft, defined as those with a maximum take-off weight not exceeding 8,618 kg, are not subject to the same measurements as part of the certification process and therefore comparable certificated noise levels are not available.

In general terms, light propeller aircraft are significantly quieter than other common aircraft, and as such they are exempt from the QC schemes in place at many other airports, for example the scheme which applies to Heathrow, Gatwick and Stansted airports[8]. They are however not exempt from the ANCS scheme, although they have a very limited impact as they comprise a very small proportion of the movements, less than 0.1% of the flights in 2019.

The exception to the generally significantly quieter nature of the light propeller aircraft is the Piaggio P180, which is a small turboprop aircraft primarily used for business aviation. This aircraft is unusual in that the propellers are mounted behind the engines, rather than in front of the engines. This design leads to relatively high noise levels considering the size of the aircraft, although it meets the ICAO limits for the appropriate certification tests.

This issue was discussed with LBN in relation to the P180 in late 2019 and early 2020. As part of these discussions, a procedure for assigning a QC score to this aircraft was agreed. It is proposed to formalize this procedure for all light propeller aircraft.

For departures, the proposed procedure for light propeller aircraft is as follows:

1. Determine the reference aircraft, being the lightest propeller aircraft for which suitable measurements when operating at LCA are available and which is subject to the ICAO Chapter 4 certification tests.
2. Compare the measured EPNdB noise levels taken by the LCA NMTs with those for the reference aircraft, separately for sideline (NMTs 1-4), flyover (NMTs 5-6) and approach (NMTs 5-6).
3. Use these difference to estimate the sideline, flyover and approach noise levels for the light propeller aircraft by comparing with noise certificates for the reference aircraft.

[8] https://nats-uk.ead-it.com/cms-nats/export/sites/default/en/Publications/aip-supplements/EG_Sup_2021_049_en.pdf

These estimated noise levels are then used to confirm that the aircraft meets the maximum noise limits. Light propeller aircraft are then treated as turboprop aircraft for the purposes of determining the arrival noise level and departure noise level. A worked example is provided in Appendix 2.

4.5 Quota Count Budget

Planning Condition 18d (part vii) of the CADP1 permission states that the noise exposure permissible as a result of the QC budget shall be:

- Equivalent to 120,000 Noise Factored Movements per calendar year (as determined in accordance with the Noise Factored Scheme);
- No worse than the airborne aircraft noise effects assessed in the UES (Updated Environmental Statement) submitted as part of the CADP1 application; and
- In accordance with Condition 33 (noise contour area).

The QC budget was initially set at 22,000 per calendar year. This was derived from consideration of actual aircraft mixes at LCA, factored up to match 120,000 NFMs.

The first review of the ANCS[9] demonstrated that the current QC budget of 22,000 remained approximately equivalent to the 120,000 noise factored movements permitted under the previous scheme, when considering the actual aircraft mix of 2017 and 2018.

Condition 33 states that the area of the 57 dB $L_{Aeq,16h}$ contour shall not exceed 9.1 km^2. This condition in itself requires that the airborne effects will not be worse than those assessed in the UES. This requirement is policed by generating an annual contour, which is reported in the APR. In 2019 this had an area of 8.0 km^2. No contour was produced in 2020 due to the Covid-19 pandemic, and it is clear from the greatly reduced activity that year that it would have been significantly smaller. Ongoing compliance with this condition is achieved by ensuring that the forecast annual contour[10], also produced as part of APR, has an area no greater than 9.1 km^2.

Taking the above into account, it is considered appropriate for the QC budget to remain at 22,000 currently. This budget will be reviewed again at the next ANCS review, when the effect

[9] Bickerdike Allen Partners LLP (March 2019), Review of Aircraft Noise Categorisation Scheme (ANCS). Available at: https://pa.newham.gov.uk/online-applications/files/C8DB67165498D108829C286D7DCA40A5/pdf/19_00548_AOD-REPORT_VERSION_2-2573873.pdf [accessed 17/11/2021]

[10] This is the "Predicted Reduced Noise Contour" in the APR which represents the airport's best estimate of the noise envelope expected as a result of next year's summer aircraft movement forecast.

of newer aircraft types such as the Bombardier CS100 and Embraer E190 E2 is expected to be more apparent.

4.6 Reporting Requirements

The reporting requirements on the operation of the QC part of the scheme are considered appropriate. It is recommended to update the ANCS to reflect the interpretation of Section 2.4.3 of the ANCS regarding the reporting requirements for new aircraft types, as agreed between LCA and LBN and described in Section 3.3.3 of this review.

The details of the QC score assigned to each individual aircraft operation throughout the calendar year are available to LBN on request.

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APPENDIX 1
GLOSSARY OF ACOUSTIC AND AVIATION TERMINOLOGY

General

Sound

This is a physical vibration in the air, propagating away from a source, whether heard or not.

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2 x 10^{-5} Pascals) and the threshold of pain is around 120 dB.

The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Effective Perceived Noise Level (EPNL)

EPNL is defined in the *International Civil Aviation Organisation* (ICAO) *Annex 16*. It is a measure of the relative loudness of an individual aircraft noise event and takes into account additional effects such as tonality that may increase annoyance.

Sound Transmission in the Open Air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law. In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB.

Factors Affecting Sound Transmission in the Open Air

Reflection

When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber or plasterboard, it is reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.

Screening and Diffraction

If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. This reduction is limited, however, by diffraction of the sound energy at the edges of the screen. Screens can provide valuable noise attenuation, however. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land beyond, typically by around 10 dB(A). The best results are obtained when a screen is situated close to the source or close to the receiver.

Meteorological Effects

Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradients are variable and difficult to predict.

Aviation Terms

Start of Roll

The position on a runway where aircraft commence their departure procedure.

Threshold

The beginning of that portion of the runway usable for landing.

APPENDIX 2
GUIDE TO ANCS

A2.1 INTRODUCTION

This appendix provides a walkthrough of the London City Airport (LCA) Aircraft Noise Categorisation Scheme (ANCS). It has been updated to include the recommended changes in the 2021 review.

Under the Section 106 Agreement of the 2009 planning permission (ref. *07/01510/VAR, 2009*), LCA was required to consult with the London Borough of Newham (LBN) and Greater London Authority (GLA) on, and subsequently implement, an Aircraft Categorisation Review (ACR). The purpose of this was to assess how LCA categorises aircraft for noise management purposes and incentivises airlines to emit less noise. The result was the publication of, and subsequent consultation on, the ANCS.

The ANCS superseded the previous Noise Factored Movement (NFM) scheme, following a trial year of parallel operation. It fulfils the requirements of the City Airport Development Programme (CADP) planning permission (ref. *13/01228/FUL, 2016*).

The ANCS mirrors the approach adopted by other UK airports (such as Heathrow, Gatwick and Stansted) although they use it to control night-time noise between 23:30 and 06:00. However, as flights in this period are not permitted at LCA, the ANCS is used to control daytime noise. This makes it the most stringent noise control mechanism employed at a UK airport today.

Key features of the ANCS are:

- It takes into account noise impacts on the wider community, not just the airport's immediate surroundings (a limitation of the NFM scheme);
- It more accurately categorises aircraft than the NFM scheme and QC schemes in place at other airports and provides greater incentives for airlines to use quieter aircraft in conjunction with the Incentives and Penalties Scheme;
- It ensures that no noisier aircraft than currently permitted to operate at the airport will be allowed to operate in the future;
- It does not allow a higher number of aircraft to operate at the airport than permitted under the 2009 planning permission or the CADP planning permission; and
- Except in the case of immediate emergency, no aircraft will be permitted to land at or take off from the airport unless the aircraft has been categorised according to the ANCS.

A2.2 AIRCRAFT NOISE CATEGORISATION SCHEME

The ANCS consists of two main aspects, which are subsequently explained in further detail. These are firstly to determine which aircraft are permitted to use the airport and secondly to define a Quota Count classification system similar to that in operation at other UK airports which is used to limit the total amount of noise that airport is permitted to produce.

Aircraft Noise levels

Each aircraft regularly operating at LCA other than light propeller aircraft (covered in Section A2.3), has a set of certificated noise levels: the sideline, flyover and approach noise levels. Noise levels are given in terms of Effective Perceived Noise Level (EPNL) in units of EPNdB.

> EPNL is defined in the *International Civil Aviation Organisation* (ICAO) *Annex 16*. It is a measure of the relative loudness of an individual aircraft noise event and takes into account additional effects such as tonality that may increase annoyance.

Communities to the east and west of the airport are typically affected by flyover and approach noise produced by departing and arriving aircraft respectively. Communities to the north and south are typically affected by sideline departure noise. By considering all of these certification levels, the ANCS takes into account noise impacts on the wider community.

In the context of noise certification, the terms sideline, flyover and approach relate to noise measurement positions which are used when a new aircraft type is tested in accordance with international noise standards. This allows a like for like comparison for various aircraft types.

These three terms are defined by the *ICAO Annex 16*, and adopted by the *Aerodrome (Noise Restrictions) (Rules and Procedures) Regulations 2003*, as:

- **Sideline** -
  a) For jet-powered aeroplanes, the point on a line parallel to, and 450 m from the runway centre line, where the noise level is a maximum during take-off.
  b) For propeller aircraft certificated prior to 19 March 2002:
    i) The point on the extended centre line of the runway 650 m vertically below the climb-out flight path at full take-off power; or
    ii) The point on a line parallel to, and 450 m from, the runway centre line, where the noise level is a maximum during take-off.
  c) For propeller aircraft certificated after 19 March 2002:
    i) The point on the extended centre line of the runway 650 m vertically below the climb-out flight path at full take-off power.
- **Flyover** – for jet and propeller powered aeroplanes, the point on the extended centre line of the runway and at a distance of 6.5 km from the start of roll; and
- **Approach** – for jet and propeller powered aeroplanes, the point on the ground, on the extended centre line of the runway 2 km from the threshold. On level ground this corresponds to a position 120 m vertically below the 3 degree descent path originating from a point 300 m beyond the threshold.

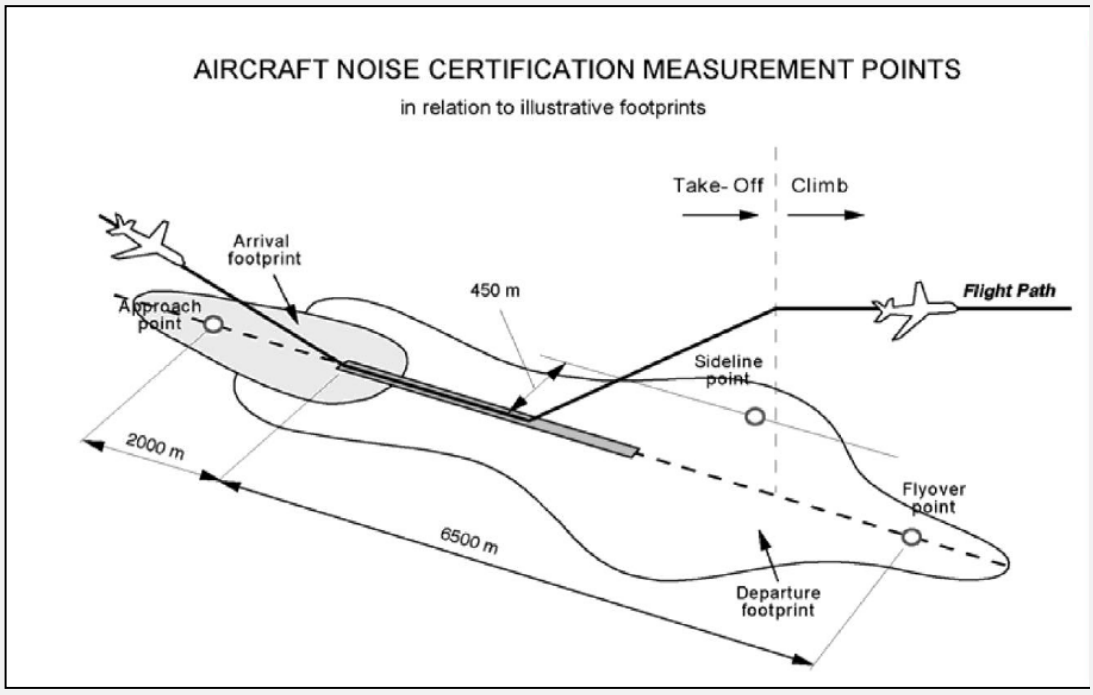

Figure reproduced from *ERCD Report 0205 Quota Count Validation Study: Noise Measurements and Analysis*, Civil Aviation Authority.

For the ANCS, different procedures apply to the certification of aircraft noise levels for departures and arrivals. A further distinction is made between turbofan and turboprop aircraft for arrivals.

Turbofans and turboprops are types of aircraft engine. The majority of aircraft operating at LCA have turbofans, with the most common aircraft being the Embraer E190.

From the certificated noise levels of each aircraft, a departure noise level and arrival noise level are calculated.

Departure Noise Level

Under regulations laid out by the European Commission (*Commission Regulation (EU) No. 748/2012: Initial Airworthiness*), all aircraft of the types used at London City Airport are required to hold a certificate that sets out the noise levels for the aircraft and the weight at which the aircraft was certificated (a higher weight typically corresponds with a higher noise level). Sideline and flyover noise levels are used to describe the noise of departing aircraft for all aircraft other than light propeller aircraft (covered in Section A2.3).

Noise certification data for a given aircraft type can exist at a variety of different take-off weights. In addition, some aircraft of a given type are fitted with modified (quieter) engines and are certificated accordingly.

The selection of certificated noise levels for individual aircraft is based on:

- Preferably, the sideline and flyover departure noise values set out on the noise certificate for the individual aircraft; or
- The values set out in the *European Aviation Safety Agency TCDSN* database for the specific aircraft type, accounting for the permitted Maximum Take-Off Weight of that aircraft type at LCA. If no entry in the database is available for the specific aircraft at this Maximum Take-Off Weight, the entry for the next highest Maximum Take-Off Weight is used - higher take-off weight typically results in more noise so this is a worst-case assumption; or
- Under exceptional circumstances, evidence is presented to LBN which demonstrates to their satisfaction that the aircraft is capable of operating at its permitted Maximum Take-Off Weight at LCA within the noise constraints applicable at the airport.

The departure noise level is calculated from the sideline and flyover noise certification values as the mean average.

$$Departure\ Noise\ Level = \frac{Sideline\ Noise\ Level + Flyover\ Noise\ Level}{2}$$

Arrival Noise Level

The approach noise level is used to describe the noise of arriving aircraft. This certificated noise level requires modification. This is because the certificated noise level appearing on the certificate is measured based on a glide slope of 3 degrees, whereas 5.5 degrees is used at LCA. This steeper approach is required to keep aircraft higher for longer for obstacle avoidance.

To account for this difference, the Aviation Environmental Design Tool (AEDT) software is used to compute the approach noise level based on both a 3 degree and a 5.5 degree glide slope.

AEDT here refers to the latest version, currently 3d. This software is developed by the U.S. Department of Transportation Federal Aviation Administration (FAA) and is the industry standard for computation of aircraft noise. It contains an in-built database of aircraft types, flight, thrust and noise parameters that has been developed in consultation with aircraft manufacturers.

This computational method provides good correlation with measurements of turbofan aircraft at the different glide slopes; however it does not accurately reflect the noisiness of turboprop aircraft on approach. Data measured with noise monitors at LCA is therefore used to validate the turboprop aircraft types within AEDT.

Approach noise levels are therefore calculated as follows:

- For turbofan aircraft, the approach noise level for the specific type of aircraft is calculated by modelling the aircraft in AEDT using the matching or recommended built-in aircraft database entry at the approach noise certification point described in ICAO Annex 16. This is done separately with a glide slope of 3 degrees and 5.5 degrees and the difference computed. This difference is then applied to the certificated (3 degree) approach noise level of the individual aircraft, obtained using the same criteria as for the departure noise level. The resulting value is equivalent to the noise certification level for that particular turbofan aircraft, but for a 5.5 degree approach; and
- For turboprop aircraft, the approach noise level for the specific type of aircraft is calculated as above with the additional step of firstly adjusting the noise profile of the most appropriate aircraft type within AEDT to match the approach noise level as measured at LCA during a 5.5 degree approach.

The resulting values are treated as the approach noise certification level for that given aircraft for the purposes of quota count classification.

The arrival noise level is then calculated according to the following equation. This is to align it with the departure noise level.

$$Arrival\ Noise\ Level = \ Approach\ Noise\ level - 9\ EPNdB$$

A2.3 LIGHT PROPELLER AIRCRAFT

Light propeller aircraft are not subject to the same measurements as part of the certification process and therefore comparable certificated noise levels are not available. For these aircraft the following procedure is followed to estimate the certificated noise levels:

1. Determine the reference aircraft, being the lightest propeller aircraft for which suitable measurements operating at LCA are available and which is subject to the ICAO Chapter 4 certification tests.
2. Compare the measured EPNdB noise levels taken by the LCA NMTs with those for the reference aircraft, separately for sideline (NMTs 1-4), flyover (NMTs 5-6) and approach (NMTs 5-6).
3. Use these difference to estimate the sideline, flyover and approach noise levels for the light propeller aircraft by comparing with noise certificates for the reference aircraft.

These estimated noise levels are then used to confirm that the aircraft meets the maximum noise limits. Light propeller aircraft are then treated as turboprop aircraft for the purposes of determining the arrival noise level and departure noise level. A worked example is provided in Section A2.7.

A2.4 QUOTA COUNT CLASSIFICATION

Each individual aircraft in operation at the airport is allocated a separate quota count for departure and arrival determined by their departure and arrival noise levels, as outlined above, which are categorised using 1 EPNdB bands (see Table A2.1). This is more accurate than the NFM scheme which used 3 dB bands. The use of 1 dB bands means that even a small reduction in noise levels can result in a lower quota count score, thereby incentivising the use of quieter aircraft. Airlines achieving poor performance in relation to improving aircraft noise will be penalised by the Incentives and Penalties Scheme.

Because the EPNdB unit is logarithmic, a change in EPNdB represents a proportional change in noise. A change of 3 EPNdB represents a doubling of sound energy (equivalent to the energy

produced by doubling the noise source, such as from two aircraft movements by a specific aircraft instead of one). The quota count values are therefore calculated such that a 3 EPNdB increase always corresponds to a doubling of the quota count.

Noise Level Band, EPNdB	Quota Count
91 – 91.9	1
90 – 90.9	0.8
89 – 89.9	0.63
88 – 88.9	0.5
87 – 87.9	0.4
86 – 86.9	0.315
85 – 85.9	0.25
84 – 84.9	0.2
83 – 83.9	0.16
82 – 82.9	0.125
81 – 81.9	0.1
80 – 80.9	0.08
79 – 79.9	0.063
78 – 78.9	0.05
77 – 77.9	0.04
76 – 76.9	0.0315
75 – 75.9	0.025
74 – 74.9	0.002
73 – 73.9	0.016
72 – 72.9	0.0125
71 – 71.9	0.01
70 – 70.9	0.008
69 – 69.9	0.0063
68 – 68.9	0.005

Table A2.1: Aircraft Noise Quota Counts

A2.5 QUOTA COUNT BUDGET

A total quota count budget is set for each calendar year. Each aircraft movement has a quota count, determined by the specific aircraft in operation as described above, which is deducted from the available quota count budget. The total quota count realised at the airport will not be permitted to exceed the approved quota count budget in any calendar year. A secondary quota count budget is also set for each week.

All departures and arrivals at LCA are included in the quota, other than those engaged in training, positioning, aircraft testing and/or evaluation.

The noisier the aircraft, the higher its quota count score and the more it will count towards the total budget, resulting in fewer permitted flights.

The quota count budget is:

- 22,000 per calendar year; and
- 742.5 in any one week.

This quota count budget is broadly equivalent to the 120,000 Noise Factored Movements which LCA had permission to operate up to under the 2009 planning permission.

A2.6 ADDITIONAL RESTRICTIONS

Maximum Permissible Noise Levels of Aircraft

The ANCS also includes a procedure for controlling the noisiness of individual aircraft operating at the airport. The aim is to ensure that no noisier aircraft than currently operate at LCA will do so in the future and to achieve equivalence with the NFM scheme.

The maximum permissible noise levels of an aircraft operating at LCA is controlled to some extent by current UK regulations that prevent an airport from restricting operations by Chapter 4 aircraft. The first method of control is therefore:

- No aircraft is permitted to operate at LCA unless it complies with the noise requirements of Chapter 4.

ICAO sets a number of standards for aircraft noise certification which are contained in Annex 16. This document sets maximum acceptable noise levels for different aircraft during take-off and landing, categorised as Chapter 2, 3, 4 or 14.

- Chapter 2 aircraft have been prevented from operating within the EU since 2002, unless they are granted specific exemption, and therefore the vast majority of aircraft fall within Chapter 3, 4 or 14 parameters. These aircraft are quieter than Chapter 2 aircraft.
- Chapter 4 standards have applied to all new aircraft manufactured since 2006. These aircraft must meet a standard of being at least 10 dB quieter than Chapter 3 aircraft.
- Chapter 14 was adopted by ICAO in 2014. This represents a reduction in allowed noise levels of 7 dB compared with Chapter 4 and applies to new aircraft types submitted for certification after 31 December 2017.

Additionally, upper noise limits are applied through the ANCS in order to control the noisiness of aircraft and to ensure no noisier aircraft can operate at LCA than those that are currently permitted. As a result, no aircraft will be permitted to operate at LCA unless the following condition is met:

- A noise certificate for the specific aircraft type shall be available which, for its maximum permitted weight of operation at LCA, demonstrates compliance with the following three noise certification levels, where the sum of all three levels does not exceed 271 EPNdB.
    - Flyover: 88.0 EPNdB
    - Sideline: 93.5 EPNdB
    - Approach: 98.0 EPNdB

Before any aircraft type is permitted to operate at LCA, evidence of compliance with the above requirements must be submitted to and approved in writing by LBN.

Maximum Permissible Number of Aircraft Movements

The ANCS does not allow a higher number of aircraft to operate at the airport than permitted under the 2009 planning permission or the CADP planning permission.

- Under the 2009 planning permission, the total number of aircraft movements was limited to 120,000 per calendar year.

- Under the CADP planning permission, this has been reduced to 111,000 aircraft movements per calendar year.

A2.7 EXAMPLE ANCS SCENARIOS

In this section three example calculations are presented.

Turbofan aircraft – Embraer E190

An Embraer E190 aircraft is to arrive and depart LCA. The airport has 11,000 quota counts remaining in the annual quota budget and 60,000 aircraft movements remaining from the annual limit.

The aircraft has the following certificated noise levels, taken from its noise certificate:

- Flyover: 81.9 EPNdB
- Sideline: 91.7 EPNdB
- Approach: 92.5 EPNdB
- Sum: 81.9 EPNdB + 91.7 EPNdB + 92.5 EPNdB = 266.1 EPNdB

The first check is whether the certificated noise levels are within the maximum permissible:

- Flyover: 88.0 EPNdB
- Sideline: 93.5 EPNdB
- Approach: 98.0 EPNdB
- Sum: 271 EPNdB

The aircraft does not exceed any of these limits.

The departure noise level is then calculated:

$$Departure\ Noise\ Level = \frac{Sideline\ Noise\ Level + Flyover\ Noise\ Level}{2}$$

- Departure noise level: (81.9 EPNdB + 91.7 EPNdB)/2 = 86.8 EPNdB

The arrival noise level is then calculated:

The aircraft is modelled using AEDT to determine the approach noise level using a 3 degree and a 5.5 degree approach. This gives an approach noise level of 93.3 dB for the 3 degree approach and 87.9 EPNdB for the 5.5 degree approach, a difference of 5.4 EPNdB. This is applied to the

certificated approach noise level of 92.5 EPNdB to give a resulting approach noise level of 87.1 EPNdB.

$$Arrival\ Noise\ Level = \ Approach\ Noise\ level - 9\ EPNdB$$

- Arrival noise level: 87.1 EPNdB – 9 EPNdB = 78.1 EPNdB

These values are then looked up in Table A2.1 for the corresponding quota counts.

- Arrival quota count: 78.1 EPNdB is in the 78.0 – 78.9 EPNdB noise band and has a quota count value of 0.05.
- Departure quota count: 86.8 EPNdB is in the 86.0 – 86.9 EPNdB noise band and has a quota count value of 0.315.

The arrival and departure of this aircraft therefore corresponds to a total quota count of 0.05 + 0.315 = 0.365 and 2 aircraft movements (1 arrival and 1 departure).

The remaining quota count budget is then reduced by 0.365 and the remaining number of movements allowed until the end of the year is reduced by 2.

Turboprop aircraft – ATR 42

An ATR 42 aircraft is to arrive and depart LCA. The aircraft has the following certificated noise levels, taken from its noise certificate:

- Flyover: 76.6 EPNdB
- Sideline: 80.6 EPNdB
- Approach: 92.4 EPNdB
- Sum: 76.6 EPNdB + 80.6 EPNdB + 92.4 EPNdB = 249.6 EPNdB

The first check is whether the certificated noise levels are within the maximum permissible:

- Flyover: 88.0 EPNdB
- Sideline: 93.5 EPNdB
- Approach: 98.0 EPNdB
- Sum: 271 EPNdB

The aircraft does not exceed any of these limits.

The departure noise level is then calculated:

$$Departure\ Noise\ Level = \frac{Sideline\ Noise\ Level + Flyover\ Noise\ Level}{2}$$

- Departure noise level: (76.6 EPNdB + 80.6 EPNdB)/2 = 78.6 EPNdB

The arrival noise level is then calculated:

The aircraft is modelled using AEDT to determine the approach noise level using a 5.5 degree approach after adjusting the noise profile of the most appropriate aircraft type within AEDT to match the approach noise level as measured at LCA during a 5.5 degree approach. This gives an approach noise level of 93.9 dB EPNdB.

$$Arrival\ Noise\ Level = \ Approach\ Noise\ level - 9\ EPNdB$$

- Arrival noise level: 93.9 EPNdB – 9 EPNdB = 84.9 EPNdB

These values are then looked up in Table A2.1 for the corresponding quota counts.

- Arrival quota count: 84.9 EPNdB is in the 84.0 – 84.9 EPNdB noise band and has a quota count value of 0.2.
- Departure quota count: 78.6 EPNdB is in the 78.0 – 78.9 EPNdB noise band and has a quota count value of 0.05.

The arrival and departure of this aircraft therefore corresponds to a total quota count of 0.2 + 0.05 = 0.25 and 2 aircraft movements (1 arrival and 1 departure).

The remaining quota count budget is then reduced by 0.25 and the remaining number of movements allowed until the end of the year is reduced by 2.

Light propeller aircraft – Piaggio P180

A Piaggio P180 aircraft is to arrive and depart LCA. This is a light propeller aircraft and so its noise certificate does not contain the flyover, sideline and approach noise levels and the light propeller procedure is followed.

1. Determine the reference aircraft, being the lightest propeller aircraft for which suitable measurements at LCA operating at LCA which is subject to the ICAO Chapter 4 certification tests.

The reference aircraft is currently the ATR 42.

2. Compare the measured EPNdB noise levels taken by the LCA NMTs with those for the reference aircraft, separately for sideline (NMTs 1-4), flyover (NMTs 5-6) and approach (NMTs 5-6).

This process is followed on the basis of measurements taken in the period January 2019 to November 2021 in Table A2.2 below.

LCY Measurement Point	ATR 42 Level, EPNdB	P180 Level, EPNdB	Difference, EPNdB
Flyover (NMTs 5-6)	81.9	86.6	+4.7
Sideline (NMTs 1-4)	89.8	92.5	+2.7
Approach (NMTs 5-6)	88.4	91.0	+2.6

Table A2.2: Measurement Comparison, ATR42 and P180

3. Use these difference to estimate the sideline, flyover and approach noise levels for the light propeller aircraft by comparing with noise certificates for the reference aircraft.

This is set out in and Table A2.3 below.

ICAO Chapter 4 Measurement Point	ATR 42 Certificated Level, EPNdB	P180 Estimated Level, EPNdB
Flyover (NMTs 5-6)	76.6	81.3
Sideline (NMTs 1-4)	80.6	83.3
Approach (NMTs 5-6)	92.4	95.0

Table A2.3: P180 Estimated Certificated Noise Levels

These estimated levels are then used for the procedure set out for other aircraft.

- Flyover: 81.3 EPNdB
- Sideline: 83.3 EPNdB
- Approach: 95.0 EPNdB
- Sum: 81.3 EPNdB + 83.3 EPNdB + 95.0 EPNdB = 259.6 EPNdB

The first check is whether the certificated noise levels are within the maximum permissible:

- Flyover: 88.0 EPNdB
- Sideline: 93.5 EPNdB
- Approach: 98.0 EPNdB

- Sum: 271 EPNdB

The aircraft does not exceed any of these limits.

The departure noise level is then calculated:

$$Departure\ Noise\ Level = \frac{Sideline\ Noise\ Level + Flyover\ Noise\ Level}{2}$$

- Departure noise level: (81.3 EPNdB + 83.3 EPNdB)/2 = 82.3 EPNdB

The arrival noise level is then calculated:

The aircraft is modelled using AEDT to determine the approach noise level using a 5.5 degree approach after adjusting the noise profile of the most appropriate aircraft type within AEDT to match the approach noise level as measured at LCA during a 5.5 degree approach. This gives an approach noise level of 95.0 dB EPNdB.

$$Arrival\ Noise\ Level = \ Approach\ Noise\ level - 9\ EPNdB$$

- Arrival noise level: 95.0 EPNdB – 9 EPNdB = 86.0 EPNdB

These values are then looked up in Table A2.1 for the corresponding quota counts.

- Arrival quota count: 86.0 EPNdB is in the 86.0 – 86.9 EPNdB noise band and has a quota count value of 0.315.
- Departure quota count: 82.3 EPNdB is in the 82.0 – 82.9 EPNdB noise band and has a quota count value of 0.125.

The arrival and departure of this aircraft therefore corresponds to a total quota count of 0.315 + 0.125 = 0.440 and 2 aircraft movements (1 arrival and 1 departure).

The remaining quota count budget is then reduced by 0.44 and the remaining number of movements allowed until the end of the year is reduced by 2.

APPENDIX 3
SUMMARY OF OTHER NOISE CONTROLS

The ANCS sits alongside a number of other noise controls currently in place at LCA. A summary of these is given below:

- Vertical take-off and landing aircraft (including helicopters, tilt-rotor or gyrocopters) are not permitted to use the airport.
- The airport is permitted to be used for the taking off or landing of aircraft between the hours of 06:30 and 22:00, except for the 24-hour period between 12:30 on Saturdays to 12:30 on Sundays. Separate restrictions apply for Public Holidays. Aircraft which were scheduled to take off or land within these times but have suffered unavoidable delays are permitted to operate up to 30 minutes later.
- The number of scheduled aircraft movements in any given hour is limited to 45.
- The airport is permitted a maximum of 111,000 aircraft movements per calendar year. There are also various restrictions on the number of daily and weekly aircraft movements.
- The airport is restricted to a maximum of 2 aircraft movements on any given day before 06:45 and a maximum of 6 aircraft movements on any given day before 07:00.
- The area enclosed by the 57 dB $L_{Aeq,16h}$ noise contour, based on the 92-day summer period, is not permitted to exceed 9.1 km^2.
- The airport operates a Noise Management and Mitigation Strategy (NOMMS) which includes a number of measures, in particular an Incentives and Penalties Scheme (IPS) which encourages aircraft to operate more quietly. This rewards those airlines with credits towards co-partnering LCA delivering a Community Projects Fund each year. It also introduced a fixed penalty for infringement of an upper departure noise limit as measured at the airport's permanent noise monitors.