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NOISE FACTSHEET

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AIRCRAFT NOISE

Whilst we can't eliminate aircraft noise completely we, at Glasgow Airport, together with our partners, are doing our utmost to reduce the effects of aircraft noise on the communities living close to the Airport and under the Airport's flight paths.

Aircraft noise is governed both by International Standards and National Regulations applied to the operation of airports and aircraft and by observing "best practice" throughout the Industry.

Over the years these regulations have become more stringent and technology has improved. Some of you may remember the "noisy" era of Tridents and BAC-111s and we think you'll agree that things are much better now with the much quieter and efficient airliners of today. However we are not complacent, we strive to reduce the impact of aircraft noise on communities where possible.

This factsheet outlines how we monitor aircraft noise and the steps we take to minimise, or further reduce, its impact. We published a Noise Action Plan[1] which outlined our plans for the period 2013-2018. This Noise Action Plan is due for renewal and is being consulted upon in tandem. This document will cover this topic in much greater detail than this brief factsheet. Other Factsheets describe how aircraft navigate and how we organise departing and arriving aircraft flight paths to minimise the environmental impact of their operations.

THE GOVERNMENT VIEW

The Civil Aviation Authority (CAA) regulates all aviation activity in the UK. To help the CAA in carrying out this role in the regulation of the use of airspace and the control of the environmental impact of aircraft operations in the vicinity of airports, the Government's Department for Transport (DfT) has published a Guidance Document outlining what the CAA must take into consideration when approving the airspace arrangements around airports. This document has recently been revised following public consultation. Click here to read this Guidance Document.

The Government's overarching policy in relation to aviation noise is 'to limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise, as part of a policy of sharing benefits of noise reduction between industry and communities in support of sustainable development'. The Government wishes this to be understood as meaning that, 'the total adverse effects on people as a result of aviation noise should be limited and, where possible, reduced, rather than the absolute number of people in any particular noise contour'. Adverse effects are considered to be those related to health and quality of life and these are measured using the Department for Transport's WebTAG tool which includes a module for valuing the impacts of noise, including those from changes in aircraft noise.

In practical terms, the Government expects that when routes are being designed or amended, precedence is given (so far as it is safely practicable to do so) to limiting and, where possible, reducing the total adverse effects on people whilst aircraft are below 4,000ft. Between 4,000ft and 7,000ft consideration should continue to be given to minimising the impact of aviation noise as this remains the environmental priority unless, this would disproportionately increase CO_2 emissions. In the airspace at or above 7,000ft, the CAA is expected to promote the most efficient use of airspace with a view to minimising overall aircraft emissions meaning that, mitigating the impact of noise is no longer a priority. Where options for route design below 4,000ft are similar in terms of impact on populated areas, consideration should be given as to whether it continues to be appropriate to maintain long-standing airspace arrangements. The Government also acknowledges the need for airports to consider the actual height of the ground as 7,000ft above mean sea level (amsl) would only be 6,000ft above ground level (agl) if the terrain has an elevation of 1,000ft.

The DfT recently commissioned a survey on attitudes to noise, the findings of which can be read here. The CAA also released a publication in March 2016 called 'Aircraft noise and health effects: Recent findings', which can be read here.

HOW DO WE MONITOR NOISE?

Here at Glasgow Airport we have two Noise Monitoring Terminals near to the ends of the runway so that the actual noise of each departing aircraft can be measured. Aircraft which exceed 94dB(A) by day or 87dB(A) by night are subject to fines. All money raised from noise fines goes directly to our Flight Paths Fund which gives aid to local charities and community groups.

The Noise Monitoring Terminals feed the noise measurements into our Noise and Track Monitoring (NTK) equipment which also monitors the track and height of departing and arriving aircraft.

1 www.glasgowairport.com/media/119680/gla-nap-web.pdf

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The NTK equipment enables us to monitor the tracks of the aircraft against the published noise abatement procedures and departure routes and also provides us with assurance that aircraft are achieving the specified minimum altitudes in the departure procedures. If an aircraft appears substantially "off-track" we can go back to the Operator or to Air Traffic Control to see if there were any specific reasons for this. The NTK data also enables us to work with aircraft operators to improve their adherence to the specified tracks through adjustments to their navigation databases.

UNDERSTANDING THE NUMBERS

The various terminologies and metrics used to measure and evaluate aircraft noise (e.g. A-weighted Decibels (dB(A), LAeq, Nx and Lmax[2]), and how they are used, are explained in the Noise Action Plan. However, technical numbers alone are often meaningless to those who actually experience the disturbance.

The tables below give an indication of the likely maximum noise that a departing aircraft might generate on the ground under its flight path and, then some idea of comparative everyday noises.

However, it must be borne in mind that the noise levels generated by every individual aircraft may vary considerably as the noise levels are affected by weather conditions, aircraft weight, speed and height, engine type, how far away it is from "direct" overflight and other variables. The numbers in the tables are the maximum values likely to be experienced.

The Tables below have been developed by the CAA's Environmental Research and Consultancy Department (ERCD) to provide representative L_{max} data as a function of aircraft height above the ground. The ERCD uses the Aircraft Noise Contour Model "ANCON Version 2" and every summer the Model is validated using hundreds of thousands of measurements around Heathrow, Gatwick and Stansted Airports. In order to simplify the data different aircraft types are categorised into representative groups relative to aircraft size. Table 1 gives the representative aircraft groups and Table 2 gives the L_{max} noise levels that the CAA noise modelling has developed for departing aircraft as a function of height above the ground. Finally, Table 3 relates the L_{max} numbers to comparable everyday sounds.

Table 1: Aircraft Noise Groups

SPECIFIC AIRCRAFT TYPES	NOISE GROUPING	GROUP
ATR-42; ATR-72;	50-70 seat regional turboprop	A
Bombardier CRJ; Embraer 135/145	50 seat regional jet	B
Bombardier CRJ700/900;	70-90 seat regional jet	C
Airbus A318/319/320/321; Boeing B737-600/700/800/900	125-180 seat single-aisle 2-engine jet	D
Airbus A330, Boeing 767-300/400	250 seat twin-aisle 2-engine jet	E
Airbus A340-200/300/500/600, Boeing 777-200/300/ER	300-350 seat twin-aisle jet	F
Boeing 747-400	400 seat 4-engine jet	G
Airbus A380	500 seat 4-engine jet	H

2 Lmax is the simplest measure of a noise event, such as an aircraft overflight, is Lmax which is the maximum sound level recorded (in dB(A))

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Table 2: Average Lmax for departing aircraft for noise assessment purposes

Height (ft)	A	B	C	D	E	F	G	H
1000-2000	78-71	78-70	85-75	85-75	92-83	90-81	92-84	91-84
2000-3000	71-67	70-65	75-68	75-70	83-77	81-75	84-79	84-80
3000-4000	67-64	65-60	68-64	70-66	77-73	75-71	79-75	80-76
4000-5000	64-62	60-57	64-61	66-63	73-69	71-67	75-72	76-73
5000-6000	62-60	57-55	61-58	63-60	69-66	67-64	72-69	73-71
6000-7000	60-58		58-56	60-59	66-64	64-62	69-67	71-68

Table 3: Everyday examples of noise levels

NOISE	NOISE LEVEL (DB(A))
Chainsaw at 1m distance	110
Disco, at 1m from speaker	100
Diesel truck passing by 10m away	90
Kerbside of a busy road, 5m away	80
Vacuum cleaner, 1m away	70
Conversational speech, 1m away	60
Quiet Office	50
Room in a quiet suburban area	40
Quiet Library	30

(Source: Airports Commission, based substantially on www.sengpielaudio.com/TableOfSoundPressureLevels.htm)

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NIGHT TIME NOISE

Glasgow Airport operates 24 hours a day with no restrictions on the number of night time flights, although the number of flights operating at night is relatively low (typically less than 4% of the total movements). Night time at Glasgow is currently defined as between 2300 and 0600. This may in due course change to 2300 to 0700 in line with the CAA guidance.

Many people are not bothered by aircraft noise during the day when ambient noise levels are higher but are more disturbed by aircraft noise at night. Therefore, the noise thresholds at which we start to fine aircraft operators are much lower during the night period. We restrict night-time operations to the less noisy aircraft types and actively encourage our Airline Operators to use the quietest aircraft types on their night services to and from the Airport. We do not expect to see any significant increase in night movements in the coming years.

GROUND NOISE

Ground noise relates to the noise produced by aircraft when they are running their engines on the ground either when they are moving around the Airport after landing, before take-off or when engines are being run for maintenance purposes. We understand that this noise can cause annoyance to people living close to the Airport and we issue local restrictions to aircraft operators to limit the time that they can run their engines or Auxiliary Power Units (APUs) on the ground. We discourage the use of the noisy practice of reverse thrust to slow aircraft after landing. The exits from the runway are positioned so that this practice is rarely needed. We also work with ATC to try and minimise the amount of time an aircraft is taxying on the ground with its engines running and queuing for take-off.

TAKE-OFF AND LANDING DIRECTION

Glasgow Airport has a single runway which can be used in either direction. For safety reasons aircraft land and take-off into wind and this dictates the direction of arrival and departure that is used on any given day. The prevailing wind in the west of Scotland is from the west and northwest, which means that Runway 23 is used (approximately 78%) most of the time (the runway is aligned to the prevailing winds). When Runway 23 is in use aircraft take off towards Linwood and Johnstone and land from the Bearsden and Clydebank direction. When Runway 05 is in use then aircraft land from the Johnstone/Linwood direction and take-off towards Clydebank and Bearsden.

NOISE ABATEMENT

We have strict noise abatement procedures at Glasgow Airport which we monitor rigorously; these do however need to change to remain relevant to the proposed departure procedures. We are proposing a single noise abatement procedure which requires all aircraft over 5,700kg (Maximum Take-Off Weight Allowed) to follow the published departure procedures until they have passed at least 4,000 feet before turning directly towards their preferred route. Government guidance is that airports should try to limit and, where possible reduce the number of people experiencing significant adverse effects from aircraft noise, not necessarily the number of people within a specific noise contour. We aim to concentrate traffic from the existing diverse spread onto a smaller number of RNAV routes. These routes will be followed until at least 4,000 feet ensuring that what has been planned is delivered. We believe that the implementation of this rationalised array of procedures vice the use of multiple RNAV 'relief' routes meets the intent of the Government guidance.

More information on the routes that aircraft follow when inbound to and outbound from Glasgow Airport can be found in the Consultation Document.

NOISE MEASUREMENT: WHAT MEASUREMENTS DO WE USE AND WHY?

The measurement of noise is very complex, and noise measurements are taken in different ways depending on what it is that you want to measure.

L_{max}, measured in decibels (dB), is the measurement of the maximum noise level during one noise event or in this case during one aircraft movement. L_{Aeq} which is measured in decibels (dB), is defined as the equivalent continuous sound level over a period of time and is used to predict or measure the average noise level and the disturbance caused; it is commonly used in environmental noise measurements. As a flight increases in altitude the noise from aircraft disperses and dissipates outwards in a cone shape, with noise levels decreasing as the height of the aircraft increases.

L_{Aeq} CONTOUR MAPS

The levels of individual noise events using Lmax are useful for many purposes including aircraft certification. However, to assess environmental noise exposure, it is necessary to account for the impact of many events over longer periods. These events will generally differ in magnitude; there will be different numbers in each hour or day; and they will occur at different times of day. Most indices for these assessments are L_{Aeq}-based.

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Noise Contour Maps use L_{Aeq} as a measurement; it is 'A' weighted to represent weighting for human hearing and is the most commonly used parameter for predicting and measuring nuisance and disturbance and stated as dBA.

The noise contours in our Consultation Document use L_{Aeq}, 16h as required by the CAA, which aggregate the noise from the flights during the 16 busy daytime hours of the airport operation (7am to 11pm) and average it over that period. These are based on the average summer day, where 'summer' is the 92-day period from 16 June to 15 September, and 'day' is the 16-hour period from 7am to 11pm. The contours are produced in 3 dB steps from 51 dBA to 72 dBA. L_{Aeq} and L_{eq} are described in further detail in the parameters section below.

The noise contour charts for night-time are calculated over an 8-hour period ($L_{Aeq, 8h}$) between 11pm and 7am for a typical summer's night. In the case of both day and night, the typical summer 92-day period is chosen because airports are normally busier during the summer period and a greater number of movements are likely to produce higher L_{Aeq} values.

Noise contour maps are used to predict which geographical areas will likely be the most disturbed by noise and help the Airport to predict areas where noise disturbance may occur and determine areas that may be entitled to extra insulation in their homes to help reduce the noise disturbance from aircraft. For this consultation, we have commissioned these contours for the existing scenario, the existing scenario with 10-year projected growth, the proposed scenario and the proposed scenario with a 10-year projected growth.

Nx Contours – Nx contours are a secondary noise metric intended to show the impacts of noise beyond the range that typically shown by the LAeq contours. Nx contours show the locations where the number of events (i.e. flights) exceeds a pre-determined noise level, expressed in dB LAmax. For example, N65 contours show the number of events where the noise level from those flights exceeds 65 dB LAmax

SCIENTIFIC DESCRIPTION OF NOISE PARAMETERS

Lmax – the highest value of the time weighted sound pressure level, which occurred during the measurement period. It is commonly used to measure the effect of very short duration bursts of noise, such as sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise.

'A' Weighting – The human ear responds better to some tones than to others, so you can hear somebody talking but cannot hear the very low tones of a car travelling in the distance or the very high tones made by a dog whistle or bat. To account for this a sound level meter is fitted with filters, the most common being 'A' weighting, which is like the response of the human ear.

dBA – Decibels 'A' weighted.

LAmax – LAmax is the Lmax measurement 'A' weighted to represent weighting for human hearing and slow time weighting.

Leq or LAeq – Equivalent continuous sound level or Leq is defined as the level of hypothetical steady sound which, over the measurement period, would contain the same (frequency-weighted) sound energy as the actual variable sound. Leq can be measured over any scale in practice. LAeq is 'A' weighted to represent weighting for human hearing and is the most commonly used and widely accepted as the most accurate parameter to use for determining nuisance and disturbance.