Luton and District Association for the Control of Aircraft Noise
Response to Airports Commission Discussion Paper 5 Aviation Noise

Introduction

LADACAN is a residents' group primarily concerned with the noise and safety impacts of Luton Airport on the surrounding communities. It was established in 1968 at a time when Luton Airport proposed a significant expansion of its operations and is represented on the London Luton Airport Consultative Committee (LLACC). The airport is currently subject to a further planning application to almost double in size.

We are pleased to comment on the above paper. Overall we welcome the paper as being a good summary of the issues regarding noise. As representatives of communities affected by aircraft noise and being aware of the inappropriateness of average noise contours like Leq and Lden, we have struggled to find meaningful metrics that help people to understand the noise effect. This resulted in a paper "Aircraft Noise: Information available for public consumption". We feel this provides important input to the Commission's deliberations and attach the paper at Annex 1.

Our answers to the questions raised are given below.

ANSWERS TO QUESTIONS

? What is the most appropriate methodology to assess and compare different airport noise footprints?
A: As discussed in the paper, there is no one indicator that achieves all purposes. This was considered by LADACAN in their paper on metrics "Aircraft Noise: Information available for public consumption" attached at Annex 1.

We suggest that the information required as general background for someone wanting to say buy a home, is very different to that required by those who already live there and want to know how much worse (or better) the environment is becoming compared with their perceptions, or who want to compare some future expansion plans with the current position. Similarly a different set of metrics are relevant for comparison of the performance of existing airports, and their changes over time.

For someone about to move to a location, N70 would seem the best simple guide.
For those already living there, N70 is inappropriate as the area only changes as the fleet changes, and in general reduces as individual aircraft become quieter. Leq would be appropriate but doesn't give sufficient weight to the number of movements: it equates a barely perceptible increase in noise of 3 decibels from each aircraft to a difficult-to-ignore doubling of the number of movements (NNI was better in this respect).
For assessing Planning Applications complex forecasts are needed showing detailed effects at specific locations giving number of movements and their noisiness, as well as Leq and N70.

Comparison between airports is more complicated and productivity doesn't help (except perhaps for the satisfaction of the individual airport operators). The number of people affected by noise at various bands is critical for determining whether an airport is best located, and/or the airport has improved.

Absolute noise is the only real measure. Background noise levels are important for determining the additional noise burden from aircraft (even at different times of the 24 hour period) but a relative measure would be unable to provide comparisons with other locations or flight patterns.

Currently unaffected areas might need Leq contours to assess the existing noise levels but these are irrelevant when aircraft noise is to be superimposed. For those areas numbers of events ie N70 is more appropriate. As an example, at Luton, there is an intention to almost double the passenger throughput, and increase movements by about 60%, and yet the projected average Leq increase is only 1dB and thus argued as being insignificant.

Are there any specific thresholds that significantly alter the nature of any noise assessment?
A: Yes. One absolute is the WHO guideline for sleep disturbance at night. Though implementation is a tough ask, it puts pressure on airlines to use the quietest possible aircraft at night and for those closest to airports to be adequately insulated.

We would also add some evidence that suggests another specific threshold of importance regarding schools.

"Research studies undertaken using school pupils in the areas affected by aircraft noise in the vicinities of airports in Los Angeles, Munich, and London Heathrow conclude that noise levels above 57dB indoors and 66dB outdoors have a marked effect on children's education. These levels, if experienced chronically, cause a state of increased arousal and decreased attention. Children lose concentration, have higher levels of hyperactivity and are significantly poorer performers in reading and comprehension. Long-term memory is also shown to be affected. These factors may impair early childhood development and education and can have an accumulative effect on the achievement of academic potential.
Children are a particularly high risk group, very vulnerable to the effects of exposure to chronic noise as well as to respiratory problems caused by poor air-quality."

To what extent does introducing noise at a previously unaffected area represent more or less of a an impact than increasing noise in already affected areas?
A: There can be no doubt that those currently affected by aircraft noise are less likely to object to more noise than those currently unaffected. To a certain extent those living close to an airport have already made their locational choice based on noise levels that do not disturb them. If they do not like it they have moved away.

Those in areas with no, or very few, flights will be traumatised by the sudden arrival of aircraft noise, and will thus be forced to make the choices that those already affected had to make in the past. This is not meant to suggest that because it is already noisy more noise can, or should, be added but merely to reflect that on a scale of disturbance, new sufferers might score 10 and existing ones might score 8. They all suffer, but some will feel the suffering more acutely.

To what extent is the use of a Noise Envelope approach appropriate, and which metrics could be used effectively in this regard?
Our submission to DAPF is worth repeating and is given at Annex 2.

To what extent should noise concentration and dispersal be used in the UK?
A vexatious issue and much argued about. It has much to do with the frequency of movements.

As an example, in the 1980's BAC1-11's flew from Luton. These often exceeded 110dBLAmax and were deafening. However there were only around 10 flights per day of this particular aircraft. We now complain more vociferously about aircraft that rarely exceed 90dB, but which fly over every 3 minutes.

Noise dispersion would be attractive if the number of flights were kept to a low level over any one particular location, but not if everyone suffers enough to feel the “one every 3 minutes” effect. We would also suggest that it would only allow airports to argue that they can have more flights without impacting local communities, as many more people would drop out of the Leq contours. We would also doubt that this would be helpful to ATC in terms of maximising capacity of our crowded airspace.

We would add that LADACAN strongly disagrees with the Commission’s view (para 5.12) that “in the medium term, planes are set to become significantly quieter”. Using the industry’s preferred metrics, the claim (para 5.2) that “noise from UK aviation will not increase despite a near doubling in flights over the next 40 years” requires that aircraft noise reduces by less than 3 decibels in that period. This is widely accepted to be less than the threshold of perception of a noise difference for a human in non-laboratory conditions, hardly a “significant” reduction.
The industry study led by the European Commission, Flightpath 2050, predicted that “perceived” aircraft noise from new aircraft in 2050 will be 65 per cent less than from those of equivalent size which were delivered in 2000. Using the perceived noise metric, this amounts to a reduction of just 4.5 decibels, little more than the threshold of perception. In fact, human response to sound is measured on a different scale in which a 10 decibel reduction represents a halving of loudness: that would be “significant”.

Annex 1

Aircraft Noise: Information available for public consumption

How to use this guide

There are a variety of methods of indicating the noise impact of aircraft movements. Though theoretically accurate, most give only limited information, and some are positively misleading. In this section we indicate what each of the common methods attempts to depict, and their failings.

Measuring noise

Noise is usually measured or estimated using the A-weighted decibel (dBA). This is a scale which is designed to match human perception in that the magnitude increases logarithmically with an increase in noise energy. An increase of 10 dBA doubles the loudness of a sound and 3dBA is usually the minimum change which we can detect. The A-weighting is applied to match the variation in the sensitivity of human hearing with the frequency (or pitch) of the sound.

The most easily understood characteristic of a single noise event related to aircraft is the maximum noise as the aircraft passes over and is designated L_{Amax}. Some idea of how loud an aircraft is can be gained by comparing the L_{Amax} value with these typical sound levels:

Typical Sound	Noise level (dB)
Threshold of pain	140
Aircraft take off at 50 metres	140
Aircraft take off at 300 metres	120
Pneumatic drill at 7 metres	95
Motor mower (operator)	80
Car at 40mph at 7 metres	70
Busy general office	60
Quiet office	50
Average suburban area	40
Quiet bedroom/library	35
Empty theatre	20
Threshold of audibility	0

While L_{Ama} gives a simple indication of how noisy a single aircraft movement is at a particular location, it cannot indicate how disturbing multiple flights over a longer period of time could be, nor does it provide such an indication for the whole area around an airport. A number of indicators or metrics seek to address these wider questions. Trying to build all this in to one simple metric is extremely difficult and yet this is clearly what people want if they are to understand the impact of aircraft noise upon them.

What do people on the ground want?

We suggest that most people want to know:

Q1. Where will I hear the noise?

Q2. How often will I hear the noise?

Q3. How noisy will that noise be?

Q4. For how long will I hear it?

Q5. At what times of the day and night will I hear the noise?

We have reviewed each metric against these questions.

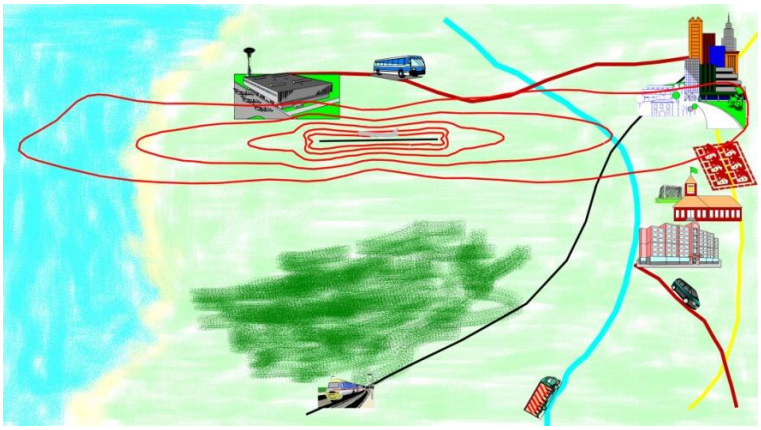
The answers to all these questions depend on the context in which the noise arises, namely:

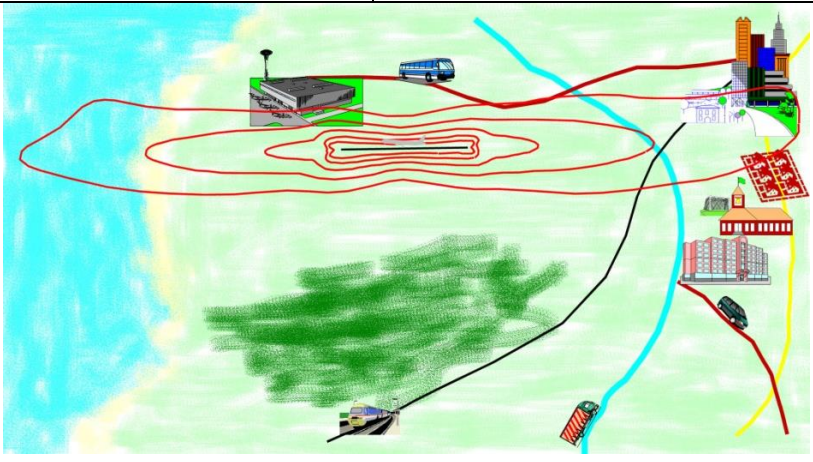
- The background noise level,
- The type of location: open countryside, wooded landscape, urban or high-rise, indoors or out.
- The activity being undertaken, and
- People's own perceptions of noise[1].

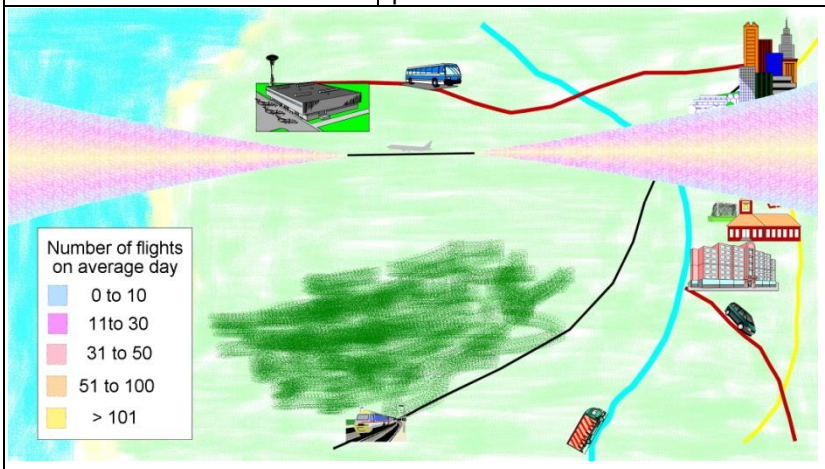
The following are some of the metrics commonly used.

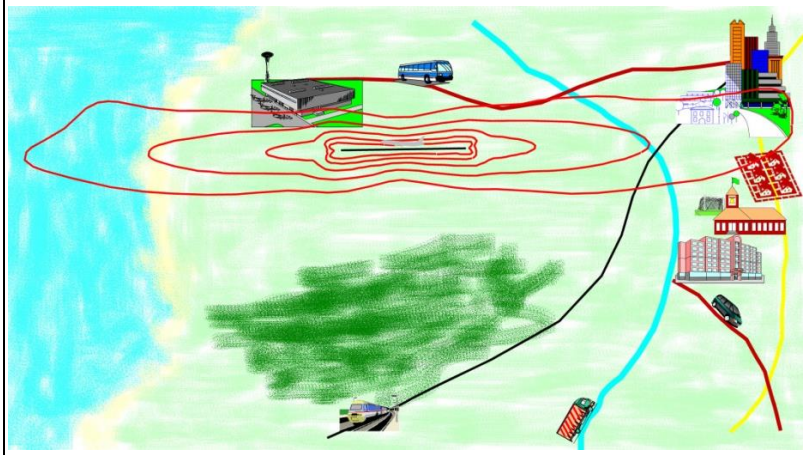
Type and example	How it is produced	What does it show?
Average noise: This is the noise indicator preferred by governments and the aviation industry. There are two common forms of average noise indicator: noise equivalent, designated L_{eq} (pronounced "lek"), and the variants produced for the European Noise Directive (END). L_{eq} is regarded as the standard noise indicator in the UK. It guides planning decisions through a Planning Policy Guidance note, PPG24, and is frequently used by planners to track changes over time, often based on the 57dBA L_{eq}	It can be measured using a sound meter but it is usually computed using records of actual movements and the noise characteristics of each aircraft. It is then presented as contours joining locations on which average noise is equal on maps showing the vicinity of the airport. The averaging is carried out over a specified period of the day, typically 16 hours (day) or 8 hours (night), and a specified number of days. L_{eq} contours are most commonly produced for a 92-day summer period from mid-June to mid-September for a 16-hour day starting at 07:00 and an 8-hour night form 23:00. The END indicators are averaged	Q1. It does give some indication of where the worst of the noise might occur though complainants are frequently miles outside the lowest of the contours which can accurately be computed. Q2. Though the number of aircraft movements does affect the contours the actual number is obscure. What is more, the weightings in the formula are heavier for the noise produced than for the number of movements. An reduction of 3dBA in noise produced by all aircraft which would barely be noticed by people on the ground would have the same effect on an L_{eq} metric as a halving of the number of movements, a very obvious change.

[1] Perception of noise is difficult to assess and interpreting a metric in terms of its effect remains a problem for most people. This comment applies to all the charts.

contour area or estimates of numbers of dwellings or populations within the contours. The END indicators are used to produce noise maps as the basis of noise action planning throughout the EU.	over a whole year. The indicators for a 12-hour day period, an evening period of 4 hours and an 8-hour night are combined into a composite day-evening-night indicator, L_{den}, with weighting of an additional 5 and 10 dBA for the evening and night levels respectively.	Q3. No-one hears an averaged noise. Although the contours expand as the noise worsens, most people are unable to interpret the contours as real noise levels that are experienced on the ground. The same average noise will be produced by a small number of noisy aircraft as by a large number of quieter ones but the effect on individuals is likely to be very different (and this could differ between night and day, for example).
		Q4. The averaging obliterates any measure of the duration of noise events.
		Q5. Some airports produce night noise contours but otherwise the averaging method gives no indication of when the noise will occur.

NNI (Noise & Number Index): NNI was used in the UK until the early '90s but is not usually available now as it was superseded by L_{eq} average noise. NNI is more sensitive than L_{eq} to numbers of aircraft movements and less reliant upon the loudness of each aircraft.	This index cannot be measured directly. It is calculated from the same data as L_{eq} (but in NNI units, not dBA) and is usually presented as contours in the same way averaged over a 12-hour day (07:00 to 19:00) over the same 92-day summer period. Numbers of dwellings and populations within the contours can be calculated.	Q1. It does give some indication of where the worst of the noise might occur though complainants are frequently miles outside the lowest of the contours.
		Q2. Though the number of aircraft movements does affect the contours, the actual number is obscured. The weightings in the formula are heavier for the number of movements but it is not possible to identify the number of movements from the index.
		Q3. Though the contours show how the noise worsens, it is not possible to relate noise measurements to the index.
		Q4. They give no indication of the duration of noise events.
		Q5. The averaging gives no indication of when the noise will arise.

Plot Density Charts: These are produced by some airports to help explain where aircraft fly and how frequently.	These are usually compiled from actual flight tracks derived from radar data. They are presented on a map with colour shading to indicate the numbers or proportions of flights which overfly each location. Separate maps for arrivals and departures and/or runway direction of operation can be produced.	Q1. They indicate where the aircraft fly in practice.
		Q2. They indicate how frequently the noise will be heard though do not tend to discriminate between times of day or night. Q3. They give no indication of the level of the noise. Q4. They give no indication of the duration of noise events. Q5. They give no indication of when the noise will arise unless they are compiled for specific times of day or seasons, for example.

N_x Charts: These were introduced in Australia as supplementary indicators which are more easily understood by the public. They are contour plots which show the number of noise events which exceed a given maximum level during a typical day.	Each contour on the map represents a given number of flights per day which exceed the given maximum noise level (in dBA). For example, at a location on the N_{70}=10 contour, a person on the ground would experience 10 aircraft noise events which equal or exceed 70 dBA in magnitude on an average day. N_{70} charts are most commonly produced but other maximum noise levels can also be used.	Q1. They give a reasonable indication of where the noise will be heard. The area within the N_x=0 contour will not change with the number of flights, only with changes in the aircraft fleet.
		Q2. They give a good indication of the average frequency of noise events. Q3. Between contours there is no indication of how noisy the aircraft will be. Q4. They give no indication of the duration of noise events. Q5. They give no indication of when the noise will arise

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<td>Track & swathe charts (Noise Preferential Routes, NPRs): These are designed to give an indication of where aircraft are permitted to fly. There are no NPRs for arriving aircraft but safety requirements usually confine commercial flights to a narrow swathe around the extended runway centre line and a fixed decent slope for the final six or more miles of their approach.</td>
<td>These are usually based upon the departure instructions for aircrew set by the airport operator to comply with safe navigation. It is assumed that aircraft can stay within 1,500 metres of the specified route and this “swathe” is shown on the charts.

Most NPRs are mandatory only until the aircraft reaches a specified height above sea level, usually 3,000 or 4,000 feet.</td>
<td>Q1. They indicate where the aircraft should fly (but may not) but give no indication of the noise that might be experienced. The noise footprint is much wider than the swathe and therefore the swathes can be misleading.</td>
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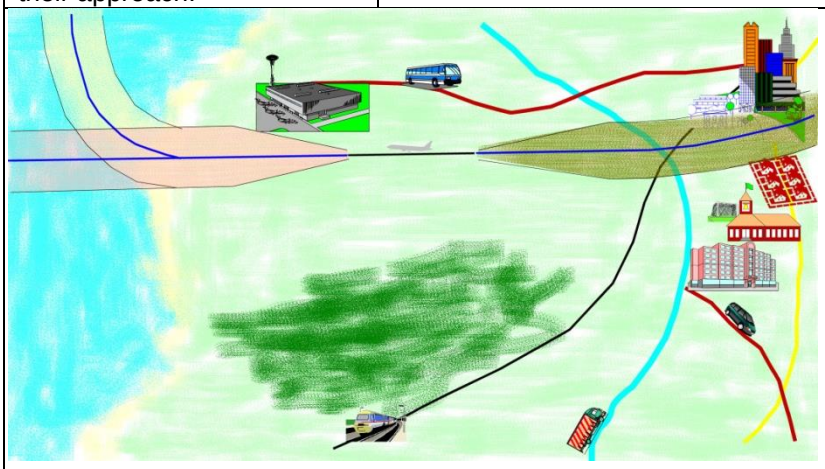
<td rowspan="4">  </td>
<td>Q2. They give no indication of the number of movements. The routes may be flown once a day or 40 times per hour.</td>
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<td>Q3. They give no indication of the level of noise that will be experienced.</td>
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<td>Q4. They give no indication of the duration of noise events.</td>
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<td>Q5. They give no indication of when the noise will arise.</td>
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<td rowspan="3">Locational noise histograms: These indicate numbers of aircraft noise events within selected ranges of maximum noise levels at specific locations.</td>
<td rowspan="3">The most common sources of these graphs are fixed noise monitors located under departure routes (see Track and Swathe Charts above) which are maintained and operated by many airport operators. Data for different periods of the day can be presented separately and the data can be aggregated over any number of days, typically a month or a quarter.

For short periods, noise meters can be located at most locations to provide this (and other) data. Local Planning Authorities should conduct such monitoring on potentially noisy sites identified in planning applications.</td>
<td>Q1. These provide good information for 1 location only. However, when combined with flight track data it is possible to estimate where noise will be heard.</td>
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<td>Q2. These show how often the noise will be heard at a variety of maximum noise levels, split by day, evening and night.</td>
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<td>Q3. The noise bands clearly indicate the level of the maximum noise measured in dBA at the monitor location but give no reliable indication of noise, say, 500m away. The noise measurements are affected by the aircraft’s height, lateral displacement from the microphone, the wind and other extraneous events.</td>
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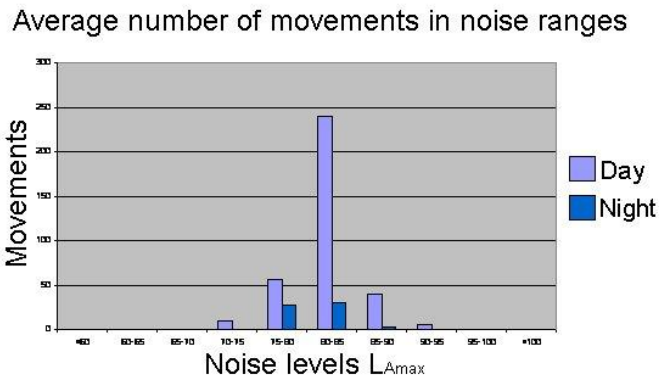


Q4. Maximum noise incorporates no information about the duration of the noise event.

Q5. They give only limited indication of when the noise arises if the data can be segregated by time of day.

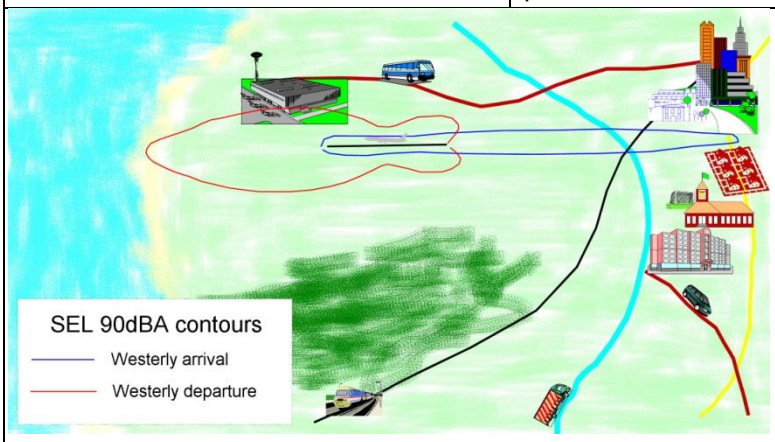
Sound Exposure Level (SEL): This is the magnitude of a noise event of one second duration which contains the same total sound energy as a single aircraft noise event. It varies with the aircraft type and its take-off weight.

90 dBA SEL is the UK Government's preferred indicator of night noise disturbance because UK research has shown that an <u>average</u> person's sleep is unlikely to be disturbed by outside noise events below this level.

SEL is also known as "Single Event Level".

SEL can be measured but it is most often computed and presented as contours on a map. This is, therefore, a representation of the calculated noise footprint of a single aircraft movement.

Each aircraft type and engine variant will have a different footprint. Given differences in weather and load the actual footprint will vary in practice.



Q1. The SEL noise footprint gives a broad indication of where the worst noise will be experienced.

Q2. SEL gives no indication of the number of movements of this type of aircraft and, thus, the number of noise events.

Q3. SEL does not distinguish between noise events which are of long duration and low volume and those of short duration and high volume. However, at locations close to airports where SEL levels are high this is not a significant weakness and different values of SEL are likely to reliably indicate differences in the potential to disturb.

Q4. SEL is normalised over the duration of the noise event so the duration information is lost.

Q5. SEL gives no indication of when the noise will arise but the exposure which it indicates happens with each flight.

How the metrics rate in answering the 5 questions

* = Poor, ***** = Excellent

Metric	Q1. Where will I hear the noise?	Q2. How often will I hear the noise?	Q3. How noisy will that noise be?	Q4. For how long will I hear it?	Q5. At what times of the day and night will I hear the noise?
LEQ Contours	**	*	**	*	*
END Contours	**	*	**	*	**
NNI contours	**	**	*	*	*
Plot Density Charts	*****	*****	*	*	*
Nx Charts	****	*****	**	*	*
Track & Swathe Charts	****	*	*	*	*
Locational histograms	*	*****	*****	*	****
SEL Charts	****	*	**	*	*
Noise at Monitoring Points tables	*	**	****	*	**

Annex 2

Response to Draft Aviation Policy Framework July 2012

 Do you agree with the proposed principles to which the Government would have regard when setting a noise envelope at any new national hub airport or any other airport development which is a nationally significant infrastructure project?
A: Why is this only applicable to NSIP's? There are many airport expansion proposals (of which Luton is considered by some to be one) that may not involve an extra 10mppa and yet will double the size of the airport. The principles should be applied to any proposed expansion otherwise it is not consistent with the broad policy objective.

We do not understand why Government does not adopt the World Health Organisation (WHO) recommended noise limits for all UK Airports as a "noise envelope" within which people are not expected to live or work. These are supported by a substantial evidence base. It may be the case that these would represent challenging targets at some airports but this could be accommodated by establishing a timetable for compliance through a combination of operational constraints, mitigation measures and compensation to householders. This would provide consistency between airports and avoid any commercial advantage which the current piecemeal approach confers on some airports over others.

As an example of the inconsistency which currently exists, residents closest to Luton Airport are overflown by aircraft at similar altitudes to those living near London City Airport. However, Luton's aircraft are often larger and, hence, noisier because it has a longer runway and the dwellings near to Luton were, in the main, built in or before the early 20th century while those near London City are modern and, we hope, incorporate noise insulation. While Luton has no constraints on hours of operation, London City has a night curfew and a 24-hour closure at weekends.

We feel that our response to the scoping consultation is worth repeating here.

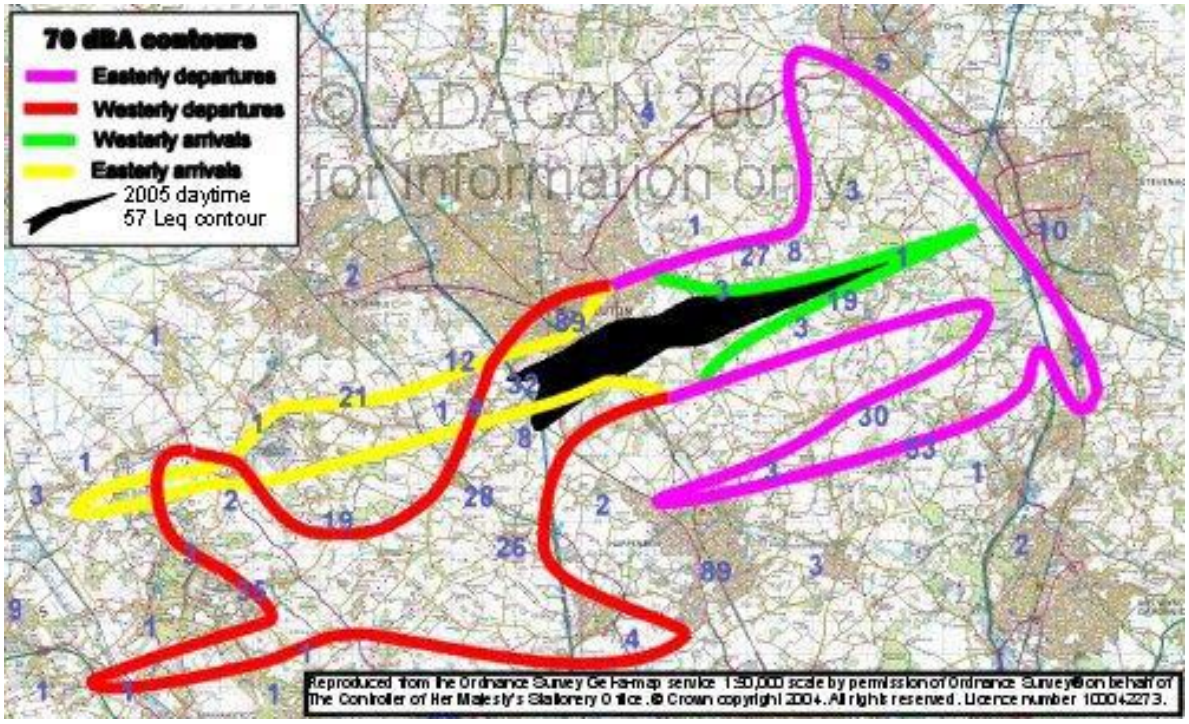
"The scoping document does not explain the 'noise envelope' concept although the use of the word 'envelope' suggests that the intention is that airport growth is to be constrained by some measure of its noise impact. Such concepts have been in operation for some years: the Government set a limit on the area of the 57 L_{eq} dBA daytime noise contour of 127 sq km at Heathrow (Future of Air Transport White Paper) and the planning permission granted for Luton Airport specifies a limit of 31.52 sq km for the same indicator.

The difference between these constraints illustrates the problem with such an approach: the area of such a contour bears no relation to the noise experienced by those living near the airport. They could be more closely related to community disturbance by specifying the number of people within the contour rather than the area but the number would remain arbitrary.

The only satisfactory approach to noise is the application of limits which are mandatory at all airports to be achieved by statutory mitigation and compensation and through operating restrictions. There is now ample guidance, particularly from the World Health Organisation (WHO), based on a growing body of scientific evidence about the health and disturbance effects of noise. The difficult decision is about the indicators to be used to specify the noise limits. Average noise indicators (L_{eq}, L_{den}, L_{night}, etc.) may be useful for fairly continuous noise sources but where the noise source is erratic or infrequent they are poor indicators. Indeed, they are widely discredited as indicators of disturbance from aviation as they equate doubling of noise energy, the limit of discrimination of human hearing in normal circumstances, with twice the number of noise events, a

change which humans can hardly ignore. The Attitudes to Noise from Aviation Sources in England (ANASE) study sponsored by the DfT produced evidence of this weakness.

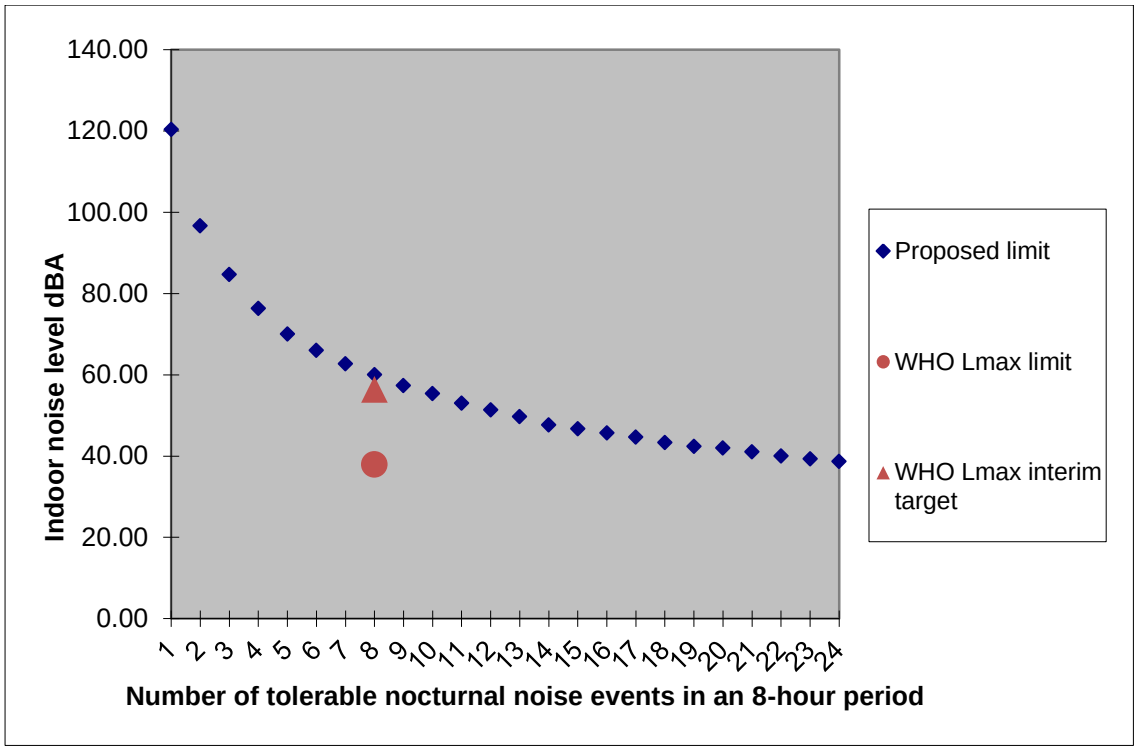
The evidence from Luton, and many other airports (see GACC evidence) is that noise disturbance as indicated by complaints, is far more widespread than L_{eq} contours suggest. Luton Airport's Annual Monitoring Report (AMR) 2010 day (57dB L_{eq}) and night (48dB L_{eq}) contours exhibit virtually no correlation with the number and location of complaints shown on page 65. It was for this reason that LADACAN undertook a study in 2005 to identify a contour based on the point at which the most frequent aircraft would generate less than 70dBA L_{Amax}, the same noise threshold used at the Airport's own fixed noise monitoring points. The results shown on the map below clearly correlate better than the L_{eq} contour with the annual complaints figures for 2005 (shown in blue).



Those living outside the contour will never experience noise events louder than 70dB (assuming an unchanged fleet mix) regardless of the number of flights. But disturbance is also caused by the frequency of noisy events, and this will affect all those within the contour. A noise envelope therefore needs to have a limit on the number of movements as well. It has often been quoted that if aircraft made no noise no-one would mind how many flights they made. So there must be targets which limit the number of movements at all locations in all noise bands above, say, 70dBA L_{Amax}.

Having examined a large number of noise indicators, LADACAN has concluded that the search for a single indicator which could provide a useful limit quantifying a noise envelope is doomed to failure. We conclude that universal noise limits must be specified as a trade-off between a maximum noise measure (L_{Amax}) and the number of events in a noise period (eg the 8-hour night) which can be permitted to exceed the specified level.

We have found a proposed limit of this kind for night noise (Griefahn B, Scheuch K, Jansen G, Spreng M. Protection goals for residents in the vicinity of civil airports. Noise and Health 2004;6:51-62) which is shown in the figure below. The graph also shows the equivalent WHO night noise limits (WHO Night Noise Guidelines for Europe 2009) transcribed to maximum indoor levels."


140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Indoor noise level dBA
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Number of tolerable nocturnal noise events in an 8-hour period
Proposed limit
WHO Lmax limit
WHO Lmax interim target