PRESENTING AIRCRAFT NOISE INFORMATION - EXPERIENCES FROM A UK PUBLIC CONSULTATION

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1 INTRODUCTION

The Government's South East and East of England Regional Airport Study (SERAS) aimed to provide a policy framework for the long-term future of aviation and airports in the UK. Not surprisingly, a important issue in the consultation was the noise impact of the future airport scenarios.

Staff from the CAA's Environmental Research and Consultancy Department were required to attend the public consultations to answer questions about the noise impact of the various airport expansion options. Technical experts involved in portraying noise around airports have for many years grappled with the issue of the best way to show noise impact. This is a vexed issue particularly because on the whole, the noise is not welcomed by the audience. In ancient times mythology has it that the King would kill the bringer of bad news. . . happily in some respects at least, we have made progress! This paper will briefly describe the SERAS process and attempt to answer the fundamental question: in what format should noise impact be portrayed?

2 THE SERAS PROCESS

In 1998, the Government published a White Paper, 'A New Deal for Transport: Better for Everyone'. That White Paper announced the preparation of an airports policy for the UK spanning the next 30 years and undertook to bring forward new policies on civil aviation. The SERAS process sought to consult on how much extra airport capacity should be provided in the South East of England over the next 30 years (if any), and (if it is needed) where any such new airport capacity should be located.

To accompany the consultation documentation the Department for Transport (DfT) organised a number of public exhibitions at the South East airports included in the consultation process. In total 21 days of public exhibitions were arranged to give local communities and stakeholders a chance to meet and question experts in the fields of aviation noise, emissions, land use planning, transportation as well as DfT representatives. The proposed development options for each South East airport are summarised in Table 1.

Airport	Consultation Proposals	Exhibition Days
Heathrow	1 extra short runway	3
Gatwick	1 or 2 extra runways	4
Stansted	1, 2 or 3 extra runways	5
Cliffe	new 2 or 4 runway airport	5
Luton	realignment or replacement of existing runway and added taxiways	3
Alconbury	Re-activation of former military airfield	1

Table 1: Summary of SERAS Options

All of the noise modelling work for the SERAS process was carried out by ERCD on behalf of the DfT using the official UK aircraft noise model, ANCON 2. Contours were computed using the standard 16 hour Leq for an average summer day based on data over a 92 day period from mid June to mid September. For aircraft noise modelling, the average summer day is considered to be

appropriate because the air traffic tends to be most intensive at this time of the year and the resident population is more likely to have windows open and wish to use their gardens. The contours were calculated using the standard 3 dB intervals between 57 dBA to 72 dBA; in most modelling runs, a 54 dBA 'sensitivity' contour was also run. The precedent for these sensitivity contours was set in the Runway Capacity to Serve the South East (RUCATSE) study in the 1990s, where they were presented to account for the uncertainties inherent in the process of estimating the future traffic mix and the noise performance of future aircraft types.

At each exhibition large boards were erected showing the current noise contours compared with predictive noise contours relating to the expansion options for the airport in question. The contour maps were accompanied by a description of the methodology used to compute the contours.

3 REACTIONS TO THE NOISE INFORMATION

Noise is an unwanted or disturbing sound. The message that anyone is likely to be exposed to something 'unwanted' or 'disturbing' is not an easy one to pass on. Consequently, any acoustician charged with reporting noise impact to the general public is likely to face a difficult and uncomfortable task; noise tends to be bad news. It came as no surprise then, that noise was a commonly voiced area of concern for those attending the SERAS consultation exhibitions, with ERCD members of staff being almost constantly inundated with questions throughout the consultation days. This process, for members of ERCD – as researchers in the field of aircraft noise – represented a fascinating first hand insight into the issue of the public understanding of aircraft noise metrics.

Overall, and perhaps understandably, the majority of members of the public visiting the exhibitions were unhappy about the proposed developments and any negative noise impact that the developments might have. The majority of visitors to the exhibitions showed some level of confusion relating to the use of Leq contours, and often voiced this in terms of suspicion about manipulation of figures. On numerous occasions, the scientific backing of the Leq metric - the Schultz curve[1] and the observed onset of significant community annoyance[2] at 57 dBA Leq_{16hour} was explained to the attendees. Despite this, there remained a good deal of open and frank distrust of the Leq contours presented. In particular, the averaging inherent in Leq was felt by many anti – airport expansion lobbyists to represent a 'massaging' of the figures.

Having said this, there was, on the whole, an acceptance that the use of a measure of noise that is linked to a human response such as annoyance was indeed a useful way of quantifying noise impact. The concept of annoyance is something that people can identify with – probably more so than, say, an L_{max} of 75 dBA which would probably not mean much to a layperson. An important question in this context is – is it possible that Leq is mistrusted because it is *in itself* reporting something unwanted, or does the audience have a fundamental problem with the use of an averaging metric to represent their experience of a noise source? It is also pertinent to note in this context that the DfT are currently funding a large scale study looking at attitudes to aircraft noise, and their correlation with Leq and other metrics. This study, when it reports, should also shed some light on the question of the public acceptance of Leq.

Perhaps an insight into the question of the acceptance of Leq can be gained by noting typical questions posed by members of the public at the exhibitions. When initially faced with aircraft noise contour maps, a frequent question was 'so how loud is 57 dBA then?'. This tends to suggest a reliance on absolute noise level as a means for assessing impact on a personal basis. Even when the concept of Leq was explained in detail, the question of absolute level still frequently remained – 'but how loud will the planes be over my house?'. Other frequently posed questions concerned whether local residents would still be able to use their gardens, whether they would still be able to hear their televisions and hold conversations comfortably in the proposed noise environment.

Temporal patterns of aircraft noise also seemed to be important to residents around airports; many were keen to understand how often the aircraft might be heard, when the aircraft would be scheduled, (in particular whether they would occur at night) and whether there would be periods when no aircraft would be noticeable.

So, overall it seems that, while the questions posed by the exhibition attendees were pointing towards the need for information to supplement that provided in the Leq contours.

4 ALTERNATIVE EXPOSURE METRICS

Equivalent-energy noise indices have been used at airports for many years - for land use planning purposes, noise insulation grant schemes, the production of annual noise contours and the evaluation of development or expansion options. In policy terms, an important issue to consider when analysing the impact of airport development or expansion is the number of people that are likely to be annoyed by the changes. The long established link between Leq_{16hour} and annoyance means that for policymakers the impact can be most effectively judged using Leq. However, as experience from the SERAS public exhibitions showed, formulae and logarithmic calculations used in noise exposure contours by airport planners and authorities are often viewed with a substantial lack of public confidence, even hostility from those residents affected. While scientists and policymakers discuss factors such as the 57 dBA Leq noise contour, laypeople talk of numbers of flights, locations of flight paths, unusually loud aircraft noise events and level of disruption to everyday life, with complaints in some cases arising from so-called 'unaffected' areas outside the mapped noise contours.

A good deal of work has been done on the subject of supplemental exposure metrics by the Australian Department of Transport and Regional Services (DOTRS), who carried out studies in response to a public outcry over noise resulting from a proposed new runway at Sydney airport[3]. The aim of the DOTRS work was to look at 'relational' indicators (i.e. indicators to which members of the public could more easily relate) to represent noise exposure to the public.

The study identified a number of methods of presenting noise and operational information that were simpler for the public to understand. Flight path movement charts were one way of showing information on the incidence of aircraft events, without actually presenting any noise data. This was something of a departure; historically there has been a reliance on the use of actual noise information to show the likely impact of aircraft operations; in this method, flight paths were plotted on a map with corresponding information on average number and range in number of flights, percentage of the total flights and days with no movements (see Figure 1). Flight movement charts of a monthly, daily, or even hourly nature can be computed. The lack of noise information in these charts can be a disadvantage – the temporal nature of the impact is depicted, but there is no information about the magnitude of the impact. The charts also lack information on specific aircraft types, which could better inform members of the public. One particular advantage of this presentational method is that residents can compare the flight movements over their area with those over another district allowing them to have a comparative understanding of the impact. If the public, as was indicated at the SERAS exhibitions, require simple information about how many aircraft they might expect under a given airport development or expansion option, this form of presentation may well address that need.

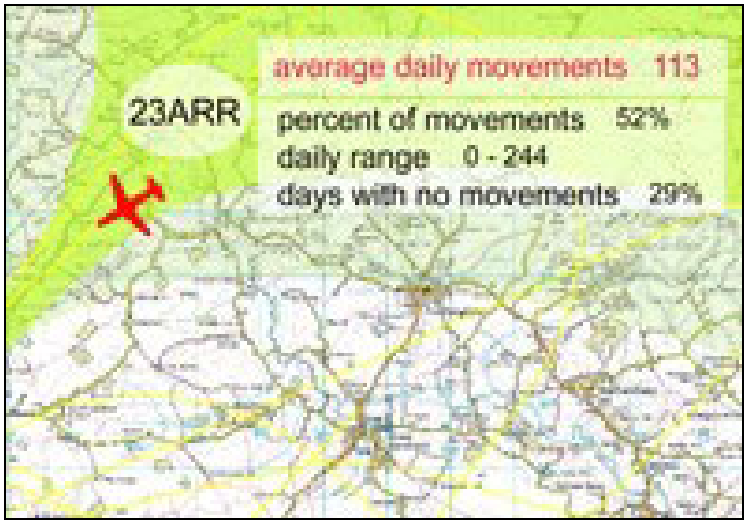

Figure 1: Flight path movement chart

Another issue of importance to residents near to airports is respite time. This measure of aircraft noise impact involves the calculation of the total time that a resident at a particular location is free from noise above a certain threshold. In the DOTRS respite time calculation method, whole clock hours were classified as 'respite', and respite was expressed as a percentage of total hours measured.

In response to residents requesting information about absolute maximum noise levels of aircraft around an airport, the DOTRS study suggests the use of 'Number above' or N-contours, which combine information on the number of aircraft movements and single event noise levels. N70, contours, for instance, show the number of times one would expect to hear a noise event above 70 dBA in a particular area (see Figure 2). To take account of differing sensitivities to aircraft noise during different periods of the day, the DOTRS method counts the number of noise events during daytime greater than 70 dBA, between 7pm and 10pm greater than 65 dBA, and during night-time greater than 60 dBA. Such an implicit weighting system echoes the method used for metrics such as LDEN. With N-contours, unlike Leq contours, as the number of movements doubles, so does the area of the N70 contour, (all other things being equal). One disadvantage of the N-contour method relates to magnitude of noise impact – there is no distinction between a 70 dBA and 90 dBA event. Take for example a resident living near an airport inside an N-contour that predicts 100 events greater than 70 dBA; depending on the aircraft types using the airport, that resident may actually be exposed to a large number of events greater than, say, 90 dBA – a very different noise expose situation. There is therefore potential for N-contours to mislead the public, but if the requirement is for information about noise levels likely to be exceeded, N-contours, if used with caution, can be informative.

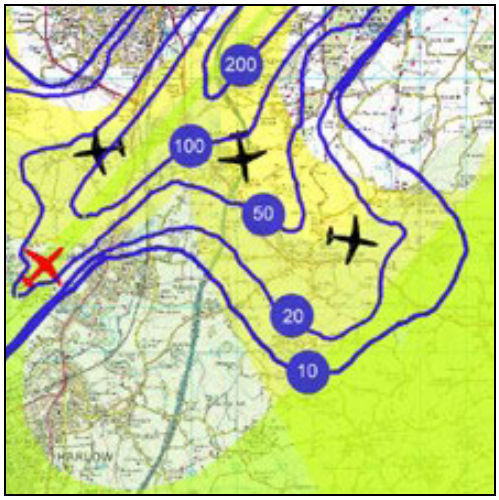

Figure 2: N70 Contours

One of the key findings of the largest UK study of night time aircraft noise impact[4] was that at outdoor noise events below 90 dBA SEL average sleep disturbance rates were unlikely to be affected and, at higher noise event levels (mostly in the range 90 - 100 dBA SEL), the chance of the average person being wakened by an aircraft noise event was about 1 in 75. This report recognised the fact that at night, aircraft noise impact and disturbance was more driven by single events rather than long term Leq type metrics. It is therefore now common practice to analyse the impact of night time aircraft noise using single event footprints. These single event footprints can be a useful supplemental metric (for daytime as well as night time) as they can provide an indication of individual event impact. The difficulty with SEL footprints though is the translation of the single figure noise level into a layperson's experience; it is important to make it clear to the audience that the SEL is effectively a 1 second Leq that attempts to account for both the duration and the intensity of the noise event. A further obvious difficulty with single event metrics is that they do not give an indication of the number of times the events will occur. Where single event metrics are very useful is in informing the public as to the relative noise performance of different aircraft types.

Another measure of airport noise impact is the 'Person-Events Index' (PEI), which represents the sum of the number of people exposed to each event (say, greater than 70 dBA for instance) multiplied by the number of events. It is an arithmetic indicator, which has the benefit of being easily understandable to the layperson, and can easily be used to compare airports or a range of scenarios at a particular airport. The drawback with the PEI is that it does not give an indication of how noise is distributed across the exposed population. The 'Average Individual Exposure' (AIE) metric gives the average number of individual exposures to noise events (say, greater than 70 dBA for instance) per day and is calculated by dividing the PEI (above) by the total population exposed. The AIE addresses the shortcomings of the PEI by giving an indication of the distribution of the impact or noise load across the population. It is possible to compare AIE values between different operating procedures at a particular airport or between airports to assess the degree to which noise is shared or concentrated.

Aircraft noise impact can also be quantified by measuring the number of minutes in a certain time period (e.g. the average day or school period) that aircraft noise exceeds a certain decibel level. This 'Time Above' (TA) metric has been used recently in the United States by Wyle Laboratories[5]. Typically, these TA contours show areas where residents on average are exposed to 10, 20 or 30 minutes above 65 dBA (or any other level if of an analyst's choosing). This form of presentation adds a further level of information to the N70 methodology and can be particularly useful in the assessment of aircraft noise impact on noise sensitive areas such as schools and hospitals, where periods of quiet or respite are deemed to be important.

5 CONCLUSIONS

The SERAS exhibitions represented a valuable insight into public perceptions of the science of noise modelling and presentational metrics. Whilst 16 hour summer daytime Leq contours, the standard method of portraying aircraft noise impact, are accepted by stakeholders in the airport and regulatory spheres – the same cannot always be said for communities around the airports. As scientists, convention leads us to accept and use methods and metrics that have been thoroughly researched, tested and peer reviewed; 16 hour summer daytime Leq contours fit this bill very well. Policy makers too, need robust and defensible measures of aircraft noise impact upon which to base decisions about airport development; again, 16 hour summer daytime Leq contours are fit for this purpose. What the SERAS process seems to have shown is that whilst Leq contours are likely to remain the tool of choice for policy makers and airport developers, the general public need more and different information to inform their judgements and comparisons of airport development options. One might assert then, that there appears to be two discrete audiences for aircraft noise information: policymakers, airport developers on the one hand and noise receivers, the local communities on the other. These two groups seem to have distinct requirements in terms of the presentation of aircraft noise information.

The use of the supplemental noise metrics that the public seems to be demanding represents something of a dilemma for scientists; unlike 16 hour summer daytime Leq contours, there is little or no scientific research linking N70s, PEIs, flight path movement charts and time above metrics to annoyance. Until such research is forthcoming, these supplemental measures will remain exactly that – simple ways of presenting information about an airport's operations in order to inform local communities. It will be interesting to see the results of the DfT's aircraft noise attitudes study; it is hoped that study will either provide robust and conclusive evidence to support Leq as the metric for aircraft noise impact, or provide similarly robust evidence to support an alternative. For the meantime, it seems likely in the UK at least, that however disliked or distrusted it is by the layperson, the 16 hour summer daytime Leq contour will remain as the driver for policy and airport development decisions. Airports in the UK are increasingly looking to supplemental metrics to present noise information to their local communities. It will be interesting to gauge the public response to this impact data – it is what they have been requesting – perhaps when the new metrics are reviewed we will find the answer to the question: is it Leq that is disliked, or is it the impact – *the noise* – that it is reporting that is the fundamental problem? Will the reporting of aircraft noise in a different way make it any more acceptable to the communities?

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