RETHINKING OUR APPROACH TO AIRCRAFT NOISE INFORMATION—GOING BEYOND THE ANEF

D Southgate

Airports Operations, Commonwealth Department of Transport and Regional Services, GPO Box 594, Canberra ACT 2601

ABSTRACT: A large number of environmental noise practitioners have had some involvement with aircraft noise issues and the Australian Noise Exposure Forecast (ANEF) system over the past twenty years. While the noise specialist generally finds the system rational and easy to use this is not the case for many decision-makers and members of the public. These latter groups treat the system, at best, with deep suspicion. Much of this negative attitude arose because of the way the ANEF was used in the EIS for the third runway at Sydney Airport - there was a widely held view that the EIS gave a very misleading picture of future aircraft noise distribution. In an attempt to gain back ground different ways to communicate with non-specialists on aircraft noise are now being developed by the Commonwealth Department of Transport and Regional Services. These 'new' approaches are based on 'numbers of events', rather than cumulated energy, descriptors since these more closely relate to the way a person is exposed to, and thinks about, aircraft noise. Very importantly detailed aircraft noise information is now being produced for areas which extend well beyond those covered by conventional ANEF contours.

1. BACKGROUND

Over the past 20 years the 'official' metric for describing aircraft noise in Australia has been the Australian Noise Exposure Forecast (ANEF) system. The system was established in the early 1980s following a major aircraft noise socio-acoustic study carried out by the National Acoustic Laboratories (NAL) [1].

This survey showed that the 10% 'seriously affected' level approximately equated to an aircraft noise exposure of 20 ANEF (approx 55 Leq 24hr). In line with conventional thinking this level became adopted as the line of 'acceptability' for aircraft noise and was incorporated into Australian Standard AS2021 'Acoustics—Aircraft Noise Intrusion—Building Siting and Construction' [2] . In essence the Standard recommends that sites with a noise exposure of less than 20 ANEF are acceptable for all land uses with regard to aircraft noise.

Despite the introduction of the ANEF system, and the effect that this has had on slowing urban encroachment around airports, the community's concerns with aircraft noise have continued and increased around some airports.

Contrary to the expectations of many people, these pressures are not coming from the high noise exposure areas. While the ANEF system describes areas with a noise exposure of less than 20 ANEF as 'acceptable', nearly all people who complain, and who put pressure on airports, live outside the contours. For example, approximately 90% of complaints at Sydney Airport come from residents living outside the 20 ANEF contour.

It could be argued that this is consistent with the findings of the 1980 NAL study—10% of the population still considers itself 'seriously affected' at 20 ANEF and hence, given the relative size of the populations within and outside the contours, for many airports the biggest 'noise affected' population is likely to live outside the contours.

2. WHY IS THE COMMUNITY CONCERNED ABOUT AIRCRAFT NOISE IN AREAS OUTSIDE THE 20 ANEF?

There are many reasons why particular individuals are highly sensitive to what the noise specialist might describe as the 'low' levels of aircraft noise exposure outside the 20 ANEF. Often the causes are very person specific and can only be addressed on a case by case basis.

However, it is possible to identify a common theme behind much of the 'anti airport' feeling expressed by the population living outside the 20 ANEF. In simple terms ANEF information has led these people to expect a much lower level of noise exposure than they are actually getting—it is considered the system is generating unfulfilled expectations.

Many of the 'misunderstandings' generated by ANEF information were scrutinised during the 1995 Senate Inquiry into Aircraft Noise in Sydney [3]. This Inquiry was established as a result of the public outcry that followed the opening of the third runway at Sydney Airport in 1994.

Conventionally the outer contour shown on an 'official' ANEF map is the 20 ANEF. No aircraft noise information is provided for residents of areas outside the contours other than in a table (extracted from AS2021) shown on ANEF maps which indicates that the areas are 'acceptable' for residential (and other) development. Residents of many suburbs around Sydney Airport told the Senate Inquiry that they believed (erroneously) that they would not be affected by aircraft noise after the opening of the third runway because they lived outside the 20 ANEF [4]. Other submissions to the Inquiry recognised that the noise could not stop at the 'line' [5] but they still had no 'real' information to indicate what the noise exposure would be like at their house site.

Compounding this lack of information for the population outside the 20 ANEF, describing aircraft noise by a single ANEF figure which relates to the amount of noise energy

received on an annual average day conveys little 'real' information. It does not provide people with information they can readily relate to such as how many aircraft movements there will be. Therefore computing ANEFs to a lower value and telling a person that a house is exposed to say 15 ANEF would do little to address the problem.

The credibility of 'noise experts' was seriously damaged through the way the future noise exposure patterns were portrayed using the ANEF in the Sydney Airport Third Runway EIS. While the ANEF exposure patterns generated by the new runway following its opening were broadly in line with those predicted in the EIS, many people very strongly submitted to the Inquiry that they believed they had been misled by the ANEF. In addition to the claims from people living outside the 20 ANEF that they had been excluded from consideration, issues such as the ANEF's averaging out of the wide temporal fluctuations in aircraft noise generated significant negative comment. It is therefore not surprising that large numbers of Sydney residents had a strong adverse reaction to aircraft noise even at relatively low exposure levels.

3. MOVING FORWARD

While the ANEF system is not intrinsically difficult to understand, by its very nature it is a system set up by 'experts' for 'experts'. In essence the noise expert has been telling the public and the decision maker 'not to worry about it' since all the work has been done—on one side of the 'line' (the 20 ANEF) the noise is acceptable and on the other there are strategies for ameliorating aircraft noise impacts. The controversy surrounding the EIS for the third runway at Sydney Airport basically revealed the flaws of this approach. The public will no longer accept assurances from the noise expert that a certain amount of noise is 'acceptable'. In advising decision makers, the days of what Dr Hede terms the 'technofficial-centred approach' where noise advisers act as 'gatekeepers' [6] are over.

We are now in a situation where we as noise practitioners have to stop expecting non experts to talk our language when discussing aircraft noise and to begin providing direct answers to the questions people ask (eg where are the flight paths; how many movements will there be; etc?). Very importantly we need to provide information to everyone who is exposed to aircraft noise, however low the levels may be, and not just to a select group who we believe are the ones who will consider themselves 'affected'.

3.1 Relational Noise Indicators

The Department has extensive experience of dealing with members of the public and community representatives on aircraft noise issues. Over the past five years a wide range of ways of presenting aircraft noise information to the public has been trialed in Sydney. This work has shown that if we really want to communicate with the community on aircraft noise we have to develop what can be termed relational noise indicators—descriptors which portray aircraft noise in a way that relates to how a person experiences the noise.

Examination of the way people talk amongst themselves about aircraft noise, or make a telephone or written complaint to authorities, reveals that the layperson almost always reports, and thinks about, the problem in terms of a series of separate noise events. For example, it is not uncommon for a person to write a letter to the Minister which attaches a log of the numbers and times of overflights which they wish to object to. Alternatively, they specifically highlight aircraft movements at what they consider to be noise sensitive times—for example they use terminology such as 'three planes flew over my house this morning before 7am'. Letters often make specific reference to the location of flight paths of individual nominated aircraft movements.

Given this, we have reached the firm conclusion that we should be prepared to speak in this type of language when dealing with the community—where, when, how many. This does not of course prelude us from talking in terms of ANEF if this is the metric an individual wants to use (although this very rarely happens now that the 'new' metrics described below are available).

Figure 1 is an example of a descriptor that has been developed by the Department of Transport and Regional Services to answer the where, when and how many questions.

The Figure shows the broad spread of the jet flight paths at Sydney Airport under its current operating arrangements and gives some statistics on daily variations in the number of movements—the average day and the busiest and quietest day during the period. This gives information far beyond the area covered by the 20 ANEF and it also, very importantly from the community's point of view, shows where 'the noise' actually is (cf the ANEF which is generally little more than say a four pointed star following the extended runway centrelines).

The statistics on variations in the noise load shown in the boxes in Figure 1 are being produced in response to community criticism that information on the annual average day, such as that given by the ANEF, does not accord with their experience. There are generally wide variations in aircraft noise exposure from day to day and week to week—the average day is rarely the typical day.

This style of report has proven to be very useful in conveying aircraft noise information to the layperson. Copies have appeared a number of times in Sydney newspapers and are now produced on a monthly basis as part of the regular Airservices Australia monitoring reports for Sydney Airport. Similar reports have now been generated for most Australian airports in response to demand from other communities.

A similar form of presentation is being produced to provide information on the 'when' question particularly for sensitive times—these are being produced in response to community requests at Sydney to know how often particular areas get a break or 'respite' from aircraft noise. 'Respite' charts show, for each of the flight path zones identified in Figure 1, the proportion of hours in specified periods (eg mornings, evenings and weekends over one month) when there were no jet aircraft movements.

It is of course noteworthy that these relational noise indicators make no reference to, and are not underpinned by, sound pressure levels. Experience has shown that this is generally not a problem—the clarity this provides is probably

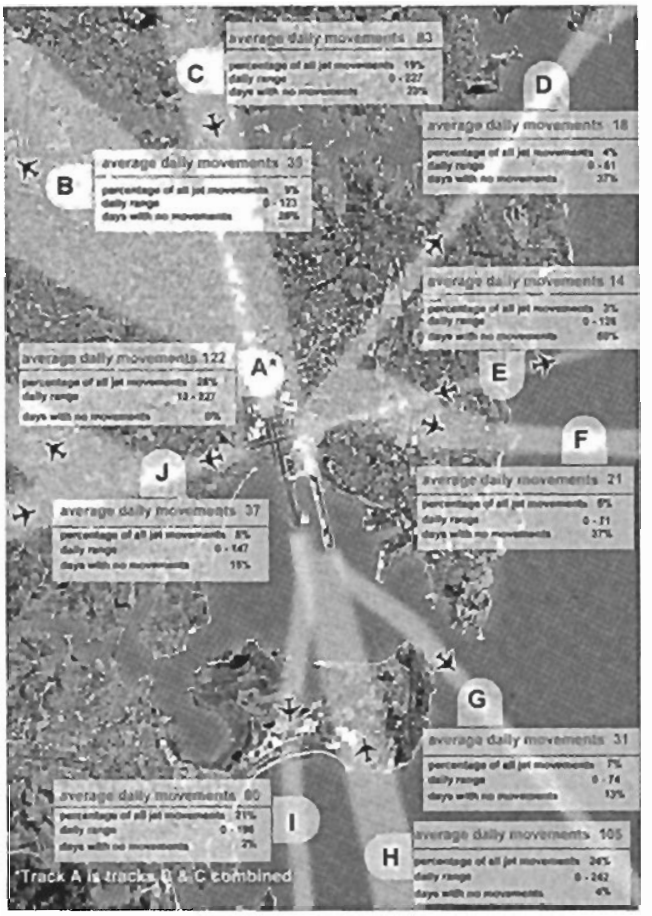

Figure 1 1998 Jet Flight Path Movements

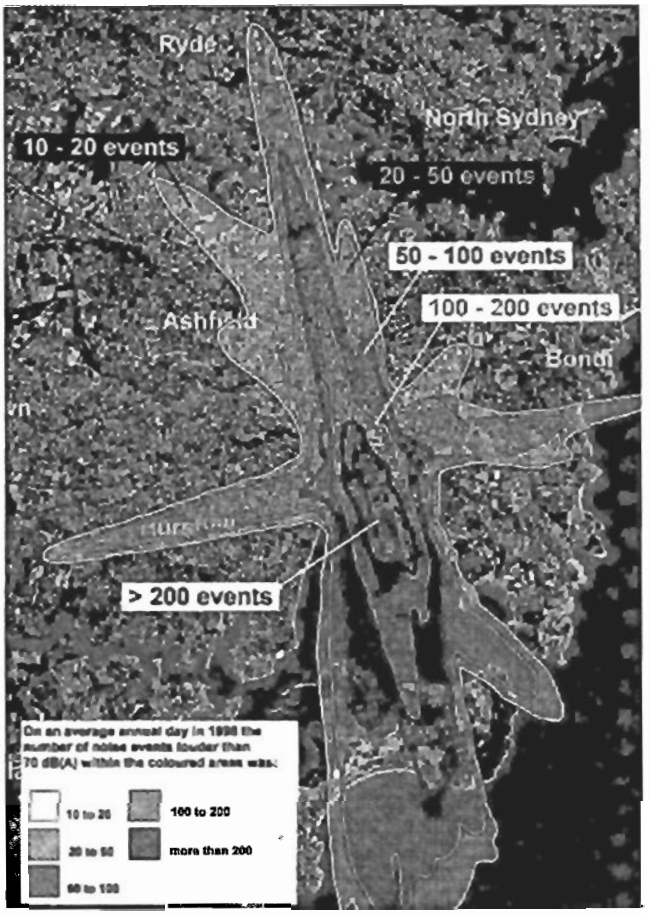

Figure 2 Contour map showing the number of noise events louder than 70 dB(A) on an average day in 1998.

a key reason for their acceptance. A person who lives under one of the flight paths has a 'calibrated ear'—they know what the planes sound like at their home—and they are for the most part not interested in a noise expert giving them information on sound pressure levels (in fact this can often cause deep suspicion because they believe that an attempt is being made to 'snow them' with technical information). The person is just interested in receiving less aircraft overflights, particularly at the noise sensitive times, and the representations in Figure 1 and the 'respite' charts allow them to track what is happening.

The danger in using the relational noise indicators arises of course when persons compare noise exposure patterns between different areas solely on the basis of the average number of movements on the respective flight paths. In discussions on relative impact it is vital that detailed noise information is available to underpin the debate.

3.2 Sound Pressure Level Information—The N70

Clearly it is important that aircraft sound pressure level information is available to those members of the public that are seeking it. Consistent with the earlier discussion concerning relational indicators, experience has shown that when members of the public are interested in the sound pressure level information they want to know the noise levels of individual flights rather than the cumulated noise energy on the annual average day (ie ANEF information). For example, the report on the Long Term Operating Plan for Sydney Airport [7] included a significant amount of information on single event noise levels in direct response to requests from community representatives.

To produce single event noise level information for every flight path and every aircraft type operating at an airport would clearly involve producing a multiplicity of charts. It is therefore necessary to aggregate the information in some way. There is also a need to incorporate information on the number of noise events since examining single event contours in isolation can be misleading because they do not show how many movements there will be for the particular aircraft types on each of the flight paths.

The most useful way to portray aggregated information on single event noise levels that the Department has identified to date is the N70—a metric reporting the number of events exceeding 70 dB(A) over the period in question. N70 contours were first produced by the Department as part of the process of drawing up the Sydney Airport Long Term Operating Plan [8] and were prepared in response to community requests for this type of information. Figure 2 shows an N70 contour map for Sydney Airport for the average day in 1998.

The N70 contour suffers equally from one of the weaknesses of an ANEF contour—it can give the (erroneous)

impression that there is no noise beyond the outer contour. In order to address this problem the Department likes to issue Figures 1 and 2 as a 'matching pair'. The N70 and the flight path movements charts make an excellent combination when viewed together as it allows a good visual feeling to be gained of how many of the movements on a particular flight path were 'loud' and it clearly shows that the noise goes beyond the N70 contours.

The 70 dB(A) threshold has been used as this equates to a maximum single event sound pressure level of 60 dB(A), inside a house with open windows, recommended in AS2021. It is of course possible to select other threshold levels in order to present a more complete picture. N80s have been produced for Sydney Airport [9] and a number of N60s appeared in the Environmental Impact Statement for the Second Sydney Airport [10].

4. GOING BEYOND COMMUNITY REACTION—EMPOWERING THE INDIVIDUAL

How does the information discussed above help us in practice? Primarily, because it can be readily understood and covers a much greater geographic area than conventional ANEF contours there is much less likelihood of persons feeling they have been misled by official aircraft noise information. However, possibly more importantly, this information permits us to progress beyond the black and white 'acceptable' / 'unacceptable' thinking that underpins the ANEF system.

One of the bases of socio-acoustic studies is that a determination is made on the level of community reaction at specified noise exposure levels. While this information is useful for setting broad standards (eg selecting the 10% seriously/highly affected level as the line of 'acceptability') it is generally only of academic interest to the individual. For example, telling a person that around 5% of the population will consider themselves 'seriously affected' at 15 ANEF effectively gives them no information that will help them to decide whether to buy a house in an area with that level of noise exposure.

By way of contrast, giving them the type of information in Figures 1 and 2 (eg on average there will be say 30 overflights a day; on a third of the days there will be no movements but on the busy days there will be 80 movements, etc) enables them to form a good mental picture of the noise patterns. They are then able to make a judgement as to whether they would be likely to find the noise acceptable if they were to move into the area. This represents a major step forward from conventional ANEF information which would simply tell the person, in effect, that the site is 'acceptable'.

5. ARE THERE LESSONS FOR THE WAY WE DEAL WITH OTHER NOISE SOURCES?

Our experience with the ANEF leads one to ask a number of questions. For example, if people believe they have been misled about aircraft noise through unnecessary 'techno-speak' and the inappropriate use of standards does the same apply to our approach to other noise sources? Does the averaging of noise by using descriptors such as Leq give a misleading picture, particularly when the noise is characterised by a relatively small number of discrete events which have wide temporal fluctuations?

While it's beyond the scope of this paper to delve into these questions it is clear that our experience with aircraft noise does have some broad lessons. In particular our journey with the ANEF has amply demonstrated that we will not get our message across, even if our information is technically correct, if the target audience cannot understand it or it fails to provide answers to the questions that the audience is asking.

There is little doubt that if the public believes it has been misled on noise predictions then there is going to be a negative reaction which far exceeds that which would otherwise be expected from a particular level of noise exposure.

Further details of the concepts put forward in this paper can be found in a Discussion Paper entitled 'Expanding Ways to Describe and Assess Aircraft Noise' which is being released by the Commonwealth Department of Transport and Regional Services. A copy of the Discussion Paper may be obtained by contacting the Department through email at david.southgate@dotrs.gov.au

The views expressed in this paper do not necessarily reflect those of the Commonwealth Government.

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8 *Sydney Airport Long Term Operating Plan Proponent's Statement,* Commonwealth Department of Transport and Regional Development, Canberra, 1997, Figure 3.15.

9 *Ibid*, Figure 3.16.

10 *Draft Environmental Impact Statement, Second Sydney Airport Proposal,* PPK Environment and Infrastructure Ltd, Concord West, 1999, Volume 3, Supplement to Draft, section 8.6.4.