

Aircraft Noise - A Broad-Area Issue

By Dave Southgate



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Until recently aircraft noise assessment and management has been focused on the 'close in' areas around airports which are exposed to the highest levels of aircraft noise. However, community pressures to impose operational constraints or oppose airport growth are increasingly coming from residents living in areas outside of conventional 'close in' noise contours. These aggrieved residents of the more 'distant' areas generally live under busy flight paths. This fundamental change in public reaction to aircraft noise raises the question of whether members of the public are becoming more sensitive to aircraft noise or whether this geographically broadened response is due to changes in the nature of noise exposure patterns around airports.

Changing Public Expectations

While it is difficult to be definitive about the evolution of community sensitivity to aircraft noise it is very evident that in recent years the nature of aircraft noise patterns around airports has changed significantly. That is, individual aircraft are much quieter, but numbers of aircraft movements have increased substantially. As a result, while the total noise dose received at a particular point on the ground near an airport may not have changed, or even may well have reduced, the composition of that noise dose is very different. The resident living at that particular point today is likely to receive their noise dose from a higher number of relatively quiet overflights; rather than from a relatively small number of very loud noise events, as was formerly the case.

Thus, the issue of concern for many people living in the areas outside the conventional sound contours is not so much the level of noise generated by individual aircraft, but rather the cumulative impact of a large number of overflights. They perceive that the times when there are no overflights, the periods of 'respite', are rapidly disappearing and that noise events are becoming more frequent in the sensitive time periods such as evenings and weekends. This change in the nature of the noise pattern would appear to be a significant factor in the widening geographic range of adverse community reaction to aircraft noise.

New Approaches Needed

Over the past four decades a large number of strategies have evolved to deal with noise in the 'close in' areas around airports. While some of these have the potential to bring benefits across broad areas, some of the key 'close in' tools would not appear to be directly applicable to managing noise in the outer areas. The residents living in the outer areas are too distant from the airport to be eligible for acoustic insulation or other common remediation programs (e.g. property buy-outs, aviation easements, etc) and are generally in areas where it would be impractical to impose aircraft noise-related land-use planning controls. Similarly, they are living in houses where noise disclosure information could not reasonably be placed on house titles, sales documentation, etc.

Given the above, there would now appear to be benefit in developing strategies for assessing and managing aircraft noise at much greater distances from airports than has conventionally been the case. This is not to say that the 'close in' areas should no longer receive attention – we have well developed strategies in-place for managing noise in these areas – rather, we now need to consider developing additional strategies to extend the geographic areas which are actively taken into account when managing aircraft noise.

Noise Expectations – a Key Driver

Experience in recent years indicates that non auditory factors, particularly noise expectations, are very important in determining the level of public annoyance from aircraft noise. Residents of the outer areas commonly have an expectation that, due to the distance from the airport, their homes will be exposed to little or possibly no aircraft noise. Therefore, if a person unknowingly moves into a house under a busy flight path in an outer area they may find the unexpected noise highly annoying.



Furthermore, this dissatisfaction is very likely to be compounded if they have made a housing decision after examining 'official' information (eg. published noise contours) that has led them to believe they will experience no noise. Similarly residents can be exposed to 'surprise noise' when flight paths are moved over their home without consultation. For example, this may occur if they have been effectively ignored in an environmental impact assessment (EIA) process because they are in an area which is considered to have 'insignificant' levels of aircraft noise exposure.

While this issue has primarily arisen at the airport level, in recent times, noise associated with major air routes at significant distances from airports has also become an issue in some countries. In a similar vein to the above, the two following examples demonstrate that even in circumstances where the total aircraft noise dose for the community may be low, public annoyance or concern can be very high if there is a community expectation that certain areas should be 'quiet'.

In late 2005 in the UK the High Court, when considering a 'distant noise' issue, ruled that '*airspace managers must take account of any environmental impact on...the Dedham Vale areas of outstanding natural beauty in terms of aircraft noise and visual intrusions.*' These areas are overflowed at heights in excess of 10,000ft by aircraft on approach to Stansted and other London airports [2]. In the United States the proposal to redesign the airspace across a wide area in the New York/New Jersey/Philadelphia region [3] is generating considerable debate with regard to noise impacts.

In light of such examples, it is believed that considerable benefits could be gained by extending aircraft noise assessment and management to an areawide basis.

Assessing Aircraft Noise on an Area-Wide Basis

Conventional aircraft noise assessment is usually based on some form of noise contouring. These contouring techniques typically involve the computation of the number of people living within the contours in order to compare competing options in an Environmental Impact Assessment (EIA) process, or to track changes in noise exposure over time.

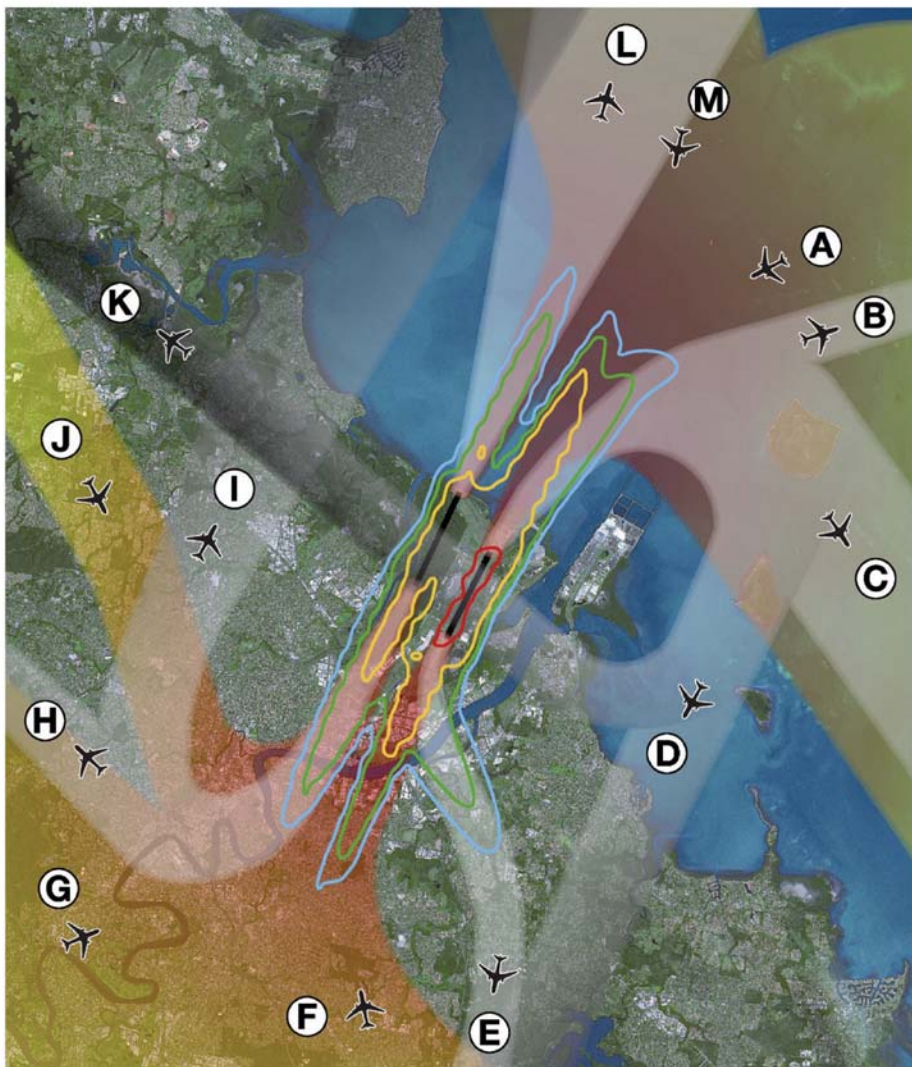
In Australia, pressures to move away from the conventional noise contouring techniques arose as the result of a major EIA process for a new runway at Sydney Airport in the early 1990s. The new runway was approved on the basis of information provided in the project's Environmental Impact Statement (EIS), but when the runway opened there were concerted community claims that the noise analysis in the EIS, based on conventional noise contouring, was misleading [4]. A key factor in this dissatisfaction was that communities living outside the noise contours believed they had been effectively excluded from the EIA process.

This experience clearly demonstrated that if there is to be community confidence in an EIA process, there needs to be a good match between the noise expectations generated during the EIA process and the actual outcomes once a project comes on stream. In order to address the concerns raised by the Sydney EIS, new noise analysis approaches have now been adopted in Australia in an effort to ensure that distant communities are not excluded from EIA processes. These new techniques are focused on the examination of flight paths across the terminal area; on time stamped activity levels on those flight paths; and on noise information based on comprehensive area wide noise grids.

By way of illustration, a major EIA process examining a proposed new parallel runway at Brisbane Airport commenced in late 2006 [5]. The projected noise exposure patterns for the new runway have primarily been portrayed using flight path movement and N70 charts¹ for selected times of day and seasons of the year. An example chart extracted from the project's draft EIS is shown in Figure 1; the area covered by the image is approx 30 km by 40 km.

¹ This chart reports the actual average number of noise events per day recorded around the airport

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Saturday and Sunday 6.00pm – 10.00pm



Flight path	Flight path type	Average number of jet flights on flight path	Expected minimum and maximum numbers of jet flights on path	Percentage of Brisbane Airport's total jet flights on path	Percentage of days with no jet flights on path
A	Arrival	20	0 - 46	18%	42%
B	Departure	2	0 - 4	2%	27%
C	Departure	<1	0 - 1	<1%	48%
D	Departure	15	0 - 30	14%	23%
E	Departure	15	0 - 31	13%	40%
F	Arrival	20	0 - 42	18%	40%
G	Arrival	3	0 - 21	3%	40%
H	Departure	5	0 - 10	4%	42%
I	Departure	7	0 - 15	6%	42%
J	Arrival	5	0 - 13	4%	51%
K	Departure	4	0 - 8	4%	24%
L	Departure	7	0 - 14	6%	41%
M	Arrival	8	0 - 19	7%	40%

Altitude Key

Arrivals
Mean Altitude
4,500 ft
0 ft

Departures
Mean Altitude
12,000 ft
0 ft

Contour Key
The number of overflights of 70dB(A) and above during the indicated time period

- 5 to 9 overflights
- 10 to 19 overflights
- 20 to 49 overflights
- 50 or more overflights

Individual values are rounded. Totals may not add to 100% due to rounding.

Figure 1 – Diagram extracted from the Draft EIS for a proposed new parallel runway at Brisbane Airport, Queensland.



Similar approaches are being adopted in the United States. A segment of an area-wide representation of aircraft noise around St Petersburg Clearwater International Airport in Florida, using the DNL² metric, is shown in Figure 2. This figure was extracted from a noise study that was carried out to support ongoing work of the Airport's Noise Abatement Task Force [6].

Managing Aircraft Noise In the Outer Areas

Are 'Close In' Noise Management Strategies Effective in the Outer Areas?

ICAO's Balanced Approach to managing aircraft noise [1] defines the four broad strategic strands which have evolved over time in order to deal with problems faced in 'high noise' areas. The question arises as to whether these 'close in' noise management techniques have applicability to broad areas around airports.

Land-use planning has limited area wide application since, irrespective of the noise exposure levels, in general it is not practical to impose aircraft noise based restrictions on land use at long distances from airports. However, at some airports opportunities do exist for basing land-use planning on flight path corridors rather than on conventional noise contours. In these instances where concentrated flight paths over unoccupied land can be fully integrated with planning it may be feasible to impose planning constraints at considerable distances from airports.

Reduction of noise at source may be beneficial. However, for many residents living in outer areas, aircraft noise disturbance primarily arises from high numbers of aircraft movements, and a lack of respite, rather than the loudness of individual flights.

Noise abatement operational procedures have potential beneficial application. For example, these may be used to optimise the location of housing in the 'distant' areas and the use of noise preferred runways at an airport can impact on which flight paths are used at a significant distance from an airport. The noise benefits of some specific operational procedures (eg. Continuous Descent Approach) may have greatest positive effect in the outer areas.

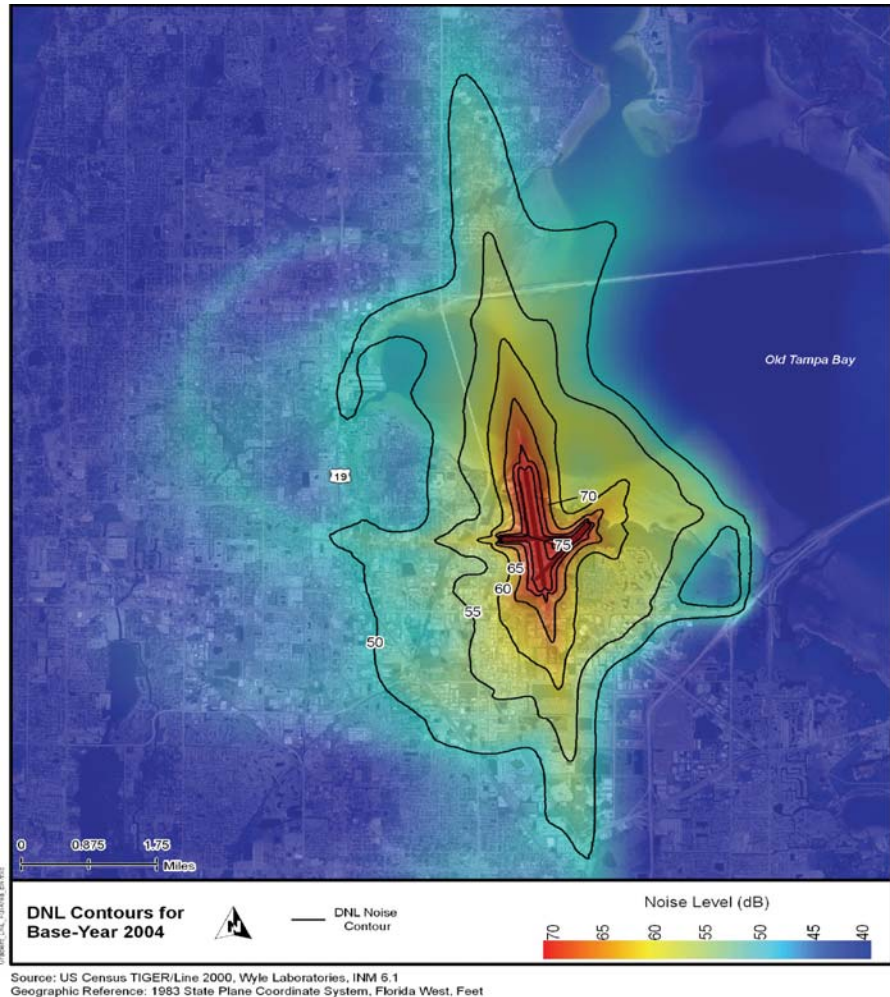


Figure 2 – Area wide noise information for an area to the south of St Petersburg Clearwater International Airport, Florida.

Implementation of *operating restrictions* (eg. curfews and movement caps) will generally provide relief for distant residents. However, application of the 'distant' noise management strategies spelled out in the next section would probably be preferred if assessed using the cost/benefit analysis principles specified in Chapter 9 of the Balanced Approach Guidance document.

Specific Strategies for Managing Distant Noise

A number of strategies, which are distinctly different to the conventional 'close in' noise management approaches, can be applied to manage noise on an area-wide basis.

²The Day-night average sound level (DNL) represents the noise as it occurs over a 24-hour period, with a 10 dB penalty for noise events occurring at night to account for greater sensitivity to night-time noise and the fact that noise events at night are perceived to be more intrusive because night-time ambient noise is less than daytime ambient noise.

Managing flight paths is a key tool in the outer areas. Close to an airport, the opportunities for varying flight paths are limited since aircraft have to be marshalled into relatively concentrated flight path zones in order to safely land on, and take off from, the runways. However, with increasing distance from the airport there are greater opportunities to be selective about the location of flight paths and to adopt strategies which influence the number, and times, the flight paths are used. Opportunities exist to disperse aircraft noise across the outer areas through the spreading of tracks and the rotation of runways and flight paths.

Area wide noise disclosure is also a key aircraft noise management tool. In this context, 'noise disclosure' does not signify the conventional placing of notifications on house titles or sales documentation. Rather, it means providing all members of a community access to comprehensible, and up-to-date, area-wide aircraft noise information. As indicated earlier, the residents of areas located a long way from an airport commonly have an expectation that they will not be subjected to aircraft noise and have a heightened adverse reaction if they discover they are unexpectedly living under a busy flight path. With recent advances in flight path tracking and home computing it is relatively simple to provide the community with ready access to effective area wide aircraft noise information in order to manage 'surprise noise'. The information is likely to revolve around showing the location of flight paths and the numbers and times of movements on those flight paths. Information on aircraft noise levels can now be readily provided using single event based noise metrics. In Australia the Federal Transport and Environment agencies have jointly published Guidance Material on selecting and providing aircraft noise information [7].

Ultimately, if there is to be broad community support for an airport there needs to be an avenue for all members of the community, both the 'close in' and those from the outer areas to have confidence that all options for managing aircraft noise have been examined and that an equitable outcome has been adopted. Experience has shown

that in order for these relationships to be established there needs to be a fully transparent exchange of information between the parties. To this end, information needs to be presented using aircraft noise descriptors that can be easily understood and that show noise exposure patterns across the broad area around an airport.

Emerging Issue in the Outer Areas – Noise/Emissions Trade-Offs

At present, many countries are putting great emphasis on the introduction of new air traffic management (ATM) procedures in order to increase operational efficiencies and to reduce gaseous emissions from aircraft. Invariably these new procedures involve some changes to existing flight paths. The opportunities for introducing more operationally efficient flight paths will generally increase with increasing distance from an airport and hence introduction of these new procedures will most likely involve relocation of flight paths over areas that are situated outside the conventional noise contours.

Commonly, flight paths in the vicinity of airports are negotiated with local communities and incorporated into Noise Abatement Procedures (NAPs) in order to minimise an airport's noise impacts (eg. flight paths are designed to avoid overflying particular communities). In many cases the NAPs are implemented fully recognising that they will require aircraft to travel greater distances, and hence burn more fuel and increase emissions. Historically, noise has been given a higher priority than emissions in optimising flight path design.

With the advent of new navigational capabilities, there is now a large potential for reducing emissions through redesigning flight paths and the question arises to what extent, if any, the balance between noise and emissions should change in response to the growing pressures to reduce aviation emissions. Some procedures such as continuous descent approaches (CDAs) have the potential to deliver both fuel burn and noise benefits. Other changes which provide emissions benefits will inevitably have noise downsides. In practice, a range of approaches could be adopted in an effort to achieve a balance between noise



and emissions. For example, operations could be optimised on noise during noise sensitive periods such as the evenings and weekends and then be optimised for emissions at other times. An alternative may be to introduce some form of emissions offsetting to take account of additional emissions incurred by managing noise.

This noise/emissions 'interdependency' question is a key issue for CAEP and its work program now contains a project to examine how the environmental benefits of proposed ATM efficiencies should be assessed. While the committee has yet to tackle this issue, it would appear that conventional average day noise assessment techniques will not assist in analysing noise/emissions trade off questions in the outer areas. These impacts are likely to need some form of 'micro' assessment, using time-stamping and single event analysis approaches of the type referred to earlier, in order to enable the community and the aviation industry to have a fully transparent discussion on the merits of any particular proposed course of action.

The Future

If current trends continue, the noise exposure patterns around airports are likely to progressively evolve as aircraft become quieter and airports become busier. It is important that we continuously review our approaches to assessing and managing aircraft noise in order to respond to these ongoing changes. The imperatives to reduce aviation engine emissions is now posing additional challenges for the way we assess and manage aircraft noise. Fortunately technological advances are providing us with numerous tools to take these issues forward.

The aviation industry is only likely to be sustainable in the long-term if it is able to build relationships with communities that lead to aviation environmental impacts being managed in a way that is perceived by the public to be fair and equitable. Treating aircraft noise as an area-wide, rather than a 'close in', issue is an important step towards building trust between airports and their communities.

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