Managing Aircraft Noise within an Air Traffic Environment

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ABSTRACT

Airservices Australia (AA) and its predecessors have provided air traffic control services throughout Australia since the late 1930's. In 1995 Airservices Australia was established when the air traffic control functions were separated from the Civil Aviation Authority. In addition to operating throughout Australia AA now provides air traffic control services to other countries. Internationally there is a push to reduce the number of air traffic service providers as a more efficient system is constantly being argued by the airline industry. When AA was formed in 1995 it had clear environmental responsibilities and specific environmental regulatory functions. AA has established a comprehensive Environmental Management System which runs parallel with the Safety Management System. Managing the environmental impact is considered a core AA function, crucial to this is the ability to report and disseminate useful information on the impacts of aircraft operations. This paper discusses how AA performs these tasks with respect to aircraft noise. Recent developments of credible environment performance metrics to enable AA to report on its environmental performance will also be discussed.

INTRODUCTION

Airservices Australia (AA) is a government-owned corporation providing safe and environmentally sound air traffic control (ATC) and related airside services to the aviation industry. AA was formed in 1995, when the air traffic control functions were separated from the Civil Aviation Authority. The Australian airspace managed by AA represents 11% of the earth's surface. As well as providing air traffic control within Australia AA also provides services to other countries.

Internationally there is a push to reduce the number of air traffic service (ATS) providers as a more efficient system of ATC is constantly being argued by the airline industry.

In providing air traffic control AA interacts with numerous stakeholders. Figure 1 illustrates these various stakeholders exerting their individual interests on AA, seldom do all of these interests overlap. For instance operators are interested in efficiency, timeliness of the operation and safety, whereas the local community wants less aircraft noise regardless of the cost to the aviation industry.

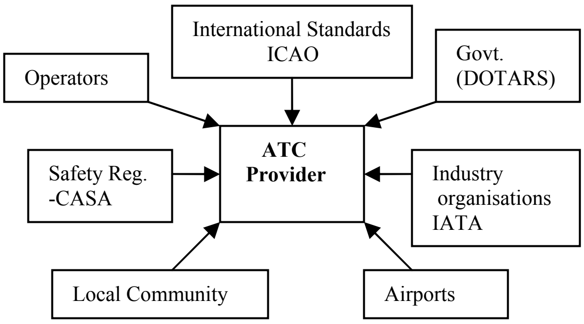


Figure 1. Stakeholders for Airservices Australia.

The major issues that confront an ATS provider are:

- Operational safety
- Meeting separation standards
- Maximising efficiencies
- Integration with other ATC providers
- Controlling impacts on the environment

Arguably the most difficult issue to manage is the environmental impact. This paper discusses how AA manages the environmental impacts associated with aircraft noise.

AIRSIDE ENVIRONMENTAL IMPACTS

The impacts on the environment due to aircraft operations fall into two categories, on-ground and in flight. Examples of on-ground are noise and emissions associated with engine testing, taxiing, auxiliary power units (small engine housed within the aircraft to provide auxiliary power to the aircraft when the main engines are off) and service vehicles. In flight refers to departure, en route and arrival.

Departure consists of take-off, where maximum power is applied, followed by a climb section where the aircraft is gaining altitude but the power has been reduced. (typically 70%-80% of maximum). For larger propeller and jet aircraft take-off power is maintained till an altitude of approximately 800ft when the climb power setting is applied. For jet aircraft "power" is often referred to as "thrust".

An arriving aircraft approaches the runway as slow as is safely possible to maintain lift. To achieve this an aircraft will have its flaps (movable extensions to increase the width of the wings providing adequate lift when the aircraft is flying slower) fully extended. As the flaps are extended the landing gear is also lowered. Consequently there is an increase in the amount of drag on the aircraft during approach requiring a small amount of thrust, 30% of maximum, to maintain a constant speed. This increase in thrust to overcome the increase in drag when the aircraft is configured for landing will result in higher noise levels. This explains why an arriving aircraft can have a greater noise impact.

As an aircraft passes through the air small vortices are generated by the aircraft's wings. The size of these vortices increases with the size of the aircrafts wing. Under the right meteorological conditions an approaching aircraft creates vortices that travel towards the ground. These vortices can cause damage to properties eg. removing roof tiles.

During departure and arrival the major impacts on the environment are noise and those associated with gas emissions; reduced air quality and green house.

The en-route phase is that part of flight between departure and arrival, this is where the aircraft operates at altitude and is most efficient. The impacts of en-route are related to gas emissions, noise is seldom an issue during this phase (except for supersonic aircraft).

AIRCRAFT NOISE

Quieter Aircraft:

In recent years considerable effort has been expended to quieten aircraft. As a result today's jet aircraft are 15-20 dBA quieter than those of the 1970's. This is driven by the aircraft certification noise standards, which have become increasingly stringent. Figure 2 shows the current Chapter 4 noise certification levels are 30dB EPNL lower than the original certification levels for jet aircraft, Chapter 2 (ICAO 1993). The newer engines have the added benefit of being more efficient and produce fewer emissions. In Australia the older Chapter 2 certificated aircraft can no longer operate (DOTARS 2002), a similar policy exists for most Western European countries, North America and Japan.

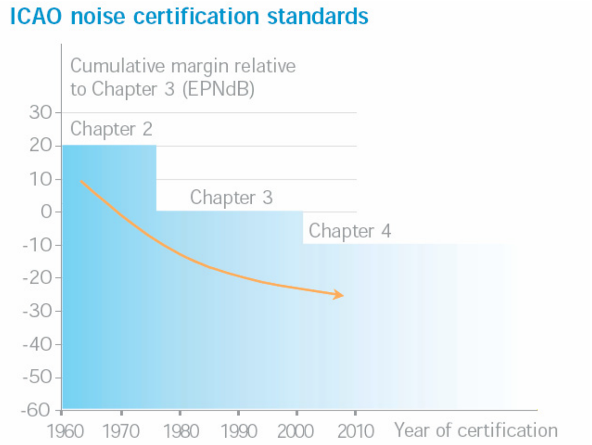


Figure 2. Progress of noise certification standards for jet aircraft.

Noise Contours and Exposure Limits:

Noise contours are lines of constant aircraft noise drawn on a base map of the airport and its surrounds. This involves modelling the aircraft noise. The Federal Aviation Authority (US) Integrated Noise Model application is commonly used around the world for this purpose. How such a contour is used depends on the legislation peculiar to that country. In Australia major airports are required to establish a set of noise contours based on a forecast for aircraft operations (Australian Standards 2000), referred to as the airport's Australian Noise Exposure Forecast (ANEF). State and territory legislation limits building siting and construction in the vicinity of the airport according to the ANEF value for that particular region.

At some airports with substantial numbers of existing residences in "high noise areas" the Government has implemented a sound insulation program. This is a program where homes exposed to high levels of aircraft noise are acoustically treated to reduce the internal noise intrusion from aircraft or in extreme cases are bought by the program and the land used for non-residential purposes. The funding for sound insulation and buy back programs is often via a levy placed on operations at the airport. In Australia sound insulation programs have been established by the Commonwealth Government for Sydney and Adelaide Airports.

The noise contours used to determine which buildings in Sydney are eligible for sound insulation are generated quarterly by AA. These contours are based on the actual aircraft movements rather than a forecast and are referred to as Australian Noise Exposure Index (ANEI). The ANEI contour for the period October to December 2003 (Airservices Australia 2004) is shown in Figure 3. Under the Commonwealth Government's Noise Amelioration Program residential properties surrounding Sydney Airport which are exposed to 30ANEI or above are eligible for funding for sound proofing against aircraft noise. The buy-back noise level threshold is 40 ANEI.

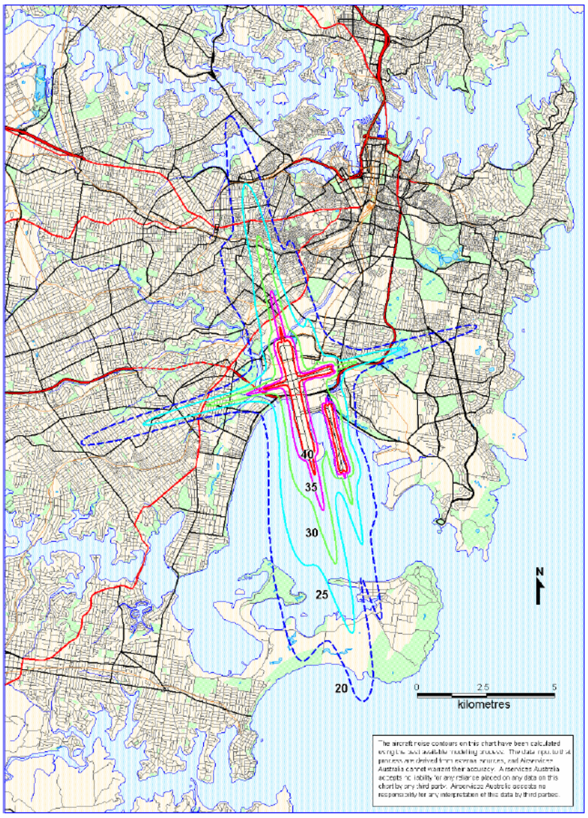


Figure 3. ANEI contours for Sydney Airport for the period October –December 2003 (Airservices Australia 2004)

A different approach is taken in New Zealand where at the major airports the noise exposure (including all aircraft operations over a preset period) is required to remain below a set level. AA provides technical expertise under contract to validate the calculation of aircraft noise exposure for Wellington Airport.

The use of contours in determining acceptability for a particular site has been challenged in many cases. The most notable was that concerning the third runway at Sydney airport. The original environment impact statement (EIS) for the Sydney third runway was based solely on the ANEF contours. The community outcry which followed the opening of the third runway resulted in an inquiry into the original EIS.

Common criticisms in using contours for quantifying aircraft noise impacts are:

1. what is acceptable for one person may not be acceptable to another
2. all the impacts from aircraft noise can not be describe by a single parameter

3. in calculating exposure limits and contours assumptions of how aircraft are operated are made

There are many cases where the resolution of what is acceptable has ended up in the courts.

Procedures:

Commercial aircraft approach the runway at an angle of 3 degrees to the horizontal, consequently they are below 5000ft from as far out as 25km from the airport. For jet aircraft 5000ft is a significant altitude when considering noise impact of aircraft (Airservices Australia 2002). By comparison departing aircraft reach this same altitude within 15km of the runway end. Although at a given altitude departing aircraft create higher noise (at ground level), arriving aircraft spend more time at lower altitudes and have the potential to impact more people.

The standard jet departure procedure at most airports will involve the aircraft turning to its first way point once an altitude of (approximately) 800ft has been reached. Arriving aircraft need to be stabilised and aligned with the runway 10-12km before the touch down point. Because of this restriction there is less flexibility for varying the arrival path than compared to the departure path.

Figure 4 shows jet departures and arrivals to the north of Sydney airport, as recorded by AA's Noise and Flight Path Monitoring System (discussed in a later section). The departures are shown turning close to the airport whilst the arrivals are aligned with the runway a long way out. These flight path patterns have the benefit of spreading the traffic and therefore the impact (arrivals to the north and departures to the east and north east). This is in line with the noise sharing policy of the Long Term Operating Plan (LTOP) for Sydney Airport. However, depending on the locations of noise sensitive areas, a noise sharing policy may not work for all airports.

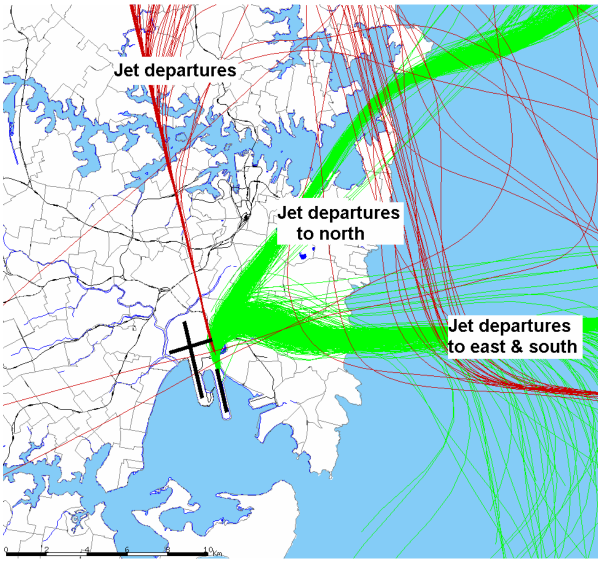


Figure 4. Arrival and departure tracks to the north using runway 16L-34R, Sydney Airport.

The sound power generated by a jet engine can be shown to be proportional to the 4th power of thrust (Beranek 1971)). Consequently small increases in thrust will make significant changes to the noise level. To minimise the impact of aircraft noise requires a careful choice of where and how much tot cut back power during departure and arrival.

CONTROLS FOR AIRCRAFT NOISE

The strategies for the mitigation of aircraft noise impacts on the local community vary from country to country and airport to airport. The ATC provider can be constrained by the aircraft noise control that is applied. The following section explains some of the common strategies in mitigating the impacts of aircraft noise and details AA's involvement with some of these strategies.

Curfew:

Curfews are used at many airports around the world to provide some nightly respite for the local community from aircraft noise. In Australia Sydney, Coolangatta, Essendon and Adelaide airports have curfews which limit operations of large aircraft between the hours of 23:00 and 6:00. A common mis-conception is that a curfew forbids any aircraft operating during the curfew hours. Some aircraft can operate and aircraft noise from these can impact on the more noise-sensitive persons of the local community. In Australia the Department of Transport and Regional Services (DoTARS) publishes a list of aircraft permitted to operate during curfew hours. The curfew can also have restrictions for runway and reverse thrust usage. However these restrictions can be overridden in the case of an emergency. Some examples for exclusion to the curfew are; diversions from other airports which may be closed due to weather, mechanical failure on board the aircraft, low fuel on the aircraft and medical condition of a passenger..

AA provides monthly reports to DoTARS which detail any curfew breaches. As new aircraft are introduced AA provides technical advice to the DOTARS as to whether or not the aircraft can operate within the curfew legislation.

Noise Monitoring:

Many airports around the world are required, often by legislation, to install a continuous Noise and Flight Path Monitoring System (NFPMS). Such a monitoring systems consist of noise monitors located at sensitive locations about the airport, an interface to the ATS to obtain the radar data and a method to correlate radar data to the noise data. The system should be able to associate noise data to particular aircraft provided the noise level is above the detection threshold. A more detailed description of the NFPMS operated by AA can be found by accessing AA internet site www.airservices australia.com. As the crucial component in the system is the radar data the ATC provider is best situated to operate such a system. However worldwide there are many installations where the airport owner operates the monitoring system. In these cases the airport has to negotiate with the ATC provider in order to obtain the necessary radar data.

Currently there are over 120 airports world wide that have an operational NFPMS. The depth of data collected by these systems have; facilitated the introduction of new metrics (such as the number of aircraft noise events exceeding 70dBA and respite), validating modelling, and provided a basis for various international collaborative studies.

In Australia the installation of NFPMS at major airports was a result of recommendations made by the House of Representatives Select Committee on Aircraft Noise committee in 1985 (House of Representatives Select Committee on Aircraft Noise 1985). AA operates a NFPMS at the following airports; Adelaide, Brisbane, Cairns, Canberra, Coolangatta, Melbourne, Perth and Sydney.

The notion of continuously measuring aircraft noise at an airport may be criticised as just measuring the same thing over and over. In practice, however the operations at an airport are constantly changing. New aircraft are introduced with different performance characteristics to those aircraft they replaced. These different characteristics will affect aircraft noise. New procedures are introduced by both ATC and the operators that change the way aircraft are flown, again affecting noise levels. An NFPMS is a critical tool in assessing and reviewing the impacts of operational changes. Weather patterns change affecting aircraft performance and the noise levels. Considering all these factors the noise environment, which the NFPMS monitors, is constantly changing. Note, the NFPMS installed at Australian airports in addition to noise, radar and plan data also logs the weather conditions and preferred runway usage.

Another criticism levelled at a system of continuously measuring noise is that aircraft noise can be modelled and by using a sample of measured noise data this model could be re-calibrated. This would be adequate to describe the impact of aircraft noise. Whist this is true it should be pointed out that the current models for aircraft noise were formulated to predict the average noise level. It can be shown that many of the noise impacts cannot be successfully modelled. One example is the number of noise events in a 24 hour period above 70dBA referred to as the N70. The level of 70dBA outdoors corresponds to the minimum indoor noise threshold for residential buildings (Australian Standards 2000).

Noise Limits:

Noise level limits are used at some airports as a control for aircraft noise. Aircraft operating at such an airport are penalised for exceeding a noise threshold, encouraging operators to use the quietest available aircraft at that airport. This system is used at Heathrow Airport to fund the aircraft noise mitigation programs. In order for Airbus to make its new large passenger jet more attractive to airlines Airbus has specifically designed the A380 aircraft so as to meet the noise limits at Heathrow Airport.

Noise Abatement Procedures (NAP):

These are airport specific procedures which are designed to minimise the impact on the local community of aircraft operations. The most common example of a NAP is the preferred runway for departures and arrivals, directing aircraft away from overflying populated areas at low altitude. Figure 5 shows a sample of jet aircraft operating at Brisbane Airport during the night period (22:00 to 6:00). This figure illustrates a particular NAP for this period where aircraft are required to approach (using runway 19) and depart (using runway 01) the airport over the ocean. This NAP also includes a further requirement that jet aircraft flying south east should be above 5000ft before passing back over the coast line. As with all procedures there are safety requirements for the application of the NAP. For example the NAP illustrated in Figure 5 will not apply when the down wind component exceeds 18.5km/hr (10kt) on a dry runway.

The ATC provider is responsible for safety in designing these procedures and securing the approval from the relevant safety regulator (in Australia this is Civil Aviation Safety Authority). NAPs are published by the ATC provider. AA designs and implements NAPs within Australia.

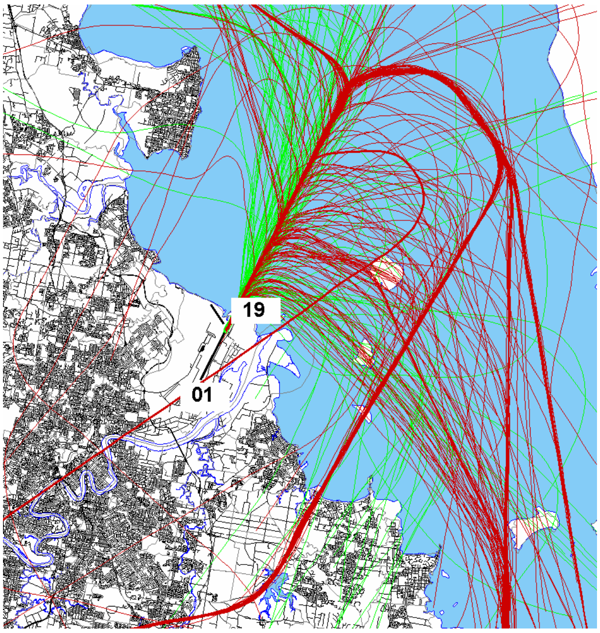


Figure 5. Arrival and departure tracks illustrating the night period NAP for Brisbane Airport

Movement Caps:

An airport movement cap is where the number of aircraft operations at an airport over a specified period is limited. For example Sydney Airport has a maximum hourly movement number of 80, which applies to both arrivals and departures.

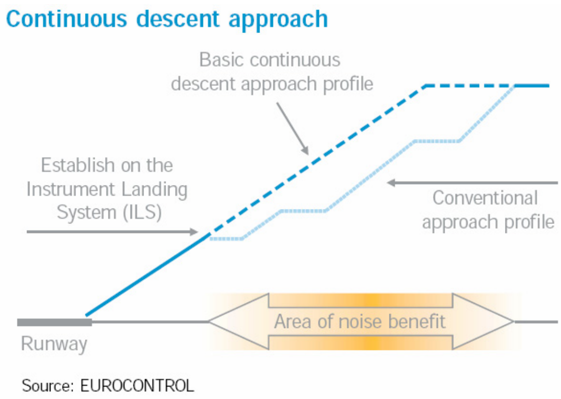
The movement cap has implications with other controls that are used at the airport. For example if the cap is high then as traffic levels increase towards the cap value the opportunities to apply NAP will be reduced. However, the movement cap does provide additional support to the benefits that the curfew provides. For a busy airport the first hour of operation following the conclusion of the curfew can experience a high number of arrivals and departures from large jets. If this is not controlled the local community will move from a relatively quiet period to a very noisy period in a short space of time causing greater annoyance. The cap can limit the maximum number of overflights near the airport during the early morning post curfew period.

AA provides reports monthly on the hourly movements to the various committees charged with monitoring the operations at Sydney Airport.

Anticipating New Technology:

The ATC system needs to constantly evolve to take advantage of new technologies as they are introduced. For instance improvements in on board navigational equipment have enabled aircraft to use continuous descent approaches (CDA). The conventional ATC method of controlling an arriving aircraft is to require the aircraft approach the airport via a series of steps, see Figure 6. Using this method the controller would know what altitude the aircraft was at all times during its descent. Each step would require enough thrust to maintain level flight. CDA allow the aircraft to smoothly descend without any level flight segments, see dotted line in Figure 6, requiring less thrust during descent. However for the final 9-10km (from touchdown) the aircraft needs to be stabilised for landing, flaps fully extended and landing gear deployed, during this phase of the landing there is no difference between CDA and conventional arrival procedure. This phase of arrival corresponds to the “Establishment on the Instrument Landing System (ILS)” in

Figure 6. Therefore a CDA procedure results in less aircraft noise for those regions further than 10km from the airport.



Source: EUROCONTROL

Figure 6. Approach path for CDA approach compared to conventional approach.

Another example of adapting to new technology is Required Navigational Performance (RNP) which exploits the improved GPS based navigation equipment with which the newer aircraft are equipped. RNP will allow appropriately equipped aircraft to follow an arrival route into the airport which has less impact on the community. An example is providing an arrival path through a valley over water and away from the residential areas with sufficient accuracy to meet international separation standards. However these procedures are available to only those aircraft that have the appropriate certified navigation equipment.

AA has introduced procedures to operate CDA at most major Australian airports and is working towards the introduction of RNP.

COMMUNITY

The effectiveness of the preceding strategies will not be realised unless there is meaningful communication with the community. Most airports have community based committees where the impacts of aircraft operations and the effectiveness of the airports mitigation strategies are discussed. Typically these committees consists of representatives from government (local, state and commonwealth), airport, operators, local residents and the ATC provider. The most important issue at these meetings is aircraft noise. This observation comes from AA's experience from attending such meetings around Australia over many years. If the ATC procedures can pass the scrutiny of these committees then it is likely that the methods that the ATC provider is using to address the local impact of aircraft noise are working. The crucial factor in achieving successful outcomes depends on the ability to provide meaningful data and explanations. At those airports where there is a NFPMS AA provides regular reports containing information on what transpired the previous quarter.

Reporting:

The first step in providing effective communication with the stakeholders regarding the impacts of aircraft noise is the generation of regular reports. Reports involve data reduction into parameters that are meaningful to the various stakeholders. Reports generated by AA from the NFPMS data include a variety of parameters some examples are:

- N70. Figure 7 shows a summary of the N70 value over a 3 month period for a particular noise monitor.
- LAeq, average noise level for a given period at a noise monitor.
- LAmax, the maximum noise level attributed to an aircraft at a noise monitor. The reported value is averaged over the quarter for a given aircraft type, operation and noise monitor.
- Number of aircraft operations broken down by runway, operation (arrival or departure), aircraft type and day/night period.

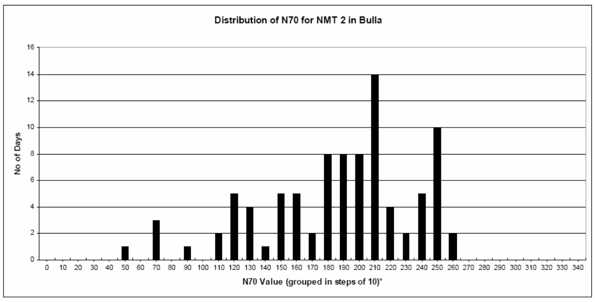


Figure 7. Daily N70 over a 3 month period at the noise monitor located at Bulla, Melbourne Airport NFPMS.

A useful tool for graphically displaying regions which are likely to be exposed to high levels of aircraft noise is the track density plot. The region of interest is divided into a 2 dimensional array of cells and each cell is coloured according to the number of flights passing over it. Figure 8 shows the track density plot for Melbourne and Essendon airports using a cell size 200m x 200m over the period April to June 2005. The colour code used is green to red representing the range of 180 to 1800 overflights; this corresponds to 2 to 20 overflights per day. A region averaging 20 overflights a day is considered high and is likely to receive high levels of aircraft noise.

A track density plot gives a useful indication of the general patterns of the flight operations. For instance in Figure 8 the general aviation corridors to the south-east and south-west of Essendon Airport are clearly visible.

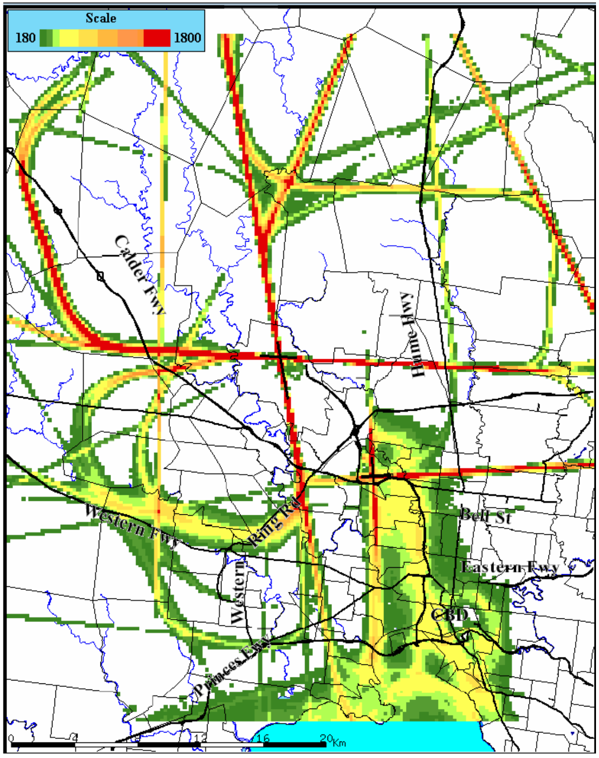


Figure 8. Track density plot for Melbourne and Essendon Airport for the period April to June 2005.

An example of the AA's consultative process in developing appropriate reports is the reporting of the N70 value. Initially only the average daily value was included, but some stakeholders wanted to know the variation in this parameter. After consultation with the community the graph of Figure 7 showing the daily N70 value for the period was settled on.

AIR TRAFFIC CONTROL ENVIRONMENTAL PERFORMANCE METRICS

During 2004 AA developed three environmental performance metrics for ATC. Two metrics describe environmental performances for gas emissions and another for aircraft noise. All metrics are based on data extracted from AA's NFPMS. Hence, at this stage, the metrics can only be applied to NFPMS equipped airports.

Population weighted noise index (PWNI)

A suitable noise performance metric for ATC should reflect the impact on the local community from aircraft noise and be sensitive to changes in ATC procedures. The metric should be independent of the size of; the local population and the number of operations, as these parameters are outside the control of ATC. The chosen noise metric is referred to as the population weighted noise index (PWNI), given below.

$$\text{PWNI} = \frac{\sum_{\text{Grid Element}} \text{Overflights}_{\text{Grid Element}} \text{ x Population}_{\text{Grid Element}}}{\text{Number of Operations x Total Population}}$$

The interpretation of the PWNI is the percentage of the community within the airport vicinity which resides in proximity to either a jet arrival or departure flight path over a nominated period. The PWNI is restricted to jets as these are the main contributors to overall aircraft noise. If the PWNI was to be applied to a regional airport non-jet aircraft may need to be included. In calculating the PWNI AA includes (jet) operations where the flight path is at or below 5,000 feet above ground level. This altitude threshold was adapted from Airservices Australia's environmental principles (Airservices Australia 2002).

The numerator of the PWNI equation requires the track density value and the population count (population density) for each cell. The population density used in the calculation is based on the latest census data (2001). A plot of the population density for Sydney is shown in Figure 9, where the intensity of red increases as the cell population increases. The PWNI is calculated quarterly for each airport where a NFPMS is installed, the calculation is performed over an area of 100kmx100km centred at the airport and each cell is a 1km x 1km square. The total population is limited to the region covered by the grid.

The PWNI for a sample of airports is shown in Table 1. The first two examples are for different operating modes at Sydney airport; normal two week period, and SODPROPS (Simultaneous Opposite Direction Parallel Runway Operations). The latter is a mode where both arrivals and departures are directed over Botany Bay (south of the airport). SODPROPS can only be used where there are parallel runways.

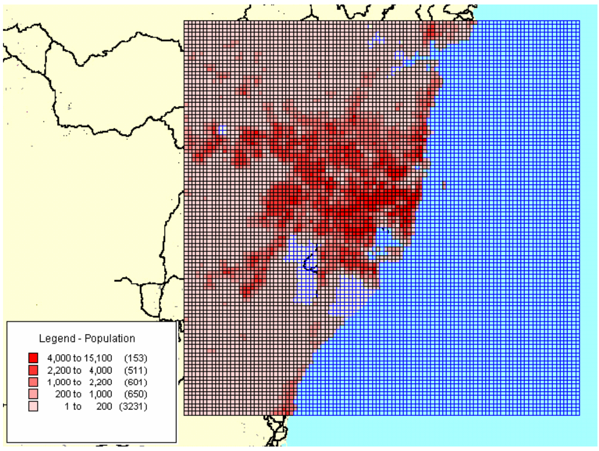


Figure 9. The population density for Sydney based on the 2001 census data.

Due to high traffic levels at Sydney Airport continuous SODPROPS operations seldom occur for a full day; however there was one day in 2004 where it did. The PWNI for SODPROPS mode is a lot lower than for normal operations, 0.6% compared to 1%. The third case was calculated for curfew operations over a 3 month period. During curfew the preferred runway for arrivals is 34L and for departures 16L, this is similar to SODPROPS mode. The PWNI for curfew (0.7%) is similar to that for SODPROPS. These results illustrate the sensitivity of PWNI to ATC procedures (operational modes).

Airport	Noise Metric (persons per operation)	Population	Population Adjusted Noise Metric
Sydney 2 weeks	37394	3710913	1.01%
Sydney 1 day of SODPROPS	22256	3710913	0.60%
Sydney curfew 3 months	2509	3710913	0.07%
Brisbane 2 weeks	14917	1646139	0.91%
Brisbane 2 weeks	11905	1646139	0.72%
Adelaide 2 weeks	27712	1141505	2.43%
Canberra 2 weeks	1045	359836	0.29%
Canberra 2 weeks	1265	359836	0.35%

Table 1. The PWNI for different operating modes and airports.

The other PWNI values in Table 1 indicate that Adelaide has a much higher value than other airports whereas Canberra has the lowest, one third of the Sydney value. The strategy for controlling aircraft noise at Canberra is to establish noise abatement zones which aircraft are restricted from flying through. Residential development outside these zones has also been restricted by the local councils. The PWNI quantitatively demonstrates how effective this method of control is in reducing the impact of aircraft noise.

How the PWNI can be used as a performance metric is best illustrated by the following example. If, for Canberra, controllers were to allow aircraft to pass through the noise abatement zones (within which the local population is concentrated) then the PWNI would increase. This would trigger an investigation and the track data would be analysed to identify what occurred and corrective action would then occur.

The PWNI is regularly used to monitor ATC environmental performance for the impact of jet aircraft noise at each NFPMS airport.

FUTURE TRENDS

Despite advances in jet engine and airframe design lowering the noise level of new aircraft, the trend of increasing air traffic will result in more people being affected by aircraft noise. Forecasts for aircraft noise based on the expected usage support this. Figure 10 from the International Air Transport Association Environmental Review 2004 (IATA 2004) contains predictions (CAEP5 and CAEP6) for the number of people exposed to DNL55 (similar to LAeq 55 but with a weighting for night operations and is the regulated threshold for aircraft noise in the United States) for different global regions up to the year 2020. The number of people exposed to a level greater than DNL55 was expected to drop during the 1998 to 2002 period followed by steady increase, except for North America where CAEP 5 shows a slight drop and then a flattening out. The initial drop for the period 1998-2002 is due to a large number of new aircraft being introduced into all regions resulting from a mandatory phase out of older Chapter 2 jets. The effect of lower noise levels at the source associated with the improved performance of new aircraft is outweighed by the increase in air traffic after 2002 resulting in the steady rise in Figure 10.

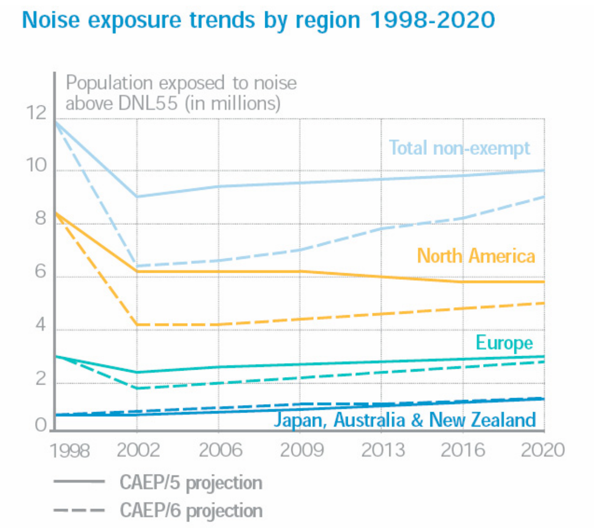


Figure 10. Predicted global trends for aircraft noise impacts.

Aircraft in the near future will possess improved navigation capability which will impact on how aircraft arrive and depart from airports. It should be possible for ATS to design improved procedures to reduce the impact of aircraft noise by exploiting the benefits of greater track and operational flexibility that these new technologies bring.

Currently meteorological data is not utilised to reduce the impact of aircraft noise, however the technology is available to use wind data to improve CDA.

Under meteorological conditions that create an inversion layer (where the atmosphere warms as altitude increases) sound refracts towards the ground resulting in higher noise levels. Technology is close to producing a reliable system to detect where and when an inversion layer exists. This would then enable ATC to select appropriate flight paths to minimise aircraft noise in the more populated areas when an inversion layer is present.

Up to recently (late 2003) the progress in producing a quieter aircraft has been driven by the airframe manufacturers such as Boeing and Airbus. These companies determine what sort of aircraft the market place wants and source engines from the engine manufacturers (such as General Electric, Rolls Royce or Pratt and Whitney). As a result the basic layout of the aircraft has changed very little. The Silent Aircraft Initiative, a joint research project between Cambridge University (England) and MIT (US), takes a different approach. The research aim is to reduce aircraft noise to the point where it would be unnoticeable to people outside the airport perimeter. For this project aircraft design has taken a more holistic approach. The airframe, engine and operational parameters are maximised for the lowest possible noise. It is anticipated that the first “silent” aircraft will start appearing in 2020. ATC will need to keep up to date with the progress of such research in order to cope with these radically different aircraft.

Gas emissions from aircraft, which affect the local air quality and add to the overall green house load, as an environment issue are becoming more important. Often in minimising the impact of aircraft noise an increase in track distance occurs. Clearly this increases environmental impact due to gas emissions. The impacts of noise and gas emissions need to be separately quantified so that a decision can be made of whether noise or gas emissions take priority when deciding on an environment strategy. The issue of quantifying the impacts of noise and gas emissions was one of the drivers for AA developing environment metrics.

CONCLUSION

When AA was first established in 1995 it had clear responsibilities for minimising the impact of aircraft noise. The field of aircraft noise has progressed since then and AA has always been in the forefront of this development as was demonstrated by AA being the first ATC provider to incorporate quantitative environmental performance measures. Since 1995 new noise descriptors have been introduced. Regulators are requiring more sophistication in analysing noise and track data. There are greater expectations placed on the ATC provider to assess environmental changes resulting from variations to procedures with increased rigor. Future challenges for AA will be to balance gas emissions impacts with that of noise, and to maximise the benefits of new technology. Despite the improvements in the field of aircraft noise it is clear that noise will continue to be an important issue for ATC providers.

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