Fact SHEET 1

INTRODUCTION TO AIRCRAFT NOISE

AIRBIZ

AIRWAYS
making your world possible

MARSHALL DAY
Acoustics

chapman tripp

CHRISTCHURCH AIRPORT

1 PLANNING IN THE VICINITY OF AIRPORTS

Airports are essential for transporting people and goods. They are intergenerational assets which connect communities with the rest of the country, and the rest of the world. As aircraft approach and depart an airport, they are lower in the sky and the noise that they make is louder and more apparent – standing out from the background noise levels for short durations. The noise from aircraft is a normal and unavoidable aspect of airport operations.

Noise from aircraft is most noticeable along the extended centrelines of the runways and under the arrival and departure flight paths.

To protect both local communities and airports, and to proactively make sure that airports can serve their communities well into the future, land use planning is important. Planners need to understand which areas of land are affected by aircraft noise. Proactive planning rules protect people from establishing sensitive land uses (like housing, schools or hospitals) in areas that are exposed to higher levels of aircraft noise which might disturb them or affect their quality of life. Those same planning rules also protect and enable airport operations to continue to support the economic and social prosperity of Canterbury, the South Island and New Zealand. As much as possible, the areas under flight paths which are exposed to higher levels of aircraft noise are reserved for things like industrial, agricultural or recreational land uses.

2 HOW AIRCRAFT NOISE IS CREATED

Aircraft noise is caused by two main things, the aircraft's engines, and the aircraft moving through the air (air flowing over the airframe, landing gear and flaps etc).

There are many different types of aircraft using Christchurch Airport – commercial passenger aircraft, freight aircraft, helicopters, the aircraft used by the International Antarctic Centre, general aviation, and military or other government aircraft. Different types and models of aircraft create different levels of noise. Generally, larger aircraft make more noise than smaller aircraft.

THE NOISE WHICH IS HEARD ON THE GROUND IS ALSO INFLUENCED BY:

- **The runway which is being used**
- **Aircraft flight paths and navigation procedures**
- **Weather conditions (through the effects atmospheric absorption, ground attenuation, cloud cover, wind, temperature, fog)**
- **Terrain surrounding the airport**
- **Background noise levels – which change throughout the day (for example, it is usually quieter at night so aircraft noise is more noticeable)**

Aircraft are constantly arriving and departing from Airport – so noise will come and go throughout the day and night.

The impact of one aircraft is markedly different to the cumulative impact of many aircraft. A person's annoyance response has been shown to be influenced by the accumulated effects of repeated exposure to noise events. New Zealand Standard 6805:1992 Airport Noise Management and Land Use Planning (NZS 6805) recognises this effect and, consistent with international best practice, aircraft noise is assessed by looking at the average noise exposure on a typical day.

3 HOW AIRCRAFT NOISE CAN AFFECT PEOPLE

Noise can affect people in different ways, depending on factors like loudness, time of day when noise occurs, length of time that it occurs for, and the context that it occurs in. Sometimes noise is just something that is noticeable but not an issue. At the other end of the scale, noise can disturb sleep, and make it hard to hear or have a conversation. Noise from specific aircraft cannot be made quieter, however the paths that aircraft fly can be designed to reduce exposure to aircraft noise over populated areas (as is the case in Christchurch and West Melton). But it is not possible to avoid noise from aircraft entirely. So the best way to avoid aircraft noise affecting people is with proactive town planning.

4 AIRPORT NOISE CONTOURS

In New Zealand, like other countries, town planning to account for aircraft noise exposure is based on contour maps which are created by noise modelling. The noise contours show the extent of exposure to aircraft noise and the areas where higher levels of aircraft noise occurs. NZS 6805 Airport Noise Management and Land Use Planning recommends using noise contours and guides this process.

NZS 6805 recommends that the noise contours need to account for future airport growth and use over time so that they are a reliable and effective long-term planning tool, not just a snapshot in time.

Air noise contours should be updated approximately once a decade, to reflect changes in aircraft fleet, flight path adjustments and usage and future traffic projections for various aviation segments including commercial scheduled passenger and freight aircraft.

The existing air noise contours for Christchurch Airport (Existing Noise Contours) were approved in 2008. They are now due to be re-modelled in accordance with the Canterbury Regional Policy Statement (CRPS). The CRPS directs that the modelling inputs, assumptions and outcomes shall be peer reviewed by an independent panel of experts. This is discussed further in *Fact Sheet 3: Overview of the air noise contour remodelling and peer review process.*

The shape and size of air noise contours are caused by various factors, which all need to be put into the model.

The work undertaken by CIAL's experts in updating the projected noise contours involved considering a range of scenarios for key assumptions:

- **Planned airport runway development to enhance capability, safety, efficiency;**
- **Air traffic, including future international and domestic routes and fleet mix;**
- **Ultimate runway capacity;**
- **Location and usage of current flight paths and, based on best available information, how flight paths may evolve in the future;**
- **The variations in runway usage based on meteorological conditions throughout the year, historic variations from year to year, and how this may be impacted by climate change.**

The modelling also accounts for the difference in noise sensitivity to daytime and night-time flights.

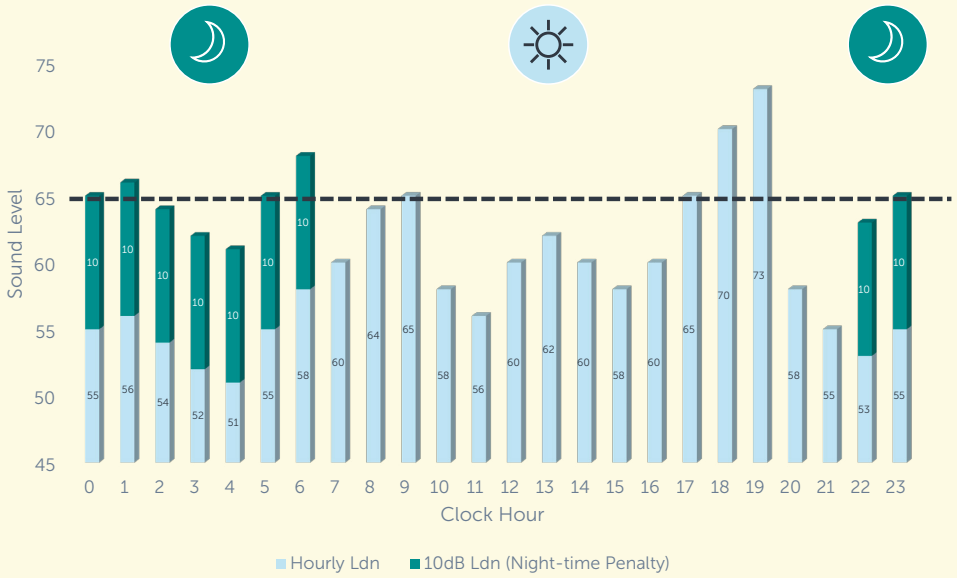
CIAL's Expert Team have completed a rigorous modelling exercise to produce Updated Noise Contours and this work was provided to Environment Canterbury for peer review by the Independent Expert Panel appointed by Environment Canterbury. This peer review process is now complete and CIAL's Expert Team consider that the 2023 Updated Noise Contours should be used for planning processes in Canterbury.

5 WHAT DOES "DBA" AND "LDN" MEAN?

Noise is measured on a logarithmic scale in a unit called a decibel (dB). Measurements of noise usually have a correction factor applied to reflect the sensitivity of the human ear. This factor is an industry approved standard and is referred to as the "A-weighting" and results in environmental noise usually being measured in dBA units. The noise level of normal daytime urban-based activities typically varies between 40dBA and 85dBA. On this scale, an increase in the noise level of 10dBA is perceived to be a doubling or a decrease of 10dBA as a halving in loudness. For example, most people perceive a noise event of 85dBA to be about twice as loud as an event of 75dBA.

The noise levels from an individual overflight are usually reported as the maximum level in dBA, even if it is only at this level for a duration of less than a few seconds.

NZS 6805 uses the Ldn metric for airport noise contours which is the equivalent sound level for a 24-hour period with an additional 10dBA imposed during night-time hours of 10pm to 7am. This night weighting accounts for people's increased sensitivity to noise at night and the sound environment at night being quieter.



24 hour Ldn (65dB Ldn)

65dB Ldn is not an individual aircraft noise limit; rather it is a weighted sound average based on cumulative exposure across a 24 hour period. In fact, 65dB Ldn can only be reached if noise events significantly louder than 65 dB are experienced at a receptor across a day (or 55 dB across the night because of the 10 dB penalty

KEY INPUTS INTO THE NOISE CONTOUR MODELLING

6 LONG TERM PLANNING USING ULTIMATE RUNWAY CAPACITY

Modelling is based on the ultimate runway capacity of Christchurch Airport – that is, the busiest that Christchurch Airport can ever be based on its physical constraints (the practicalities of air traffic control and how aircraft take-off, taxi and land on the runway) and expected operational characteristics. Ultimate runway capacity is determined by experts in aviation and airport planning. It is important that the contours show the noise that will be generated when Christchurch Airport is at ultimate runway capacity so that planners can take the full extent of projected noise into account and anticipate this in planning decisions.

The exact date at which ultimate runway capacity is reached will shift in response to events like the recent COVID-19 lockdown or in response to uplifts in air travel demand - ultimate capacity may be reached between 50 to 60 years into the future. But the point is that it will be reached and should be anticipated in planning documents.

8 WILL AIRCRAFT GET QUIETER?

In the past, improvements in engineering and design have meant that newer aircraft models have been quieter. But there is no guarantee that aircraft will continue to get quieter in the future. Recent engineering focus is to reduce engine emissions, not necessarily noise reduction.

New aircraft must comply with the latest noise standards as defined by ICAO, an agency of the United Nations and international body setting rules and regulations for international civil aviation. These noise certification standards for aircraft have become more stringent over time. However, at any point in time there will still be older noisier aircraft flying as the changeover of an airline fleet occurs over an extended period, and the useful operational life of modern jet aircraft is well beyond twenty years. The impetus for an airline to upgrade its fleet is very often driven by fuel efficiency of newer aircraft, as well as greater capability (range or payload) with the added benefit of more new generation quieter aircraft. So, given there is no clear evidence that aircraft will get appreciably quieter in the future, it is not advisable to rely on that for modelling purposes.

The modelling used for the 2023 Updated Noise Contours accounts for aircraft that are already flying, or are anticipated to be introduced into fleets of airlines most likely to be using Christchurch Airport. This incorporates consideration of new generation aircraft. The modelling does not, however, attempt to speculate on the noise profile or potential use of aircraft models that are in developmental phases.

7 AIRCRAFT FLEET

The overall makeup and mix of the fleet of aircraft using Christchurch Airport is considered when modelling the noise contours because each type of aircraft – and the make and model – has a different noise profile. The modelling software (known as AEDT) has in-built profiles for different makes and models of aircraft so that an accurate picture of the fleet used by airlines can be built. Airline companies have provided information about the fleet they use to inform these assumptions. The experts have also used measurements of specific aircraft operating at Christchurch Airport to improve accuracy of the noise modelling.

The aircraft noise and operating performance parameters in AEDT are sourced from:

- International Civil Aviation Organisation (ICAO) Aircraft Noise and Performance Database (ANP);
- Eurocontrol Base of Aircraft Data (BADA).

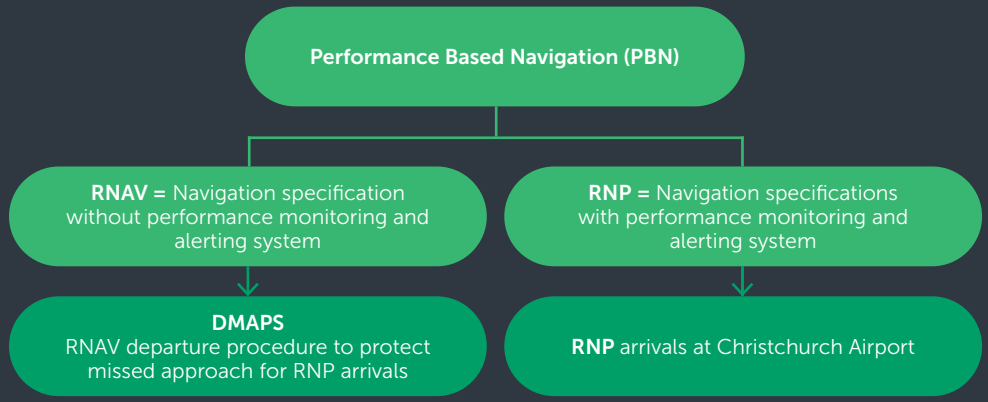
9 FLIGHT PATHS AND PRECISE NAVIGATION

Newer navigation technology can change aircraft flight paths - such as Required Navigation Performance (RNP). RNP is satellite-based aircraft navigation technology specifications under Performance Based Navigation (PBN) to help aircraft operate along a precise flight path with a high level of accuracy. PBN offers safety and efficiency benefits compared to visual navigation of flight paths. Over time this permits new flight paths to be considered in addition to existing arrival and departure paths and changes the distribution of traffic across existing and new flight paths as more aircraft, airlines and pilots use the new technologies. Precise navigation can, where possible, help aircraft to avoid sensitive areas but in doing so can concentrate noise along these precise flight paths.

Historically, aircraft approached and departed Christchurch Airport straight on, but flight path design and procedures changes from time to time. Since 2018, increasingly aircraft have been turning onto final approach closer to Christchurch Airport - angling away from urban areas. This affects the shape of the noise contours.

Another way in which flight paths have changed in recent years is air traffic control now require aircraft to depart the airport using the Divergent Missed Approach Protection System (DMAPS). DMAPS are departure tracks that turn at an angle soon after take-off, instead of flying straight and then turning when instructed by Air Traffic Control. Aircraft have been required to use DMAPS departures since 2020.

When DMAPS procedures were designed, the opportunity was taken to mitigate noise impacts by making the turns in the direction of less populated areas, namely to the north-west and south-west, rather than north-east and south-east.



The modelling for the 2023 Updated Noise Contours takes account of these navigation specifications and procedures, and historical analysis of actual radar flight track data that has been supplied by Airways. This data shows actual historic flight paths and is used as the basis for the flight tracks and spread assumptions used in the noise modelling. This is discussed further in *Fact Sheet 4: Outcome of the peer review process – updates to the 2021 Draft Updated Noise Contours.*

10 RUNWAY USAGE

There are four runway ends at Christchurch Airport. Aircraft generally take off and land into the wind. The main runway (with ends facing north-east and south-west) is used most of the time and aligns with the prevailing wind conditions. On occasions when there are sufficiently strong current or forecast north-westerly winds so that air traffic control declares the runway 'in-use', the crosswind runway is used to ensure aircraft continue to take off and land into the wind. Use of the crosswind runway tends to increase in the summer months when north-westerly winds are more frequent.

The area of land affected by noise from an individual aircraft changes depending on which runway is used. To model the overall noise environment, the contours account for the proportional split between each runway end.

11 CLIMATE CHANGE

Climate change has the potential to impact the size and shape of the contours in two ways. NIWA predicts that the frequency of north-westerly winds will increase due to climate change, which will increase use of the crosswind runway. NIWA also predicts an increase in temperature and more hot/humid conditions, which could impact the propagation of sound. The predicted impacts of climate change have been tested in the modelling.