

Understanding Aircraft Noise

December 2022

Sources of airport and aircraft noise

It is often assumed that an aircraft’s engines are its single source of noise, however, that is not the case.

The three main sources of aircraft noise are:

1. The engine components
2. The aerodynamic drag or the resistance of airflow around the aircraft’s fuselage and wings
3. The deployment of landing gear

Noise at an airport is a result of airline operations, ground support activities (engine maintenance, re-fuelling, baggage handling and re-provisioning of aircraft), airfield maintenance and site development.

The extent to which noise affects an airport’s neighbours depends on a wide range of factors, including the time of operations, aircraft type, air space management, prevailing weather conditions and the ambient noise environment.

Today’s aircraft continue to be much quieter

Aircraft built today are about 75% quieter than their counterparts were 50 years ago.

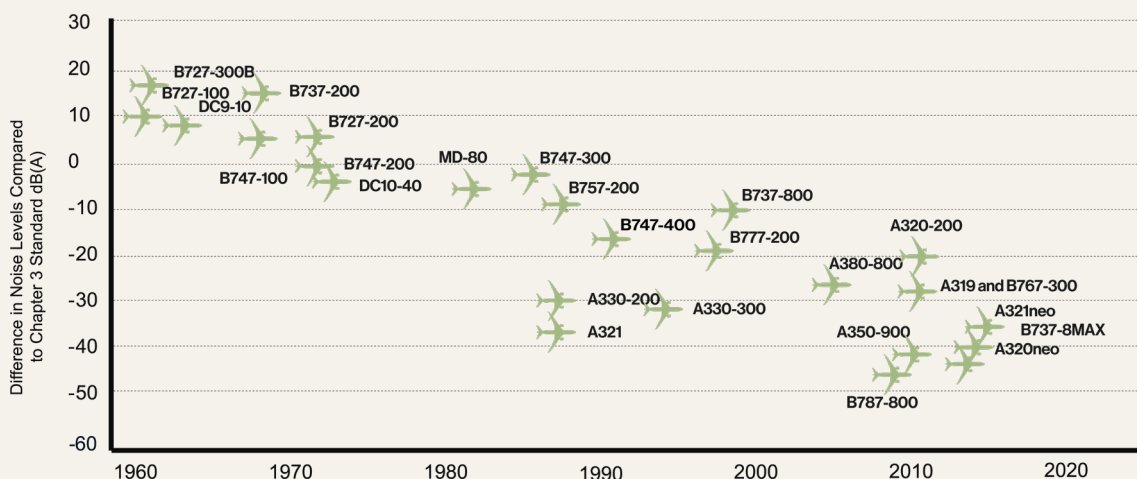
That’s largely because aircraft manufacturers have continually been working to reduce aircraft noise through improving the design of both engines and airframes.

You can see, from the graph below, that the biggest gains were made between the 1960s and the late 1990s with improvements becoming smaller in recent years and expected to be more incremental in the future.

Electric and hydrogen aircraft engines are expected to be quieter than conventional aircraft.

As more detailed work continues to be undertaken to understand their noise profiles, this project has deliberately chosen to use existing aircraft profiles rather than make assumptions as to how quiet future aircraft will be.

The trend towards quieter aircraft



Aircraft noise is most noticeable closest to its source

Aircraft noise is most noticeable in the immediate vicinity of a runway and on the extended centrelines when aircraft land or take-off.

In general:

- Aircraft noise and the resulting sound waves travel equally in all directions.
- As sound waves travel away from their source, their intensity decreases.
- The way sound travels is dependent on a range of factors, such as wave divergence, atmospheric absorption and ground attenuation.
- People directly under flight paths will be subject

to higher levels of aircraft noise than those who are further away where aircraft will be at higher altitudes.

- Meteorological conditions can also change the way that noise is experienced.

Most aircraft noise is short in duration as aircraft pass over a location – similar to a car passing someone on a street. In addition, the higher an aircraft is, the less likely its noise is to impact those on the ground below.

Airports actively monitor noise

The specialised United Nations' agency, the International Civil Aviation Organisation (ICAO), sets standards for safe and sustainable aviation in its 190 member countries, including New Zealand.

Limiting or reducing the number of people affected by significant aircraft noise is one of ICAO's main priorities.

The Civil Aviation Act outlines rules for the operation of aircraft in New Zealand, including rules and guidance for reducing aircraft noise.

In addition, territorial authorities use airport noise contours as planning tools to discourage noise sensitive activities from establishing too close to an airport. These same tools also require airports to monitor and manage noise so it does not exceed specific limits.

There are several strategies airports can use to manage the impacts of aircraft noise, these include:



Working with local government to ensure development of land in areas affected by aircraft noise is limited to compatible uses (like agriculture)



Working with the owners of properties under approach and departure paths close to the airport to mitigate indoor noise intrusion



Designing airports so airlines can use the latest generation of quieter aircraft



Designing efficient aircraft operations so that on the ground movements are optimised

A low population density makes it easier to manage any impacts

Two factors in the selection of the site were the area's relative low population density and the rural land use in the immediate surrounding area.

Land uses are important. In urban areas, noise sensitive activities, such as medium to high density residential developments, are discouraged around airports.

This protects communities from any noise impacts while helping ensure airports can operate safely and efficiently.

The land around the site and its potential flight paths is already limited to rural activity, with large rural and lifestyle block sized properties. This means a limited range of permitted land uses

currently exist with restrictions in place limiting current and future higher density residential development.

Rural land use is generally compatible with an airport operation so it's unlikely existing land use rules around the site would require significant change.

While low population density makes it easier to manage any impacts on people, it is important those impacts are well managed.

Christchurch Airport is experienced in managing noise and has done so for more than 80 years adjacent to the South Island's largest city.

A variety of manmade noises exist in the local soundscape

How aircraft noise is perceived can be subjective and depends very much on the environment in which it is experienced.

On a typical day, the combination of multiple man-made and natural sound occurrences creates an ambient noise setting.

Importantly, the ambient noise level changes over a 24-hour period with night-time soundscapes being generally much quieter.

The extent and nature of ambient sounds will impact how some aircraft noise is perceived.

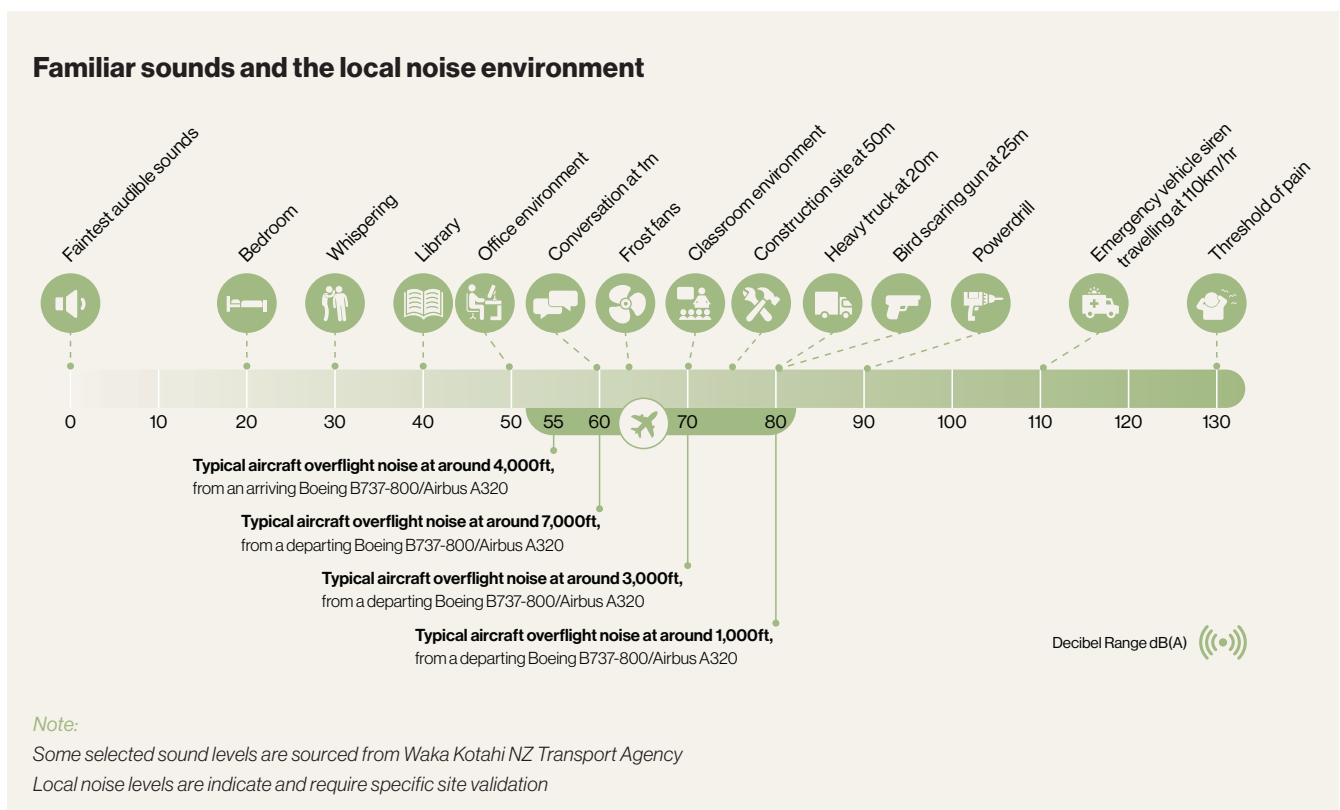
For example, loud aircraft noise may go unnoticed by a person on a busy street while a quieter aircraft noise may be more distinctively perceived by a person lying in bed at midnight.

Therefore, a first step in assessing the potential noise impacts of a new regional airport is scoping the existing local noise environment.

Tarras is a rural area that is intersected by two State Highways (8 and 8A). Its local soundscape consists of state highway traffic, noise from agricultural and viticultural operations (including acoustic bird scaring and frost fighting equipment).

The illustration shows indicative sound levels for a selection of man-made sounds familiar to the local area.

It also shows how the noise from various aircraft at differing heights would compare.



Noise effects at the proposed regional airport site will be carefully assessed

Two potential flight paths - the Lindis Valley – Lake Dunstan alignment (04/22) and the Hawea Valley – Lake Dunstan alignment (01/19) have been identified.

Christchurch Airport has signalled its intention to determine a single preferred runway alignment. This requires an assessment of four criteria - the most important of these is safety.

The other three criteria are environmental (including any noise impacts), capacity and operational performance.

Assessing the effects of aircraft noise associated with airline operations at the proposed airport involves estimating the number of dwellings and people that may be exposed to various levels of noise in their place of residence. Other noise

sensitive activities in the area such as the Tarras School are also taken into account.

These effects then inform the selection of preferred flight paths and procedures and are reviewed as adjustments to those options are considered as part of the assessment procedure.

At the conclusion of this process a single event noise contour will be prepared for Code C and E aircraft detailing the preliminary locations where various levels of noise could be experienced on the ground for the short period of time that a single aircraft overflies that location.

This information will enable consideration of the appropriate noise mitigation approach for individual properties.