Noise Complaints and Information Service

FUNDAMENTALS OF SOUND

This factsheet outlines the basics of sound and how these relate to aircraft noise.

How sound occurs

Although the terms 'noise' and 'sound' can be used interchangeably, 'noise' is used to refer to an unwanted sound which can impact on the quality of life. 'Sound' is a generic term for anything acoustic. Sound from aircraft (as with sound from other forms of transport) is often considered as having an impact on the quality of life which is why we use the term aircraft noise.

Sound is pressure variations travelling through the air from the source to the receiver, usually the human ear. The pressure variations are due to air molecules vibrating back and forth. These variations (or sound waves) travel through the air as a longitudinal wave. The direction of vibration of particles is in the same direction as the travelling wave.

Measuring sound

Sound is measured on a logarithmic scale with the decibel (dB) as the unit of measure. The sound level of typical daytime urban-based activities can vary between 40dB and 85dB. The sound levels in a nightclub often exceed 90dB.

Measurements of sound by acoustic equipment have a correction factor applied to reflect the sensitivity of the human ear. This factor is referred to as being 'A-weight' corrected and is indicated by the letter 'A' next to the unit measure 'dB'. Hence sound can also be measured in dB(A) units.

The typical aircraft noise levels detected by Airservices noise monitors are between 65dB(A) and 95dB(A).

Frequency or pitch

The frequency of a sound is what gives it a distinctive pitch or tone. The rumble of distant thunder has a low frequency, while a whistle has a high frequency. The ear is more sensitive to high frequency noise events than low frequency ones.

Most environmental sounds contain a broad range of frequencies. However, it is the middle to high frequency sounds that have the greater potential to cause annoyance for the typical person. For example, the muffler of a truck is designed to attenuate annoying middle to high frequencies from the truck's engine.

Propagation of sound

Sound waves originating from a source will travel equally in all directions. The effect is similar to the rippling waves on still water caused from a rock thrown into a pond. As soundwaves travel away from a source they become less intense as the energy is spread out over an ever increasing surface.

For sound containing mid to high frequency components and travelling distances greater than 500m the higher frequency components are noticeably reduced due to atmospheric absoption.

In the case of aircraft noise the acoustic energy can pass through 500m to 10km (or more) of air to reach local communities. As a result an aircraft can sound very different depending on how far from the airport the community is. This is why the noise from a distant jet aircraft is often heard as a low frequency rumble.

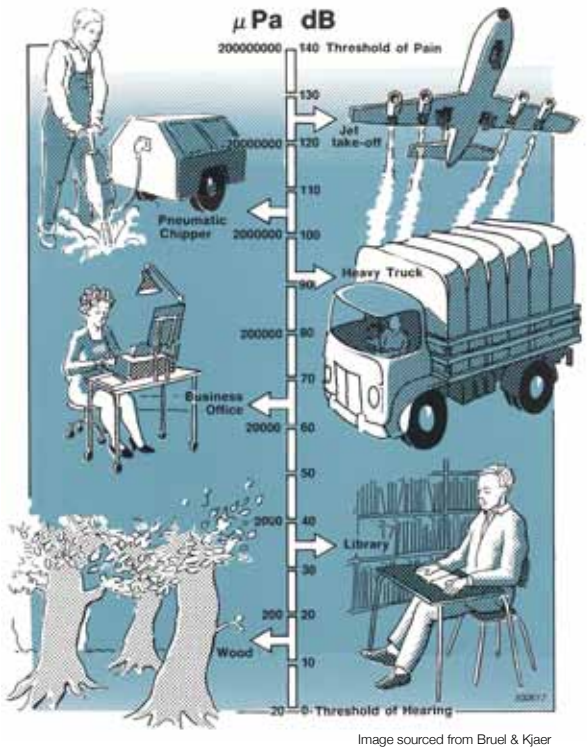

Image sourced from Bruel & Kjaer

Aircraft noise characteristics

The characteristics of sound from aircraft can vary depending on a range of factors, including the type of engine (for example, propeller or jet) and the height of the aircraft.

Although there are many sources of noise from an aircraft (e.g. engine, airframe, landing flaps and landing gear) for the majority of the flight it is the engines that are the dominant source. Even on arrival a jet will use 10-30% thrust during the last 10km of flight.

Jet aircraft noise is generated by a combination of the mixing of high velocity exhaust gasses with ambient air, combustion of fuel and compressor fans. Noise from propeller driven fixed-wing and helicopter aircraft result from the rotating propeller cutting through the air. The resulting sound is heavily influenced by the size of the propeller and the velocity of the propeller tips through the air.

Differences in aircraft noise

Generally noise from departing aircraft is greater than from that of an arriving aircraft. On departure, the noise level experienced on the ground from a particular aircraft is influenced by:

- the aircraft type and size
- the way the aircraft is flown by the pilot and aircraft settings
- the rate at which the aircraft climbs
- meteorological conditions.

Long range heavy aircraft such as the Airbus A380 or Boeing 747 climb more slowly than smaller aircraft and expose more of the ground to higher noise levels.

Improvements in both engine and airframe technologies have resulted in modern aircraft being more efficient and quieter. Australia is in a fortunate position, from an aircraft noise perspective, as it has one of the most modern fleets of any country.

Monitoring aircraft noise

Airservices has noise monitors located within communities near eight major Australian airports. These form part of our noise and flight path monitoring system (NFPMS).

More information on the NFPMS and aircraft noise levels can be found at www.airservicesaustralia.com/aircraftnoise/monitoring-aircraft-noise

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