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Noise Complaints and Information Service

AIRPORT CURFEWS

A number of airports around Australia have legislated curfews that restrict operations to provide noise relief to residents surrounding the airport.

An airport curfew is a legislated restriction on aircraft operations during a specified time period. Curfews are currently in place at four Australian airports between 11pm and 6am. The restrictions limit what aircraft can land and take off, and, in some cases, the runways that can be used.

The four airports with curfews are:

- Sydney
- Adelaide
- Gold Coast (Coolangatta)
- Essendon.

This factsheet provides an overview of how curfews are managed in Australia. The specific curfew restrictions for individual airports can be found at the Department of Infrastructure and Transport website: www.infrastructure.gov.au/aviation/environmental/curfews

Airservices role

Airservices monitors which aircraft operate during curfew periods and provides reports to the Department of Infrastructure and Transport. The department is the only organisation that can make a determination of a curfew violation and prosecute an airline or aircraft operator for breaching a curfew.

We can also provide advice to the community on aircraft movements during curfews through the Noise Complaints and Information Service (NCIS). Further information on making a complaint or enquiry is available at www.airservicesaustralia.com/aircraftnoise/about-making-a-complaint/

You can also identify individual flights during curfews using our WebTrak service: www.airservicesaustralia.com/aircraftnoise/webtrak

Permitted operations

An airport curfew does not stop all aircraft from operating during the legislated time period.

As a general rule, most commercial aircraft carrying passengers are restricted from operating during the curfew.

The main exception is a small number of 'shoulder' movements in between 5:00am and 6:00am, and 11:00pm and midnight. These are permitted on a quota basis to take account of time differences during the northern hemisphere summer which affect the schedules of airlines flying from these destinations to Australian airports. The shoulder periods are also required to address compliance with curfews at some international airports.

Quotas for shoulder movements are decided by the Minister of Infrastructure and Transport and administered by the Department of Infrastructure and Transport.

Other exceptions to curfew restrictions are:

- a limited number of low noise freighter aircraft
- aircraft approved by the department. These are usually small propeller aircraft that meet international noise standards

- emergency aircraft, police, air-ambulance, Royal Flying Doctor Service, search and rescue, or an aircraft declaring an emergency
- departing aircraft that have commenced taxiing prior to the start of a curfew
- an aircraft granted a one-off dispensation by the department to operate in exceptional circumstances
- a limited number of low noise corporate jet aircraft that meet international noise standards.

Aircraft may also operate in the same airspace as an airport with a curfew and not be subject to any curfew requirements provided they do not land or take-off from the airport. Examples of flight operations not subject to curfew restrictions include aircraft en route to another airport or helicopters operating at helipads away from the airport.

Government policy

The government is committed to maintaining existing curfew arrangements while also recognising the value of a network of curfew-free airports. There is no intention to introduce additional airport curfews at present.

Further details on the government's aviation policy can be found in the Aviation White Paper – Flight Path to the Future, www.infrastructure.gov.au/aviation/nap

Granting of curfew dispensations

Under curfew legislations and regulations, the Minister of the Department of Infrastructure and Transport has the power to grant a dispensation that allows an aircraft to operate during a curfew.

In practise, a dispensation is granted by the department where it is satisfied that there are exceptional circumstances to justify the flight. Dispensations must be granted before a flight operates into, or out of, an airport with a curfew. They cannot be granted retrospectively.

Further information

Specific information regarding the Commonwealth Curfew Acts and Regulations can be found at: www.infrastructure.gov.au/aviation/environmental/curfews

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11-152DEC Corporate Communication

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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.

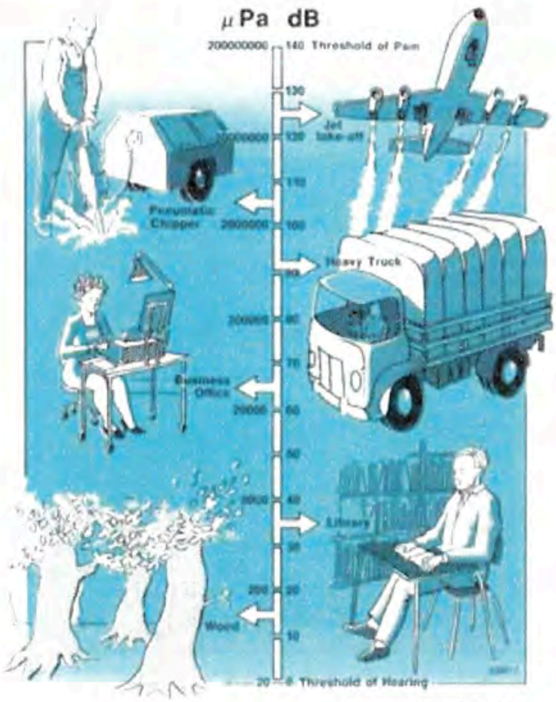

Image sourced from Bruel & Kjaer

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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11-154DEC Corporate Communication

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WHY AIRCRAFT FLY WHERE THEY DO

Airservices is responsible for the management and control of the flight paths used by aircraft approaching and departing from major airports. In most cases, aircraft fly approved flight paths that have been developed over time in consultation with government, councils and residents.

Aircraft fly within a corridor known as a flight path, rather than along a precise, straight line. Over time, as navigation technology has improved, these corridors have generally been getting narrower. Factors such as aircraft type, weight and weather conditions can also determine how precisely aircraft fly within corridors. From the ground, it can appear that aircraft that should be flying the 'same' path, are flying a different path. This leads to the perception that aircraft are flying on the 'wrong' or a 'new' flight path, which is rarely the case.

ARRIVING AND DEPARTING AIRCRAFT

Air traffic controllers keep aircraft at safe distances from each other in the air and on the ground, while arranging them in a sequence for landing or take-off along organised flight paths. The management of aircraft by air traffic control is a complex issue, particularly at major airports. That is why strict procedures are in place to manage arriving and departing aircraft.

Take-off and landing phases are when aircraft have the greatest noise impact. Aircraft take off and land into the wind, or with minimal tail wind. As a result, the wind direction dictates the selection of runway(s) in use at any time. This in turn determines which flight paths are used.

Arriving aircraft must be stabilised and aligned with the runway at least three to four kilometres from the runway end. In bad weather this increases to 15 km.These areas will always be most impacted by aircraft noise. There are no alternatives to this.

The procedures for departing aircraft are designed to take a number of factors into account, including safety and noise impacts.

CHANGING WHERE AIRCRAFT FLY

Changes to flight paths for arriving and departing aircraft are made for a variety of reasons, including safety and the environment. However, changes are not easy to make as they have to take into account the impact on the entire terminal airspace. Airservices aims to minimise the impacts of changes while ensuring the safety of the air navigation system and the provision of critical infrastructure.

Airservices is committed to providing information to and consulting with stakeholders and the community on changes to flight paths. Community Aviation Consultation Groups (CACGs), which have been established at all federally leased airports, are the primary forums for Airservices and the wider aviation industry to engage with communities on airport management issues—including potential changes to flight paths.

Information on CACGs is available at: www.airservicesaustralia.com/aircraftnoise/community-aviation-consultation-groups

Airservices also undertakes a range of additional consultation methods as necessary. Airservices Communication and Consultation Protocol is available online at www.airservicesaustralia.com/publications/corporate-publications/communication-and-consultation-protocol

FURTHER INFORMATION

Airservices website – www.airservicesaustralia.com/aircraftnoise contains information and fact sheets about airports, aircraft noise and related resources.

WebTrak – www.airservicesaustralia.com/aircraftnoise/webtrak

Guide to our operations – www.airservicesaustralia.com/publications/corporate-publications

15-152AUG Corporate Communication

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MONITORING AIRCRAFT NOISE

Airservices Noise and Flight Path Monitoring System (NFPMS) collects noise and flight path data at Brisbane, Cairns, Canberra, Gold Coast, Sydney, Melbourne, Essendon, Adelaide and Perth airports.

This system collects noise and flight path data 24 hours a day, seven days a week via monitors located within the local communities.

The system is the world's largest, most geographically spread system of its type. It records the identity, flight path and altitude of each aircraft operating to and from the airport, the noise levels produced by individual aircraft flying over the noise monitors, weather data, and the general background noise levels.

Purpose of noise monitoring

Noise monitoring data is used by a variety of organisations for different purposes, including the Department of Infrastructure and Regional Development, airports and airlines. Noise monitoring is not conducted to determine compliance with aircraft noise regulations - there is no maximum level allowed for aircraft noise. Rather it is undertaken to:

- determine the contribution of aircraft noise to the overall noise that a community is exposed to
- provide information to the community about aircraft noise and operations
- help local authorities make informed land use planning decisions (though decisions can only be refined through the use of monitoring data, not completely overturned)
- inform estimates of the impact of changes in air traffic control procedures - including changes designed to reduce noise impacts of aircraft
- validate noise modelling
- inform the determination of aviation policy by government
- assist the government to implement legislation, such as curfew acts and regulations.

Measurement of aircraft noise

As an aircraft flies over a monitor, the noise level rises above the background level to a peak usually within 10 seconds and then slowly returns to the background level. The duration of this event varies depending on the height, type and loudness of the aircraft but is usually around 20-40 seconds.

Airservices noise monitoring captures each event as a separate instance. An event begins when the noise level exceeds the threshold value set in the noise monitor and terminates when

the noise level drops below the threshold value. The average noise level, peak level and the noise level for each second of the event is stored. Noise monitors also measure average noise levels and track trends.

This data is then matched with Airservices radar data. Data is usually averaged over a timeframe to reduce the distortion of the extreme results that may arise from unusual weather conditions or other noise sources (eg machinery, motorcycles).

Noise monitors

A noise monitor, also referred to as an environmental monitoring unit (EMU) consists of a microphone attached to a mast and an electronics box. The microphone continuously measures the noise level within the range of 30 to 130 decibels. The noise data is downloaded to a central computer system and matches recorded noise events to aircraft flights.

Types of monitors

Airservices uses a combination of permanent, portable and temporary noise monitors. Some of the permanent monitors have been in place for over 10 years. Temporary monitors may be in place for a period as short as two weeks.

Permanent monitors are fixed installations and are required to meet international standards, including having the microphone on top of the mast, between four and six metres off the ground.

Portable monitors are semi-permanent installations and are deployed for up to 12 months. The components of a portable monitor are much the same as for a permanent monitor, except for the mast which needs to meet the individual requirements of the location.

Temporary noise monitors are used to meet short term monitoring requirements of up to four weeks. Locations are decided by Airservices but the actual sites are determined by the contracted service provider to meet the particular purpose of a noise study. Temporary monitors are also comprised of a microphone and electronics box but are powered by batteries.

Locations of noise monitors

Airservices reviews the location of all monitoring units against a range of criteria, including changes in flight paths and aircraft traffic patterns. Airservices publishes the reports on the noise monitor reviews, known as "Review of Environmental Monitoring Unit" at http://www.airservicesaustralia.com/publications/noise-reports/noise-monitoring-network-reviews/

Airservices also works with airport community aviation forums (eg. Community Aviation Consultation Groups) to consider short-term monitoring programs and the suitability of additional or alternative locations for monitoring units.

Most private residences are unsuitable as a location for monitoring units. There are a number of requirements that must be met for Airservices to be able to install a noise monitoring unit (permanent or portable) at a particular location.

Reporting of noise monitoring

Summaries of the noise data collected at each noise monitor are reported quarterly for each of the eight airports where monitoring is undertaken. These are available at http://www.airservicesaustralia.com/aircraftnoise/airports/

Historical and near real-time noise data from each noise monitor is also displayed by WebTrak, which provides information about where and how high aircraft fly over metropolitan areas for a period of up to three months. WebTrak is accessible at www.airservicesaustralia.com/aircraftnoise/webtrak/

Who is responsible for aircraft noise management?

Responsibility for aircraft noise management is shared between a number of key industry stakeholders:

- airlines and aircraft operators
- air navigation service providers (such as Airservices)
- airports
- federal government agencies
- state and local governments.

Further information

- Airservices website – www.airservicesaustralia.com/aircraftnoise/ contains information and fact sheets about airports, aircraft noise and related resources
  - WebTrak – www.airservicesaustralia.com/aircraftnoise/webtrak/
- Department of Infrastructure and Regional Development – www.infrastructure.gov.au/aviation/general/index.aspx provides information about government policy for aviation, including government strategies for safeguarding airports and surrounding communities, legislation and regulations, and noise insulation schemes.
- Aircraft Noise Ombudsman website – www.ano.gov.au includes information about the ANO's role and reports on reviews undertaken.

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RUNWAY SELECTION

Weather, in particular wind speed and direction, is generally the main factor in determining which runways are in use at an airport, in which direction aircraft will take off and land and which flight paths are used.

At all times, the safe operation of aircraft will be the primary consideration.

This factsheet explains how runways are selected for use, limitations on runway selection and how runways are named.

The decision of which runway is in use at any time can have an impact on aircraft noise experienced by residents around airports.

Air traffic control tries to minimise the number of aircraft flying over residential areas when arriving or departing from an airport.

RUNWAY NAMES

Runways are named using a numbering system which reflects the runways' orientation. The number, between 01 and 36, correlates to the degrees on a compass.

This means that:

- a runway numbered 09 points east (90°)
- a runway numbered 18 points south (180°)
- a runway numbered 27 points west (270°)
- a runway numbered 36 points to the north (360° rather than 0°).

A runway can normally be used in both directions, and has a different name to refer to each end. For example, 'Runway 09' in one direction is west to east, 'Runway 27' is east to west when used in the other direction. The two numbers always differ by 18 (180°).

Some airports have parallel runways, or runways which run 'next to' each other. These are identified by adding Left (L), Centre (C) or Right (R) to the runway number.

This can be seen in the photograph of Archerfield Airport (pictured below) with Runway 10L and Runway 10R. When used in the opposite direction, Runway 10R becomes Runway 28L.

SELECTION OF RUNWAY IN USE

Aircraft take-off and land into the wind, or with minimal tail wind. Based on the wind direction, air traffic control will decide which runway is to be used at any given time.

Larger airports tend to have more than one runway, so that a runway is always available depending on the wind direction. Airports with just one runway are generally constructed so that the runway is aligned with the prevailing wind.

Runway selection is monitored at all times, as weather conditions can quickly change. Every runway has a wind indicator known as an 'anemometer', and wind observations contribute to the runway selection decision. Pilot reports of upper level winds can also impact on runway selection.

When a runway is selected, it needs to be available for an extended period of time to allow pilots to plan their descent, approach and landing. As this involves anticipation of developing trends, aircraft may continue to land on a runway for a period when weather conditions at a local level no longer appear to warrant it.

Other factors that air traffic control will take into consideration when deciding which runway to use include:

- the number and type of aircraft programmed for the airport
- length of runway(s)
- weather conditions (both present and forecast); including wind velocity and gradient, wind shear, wake turbulence effects and position of the sun
- availability of approach aids in poor visibility conditions
- location of other aircraft
- taxiing distances, including availability of taxiways
- braking conditions.

Some airports also have 'preferred runway' systems. This means that if wind conditions, workload and traffic conditions permit, a particular runway will be used to move traffic as efficiently as possible to reduce the noise impact over residential areas.

SEASONAL TRENDS

In many Australian cities, prevailing winds vary by season. This means that one runway may get used more in one season than in another. As a result, some communities may be affected predominantly by noise from arriving aircraft in one season, and by departing aircraft in another.

NOISE VARIATION WHILE CHANGING RUNWAYS

A sudden change of wind direction when the wind is strong may require aircraft established for arrival on one runway to divert to land in the opposite direction. This can require an immediate operational change. In these circumstances, air traffic control will safely divert aircraft. This can lead to aircraft using flight paths over areas that generally experience few overflying aircraft.

LIMITATIONS ON RUNWAY SELECTION

Operating in strong tailwind and crosswind conditions can have adverse effects on aircraft performance during take-off, approach and landing. Certain conditions set out in the table following generally preclude the use of a runway.

Completely dry	Crosswind exceeds 20 knots (KT) including gusts
	Downwind exceeds 5 KT including gusts
Not completely dry	Crosswind exceeds 20 KT including gusts
	There is a downwind component

Air traffic control may nominate a runway when a crosswind or downwind exceeds these conditions:

- if an alternative runway does not exist
- if a landing is not possible on an alternative runway
- if noise abatement procedures recommend the use of that runway and air traffic control considers that this would not compromise safety.

The decision to take off or land rests solely with the pilot-in-command. The pilot must ensure that the runway is suitable for the operation of the aircraft. When a pilot asks for an alternative runway for operational reasons, this will be provided without the aircraft being delayed.

FURTHER INFORMATION

Specific noise abatement Procedures (NAP) for individual airports may be found at: www.airservicesaustralia.com/aip/current/dap/AeroProcChartsTOC.htm

Information on the Sydney Airport Long Term Operating Plan (LTOP) may be found at: www.airservicesaustralia.com/publications/reports-and-statistics/sydney-airport-and-associated-airspace-ltop

Airservices has published other factsheets about aircraft operations and noise, which can be found at: www.airservicesaustralia.com/aircraftnoise/factsheets

15-153AUG Corporate Communication

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SEASONAL WEATHER PATTERNS

This factsheet outlines why different seasonal weather patterns occur and how they can affect exposure to aircraft noise.

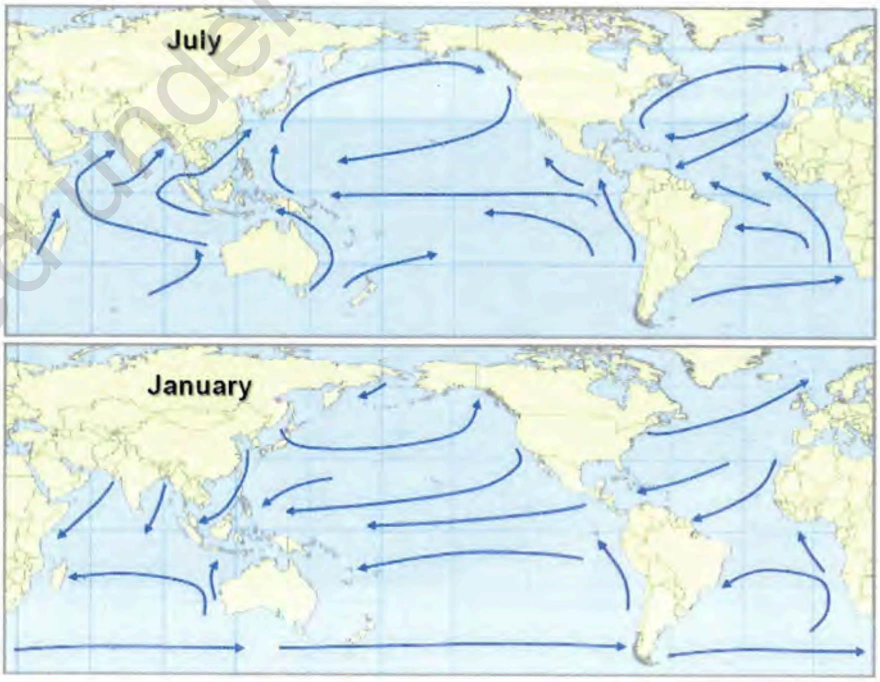
Weather such as wind, clouds and precipitation are all the result of the atmosphere responding to uneven heating of the Earth by the Sun. The uneven heating causes temperature differences, which in turn cause air currents (wind) to develop, as heat is moved from areas of high temperatures to areas of lower temperatures. The atmosphere becomes a giant 'heat engine', continuously driven by the sun.

Seasonal variations in the speed and direction of the wind result from the seasonal changes in the relative inclination of the Earth towards the Sun, which in turn changes the patterns of differential heating.

So how does this affect aircraft over my home?

Wind speed and direction is the main factor in determining which runways are in use at an airport, in which direction aircraft will take off and land and which flight paths are used. For fixed wing aircraft it is advantageous to perform take-offs and landings into the wind to reduce take-off roll by providing better lift; and reduce the ground speed on take-off and landing. In Australia the Civil Aviation Safety Authority (CASA) sets limits upon when an aircraft may operate opposite to the wind direction. Larger airports usually have more than one runway in different directions, so that one can be selected that is most nearly aligned with the wind.

As the map below shows, at different times of the year, the wind will be from a different direction. This means that a different runway will be in use more at certain times of year, which may either increase or decrease your exposure to aircraft noise. Further information on runway selection is available on the Airservices website at: www.airservicesaustralia.com. The Bureau of Meteorology publish data in the form of wind roses showing the frequency of occurrence of wind speed and direction for selected Australian sites which have data for at least 15 years. This data may be accessed at: www.bom.gov.au.



Seasonal wind patterns of the world (Source: Dr. Jean-Paul Rodrigue, Dept. of Global Studies & Geography , Hofstra University, New York, USA).

Other factors that affect wind direction

Air movement is also affected by global scale factors such as the Earth's rotation and ocean currents and on a local scale by the landscape (eg. mountains, rivers and lakes). Air-flow is rarely smooth, with most sites experiencing fairly rapid changes in wind speed and direction. Wind speed also increases with the height above the ground, due to the reduced frictional drag of the ground, vegetation and buildings. Thunderstorms and wind shear (change of wind speed and direction over a very short distance) will also have an effect on runway use.

Daily wind patterns can result from differential heating on a local scale caused by proximity to water, called sea and land breezes. On a warm summer day along the coast, as air above the land surface is heated by radiation from the sun, it expands and begins to rise, being lighter than the surrounding air. To replace the rising air, cooler air is drawn in from above the surface of the sea (see Diagram A below) causing a sea breeze. At night time, the sea retains heat better than the land, so the process happens in reverse (see Diagram B) causing a land breeze. At airports located close to the sea, these breezes can affect runway selection.

Useful links

www.airservicesaustralia.com/aircraftnoise/factsheets

www.airservicesaustralia.com/publications/reports-and-statistics

Diagram A: Sea breeze (daytime)

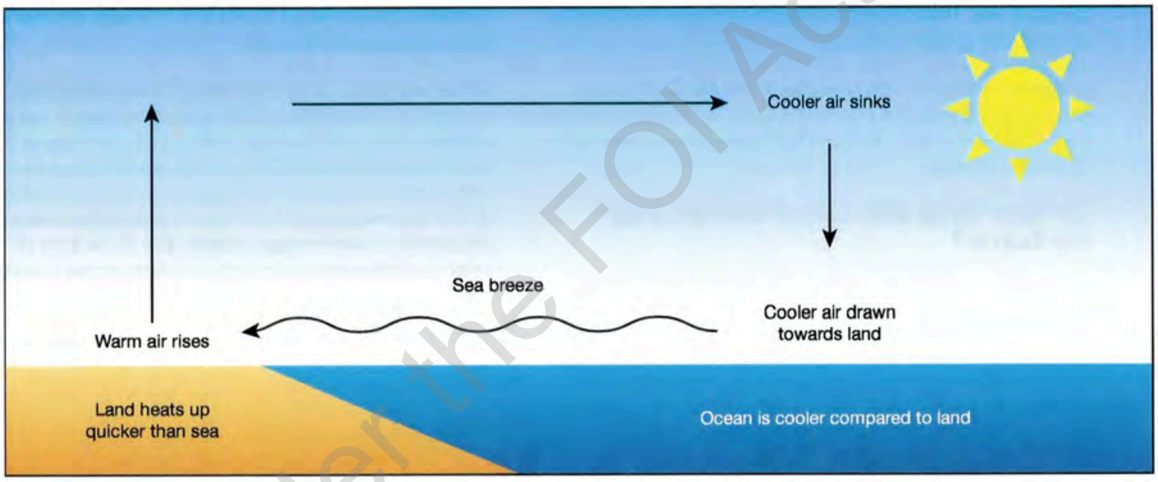
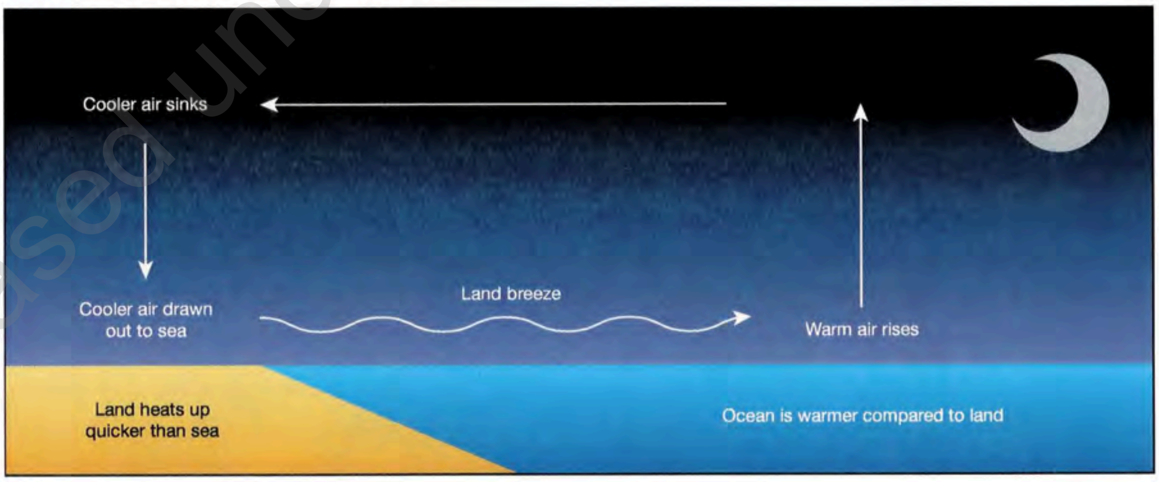


Diagram B: Land breeze (evening and night)



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AIRPORT MASTER PLANS

This factsheet outlines Airservices role in the master plan process.

The *Airports Act 1996* (as amended) requires federally-leased airports[1] in Australia to produce a Master Plan every five years. This is effectively a blueprint for the future coordinated development of an airport over a twenty year period, with an emphasis on the first five years. It includes information relating to forecast growth, airport terminals and facilities, runways and incorporates an environmental strategy.

Purpose and objectives

The broad purpose and objectives of a master plan are set out in the Airports Act 1996 to:

- establish the strategic direction for efficient, economic development at the airport over the planning period
- provide for the development of additional uses of the airport site
- indicate to the public the intended uses of the airport site
- reduce potential conflicts between uses of the airport site and to ensure that these are compatible with the areas surrounding the airport
- ensure that all operations at the airport are undertaken in accordance with relevant environmental legislation and standards
- establish a framework for assessing compliance at the airport with relevant environmental legislation and standards
- promote the continual improvement of environmental management at the airport.

Roles in the master planning process

Airports are responsible for producing the master plan, while the overall process is administered and regulated by the Department of Infrastructure and Regional Development. More detail on this process is available at www.infrastructure.gov.au/aviation/airport/Planning/index.aspx

As an airport tenant, Airservices has an interest in the content of master plans as they relate to our own facilities, infrastructure and services provided at an airport. We engage airports early in the drafting stage to provide technical and operational expertise to assist the airport and protect our facilities and operations.

[1] These are: Brisbane, Archerfield, Townsville, Gold Coast, Sydney, Bankstown, Camden, Canberra, Melbourne, Essendon, Moorabbin, Hobart, Launceston, Adelaide, Parafield, Darwin, Alice Springs, Perth and Jandakot. (Mount Isa and Tennant Creek, while federally-leased airports, are not required to prepare a master plan under the Act.)

Australian Noise Exposure Forecast (ANEF)

A master plan must include an Australian Noise Exposure Forecast (ANEF) in the form of an ANEF chart. An ANEF is the forecast of future noise exposure patterns around an airport and constitutes the contours on which land use planning authorities base their controls, as described in Australian Standard *AS2021-2000 Acoustics - Aircraft noise intrusion – Building siting and construction*.

ANEFs are prepared by airports before the draft master plan is published for community consultation and are produced with a forecast of 20 or more years, or the ultimate practical capacity of the airport.

Airservices is responsible for endorsing an airport's ANEF for technical accuracy. This involves checking that:

- modelling inputs include appropriate selection of aircraft types
- modelling inputs include operationally feasible runway use and flight path data
- modelling inputs include operationally feasible aircraft movement forecasts
- contours have been modelled correctly
- that the airport identifies who is responsible for the modelling assumptions
- the airport has paid due regard to all issues raised by state and local government authorities in relation to the ANEF.

Importantly, other than testing that forecast activity is operationally feasible, Airservices makes no assessment of an airport's activity forecasts.

More information about ANEFs is available from the Department of Infrastructure and Regional Development at www.infrastructure.gov.au/aviation/environmental/transparent_noise/expanding/app_a.aspx

Flight path design

Master plans may propose increases in demand or major developments (such as a new runway) at an airport, which would necessitate changes to flight paths. In such cases, the airport is required to map indicative new flight paths where required.

Airservices has responsibility for airspace design and flight paths can only be designed after taking into account wider regional issues close to the time of implementation. For that reason, Airservices carries out detailed flight path design close to the time when changes are actually required – normally around two years prior to operation. As a result during the endorsement process Airservices cannot validate the indicative flight paths used in an ANEF. The endorsement process requires the airport to demonstrate the rigor to which technical input into the design of future flight paths has been applied.

Public Consultation and approval

Airports are required to consult with airport users, state or territory governments, local authorities and the community in developing master plans.

More detail on consultation and approval requirements is available at www.infrastructure.gov.au/aviation/airport/Planning/index.aspx

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13-087 JUNE Corporate Communication

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AIRSERVICES ENVIRONMENTAL ASSESSMENT PROCESS FOR CHANGES TO AIRCRAFT OPERATIONS (EXCLUDING ON-GROUND WORKS)

Airservices Australia's environmental obligations are derived from both the Air Services Act 1995 and Commonwealth environmental legislation.

The Air Services Act states that Airservices must give regard to the safety of air navigation as its most important consideration. Subject to this, Airservices must perform its functions so that as far as practicable, the environment is protected from the effects associated with the operation and use of aircraft.

Airservices obligations under the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 require it to obtain and consider advice from the Commonwealth Environment Minister before authorising the 'adoption or implementation of a plan for aviation airspace management involving aircraft operations that are likely to have a significant impact on the environment'.

This factsheet explains the environmental assessment process that Airservices (and consultants working for Airservices) must apply to meet its environmental obligations for aircraft operations.

National Operating Standard

Airservices operates under a standard process, known as a National Operating Standard (NOS), to undertake all environmental assessments, including those relating to proposed changes to aircraft operations. The NOS applies to all proposed changes to Airservices air traffic management practices, such as:

- a new, or amendment to an existing, instrument approach
- a new, or amendment to an existing, flight path or air route
- a change to preferred runways
- a change in time of day of operations (such as amendments to tower hours of operation – the time of day that a tower operates may alter the flight path used by aircraft).

Neither a decision of an air traffic controller to alter the track of an individual aircraft nor a change in level of use of a flight path constitutes proposals requiring assessment.

The NOS ensures Airservices meets its legislative obligations and helps it identify issues for mitigation and engagement strategies wherever appropriate. In addition, the NOS aligns with the requirements of the Environmental Management Standard (ISO 14001) under which Airservices is certified. The standardised process is set out below.

Initial change screening

An initial screening of a proposal is undertaken early in the planning phase to assess potential environmental risks against criteria relating primarily to aircraft flight patterns (including location, altitude and communities flown over).

If the risk screening finds that under any of the criteria there is a potential risk of increased impact, then further environmental assessment is required, as detailed below.

Environmental assessment planning

Airservices considers the level of environmental risk arising from the proposed change, and then designs the detailed assessment methodology.

Where Airservices considers the risks to be so great that they could not be mitigated, the proposal will be removed from the assessment process and sent back to the proponent for rescoping.

Environmental assessment

This comprises a detailed assessment of risks in the following key areas:

- community noise
- aircraft emissions
- other environmental impacts. This is defined by the EPBC Act as:
  a. ecosystems and their constituent parts including people and communities
  b. natural and physical resources
  c. qualities and characteristics of locations, places and areas
  d. heritage values of places; and
  e. the social, economic and cultural aspects of a thing mentioned in paragraphs a, b or c.

This assessment stage determines whether the change has the potential to cause significant impact to the environment and is undertaken against a suite of metrics (which have been informed by best practice in other noise-generating industries), including:

- number of noise events above 60dB(A) and 70dB(A)
- maximum noise levels
- average noise levels
- estimates of population levels potentially affected by changes in noise levels.

Where Airservices determines that the proposal is unlikely to result in significant impact on the environment, then the proposed change may continue as planned.

In accordance with Section 160 of the EPBC Act, where Airservices determines that the proposal may have a potential significant impact on the environment, the Environment Minister must be informed of the proposal and will then provide advice as to whether formal assessment under the Act is required or if the proposal can proceed as planned (subject to a range of conditions).

Community and stakeholder plan

For proposed changes that could have a negative impact on a community, Airservices will use the information provided by the environmental assessment to develop a plan for engagement with the community and stakeholders. This plan will inform engagement and consultation with the community in line with Airservices published Communication and Consultation protocol. The plan can be updated at any time throughout the process as new information becomes available through further environmental analysis or community feedback.

Further environmental analysis

At any stage, further analysis into specific issues can be undertaken. This may support community or industry engagement or to refine the design of the procedure.

Post implementation review

A post implementation review (PIR) is undertaken for implemented changes. This examines whether predicted and actual outcomes align and will also analyse community responses and/ or complaints. The PIR can recommend redesign to achieve improvements, noting that any such changes would require further environmental assessment.

Useful documents

Air Services Act 1995 - http://www.comlaw.gov.au/Series/C2004A04931

Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 - http://www.comlaw.gov.au/Series/C2004A00485

About the EPBC Act - http://www.environment.gov.au/epbc/about/index.html

Airservices Communication and Consultation Protocol - **http://www.airservicesaustralia.com/publications/corporate-publications/communication-and-consultation-protocol/**

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13-167OCT Corporate Communication

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GROUND RUNNING

Ground running is when an aircraft engine is tested at the airport while the aircraft is stationary on the tarmac.

There are two types of ground running; one is a series of last minutes checks performed by a pilot prior to take-off and the other is to test aircraft engines and diagnose engine problems, allowing engineers to verify that aircraft engines are working properly. Both of these procedures are regulated by the Civil Aviation Safety Authority.

During ground running, engine settings are increased from idle to a higher power in order to simulate what would happen in flight. For safety purposes, engine ground running requires facing the engine into the wind. Therefore, the direction of the aircraft and its engine noise will change with wind direction. Due to airline operating schedules, some ground running takes place at night, although at most airports, engine running locations are situated away from the closest residents to reduce noise impacts.

Management of ground running is the responsibility of the airport as set out in the *Airports (Environmental Protection) Regulations 1997 under 252*. When receiving inquiries or complaints regarding engine running, the Noise Complaints and Information Service (NCIS) will try to link it to a specific aircraft operation and pass this information to the relevant airport to help them manage the issue in accordance with these regulations.

Some airports have developed 'Fly Neighbourly Agreements' with aircraft operators and local councils, which are voluntary codes that include measures to reduce the noise impact of aircraft operations on residential areas near airports. These often include measures to reduce the noise impacts of ground running.

ODOURS

In Australia, aircraft engine emissions are regulated through the *Air Navigation (Aircraft Engine Emissions) Regulations* which are administered by the Department of Infrastructure and Regional Development. These regulations require aircraft operating in Australia to meet emissions standards established through the International Civil Aviation Organization (ICAO).

The *Air Navigation (Fuel Spillage) Regulations 1999* prohibit the intentional or unintentional release of fuel by an aircraft in flight except in emergency of special circumstances. Under these regulations, the operator of an aircraft within the Commonwealth's jurisdiction must ensure that fuel is not released from an aircraft during flight unless it is:

- in an emergency over areas where it does not create a hazard to a person or property on the ground, or
- according to a direction issued by CASA under 150(2)(a) of the *Civil Aviation Regulations 1988*, or
- according to a permission given by a person performing duty in air traffic control.

Unless a fuel odour report from a member of the public can be linked specifically to a particular aircraft operation it is difficult to fully investigate a report. If details are able to be provided, such as identifying aircraft in the vicinity at that time, the circumstances surrounding the fuel odour may be examined in detail by the responsible authority.

FURTHER INFORMATION

- Airservices Australia – www.airservicesaustralia.com/aircraftnoise/frequently-asked-questions/
- Department of Infrastructure and Regional Development – www.infrastructure.gov.au/aviation/airport/planning/aeo_faq.aspx

14-195NOV Corporate Communication

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REDUCING IMPACT OF AIRCRAFT NOISE AT HOME

This fact sheet outlines ways to reduce the intrusion of aircraft noise and other external noise in homes. It also provides guidance on where to find information on sound insulation.

The Australian Standard 2021-2000, shows that aircraft noise intrusion within a building depends on:

- the location, elevation and orientation of the building relative to the aircraft flight paths
- the types, times and frequency of aircraft operating
- meteorological conditions (including wind, cloud cover and temperature)
- the type of layout used in the building
- the construction and ventilation of the building
- the internal acoustic environment.

The major entry points for external noise intrusion in homes are windows, doors, ventilation openings and other cracks and openings.

Effective methods for reducing external noise intrusion in homes include:

- facing windows away from noise sources
- minimising the use of hard exterior surfaces such as paving as this reflects sound rather than absorbs it
- using insulation in the ceiling to close gaps in roof tiles
- using materials such as acoustic insulation for internal and external walls, floors and ceilings
- using double glazing and laminated glass windows
- using screen walls to shield external noise
- using sound absorbing materials such as acoustic tiles, carpet, curtains and noise reduction underlays to help absorb sound and control sound reverberation
- ensuring windows and door seals are properly fitted and fixed
- repairing any gaps or installing new window seals to help noise reduction
- installing air conditioning rather than relying on open windows to help reduce external noise, particularly for rooms used for sleeping
- using external solid core doors with acoustic seals.

For those affected mainly by noise at night, consider using these methods for rooms used for sleeping. This will achieve effective noise reduction without the expense of treating the whole home.

BUILDING CODE OF AUSTRALIA

The Building Code of Australia (BCA) forms volume one and two of the National Construction Code and contains technical provisions for the design and construction of buildings and other structures. More information on the BCA can be found at the following link: http://www.abcb.gov.au/ncc-online/About

ACOUSTIC CONSULTANT

If you are considering sound insulation for your home, it may be useful to contact an acoustic consultant to ensure your proposed changes will provide effective noise reduction. The following link to the Association of Australian Acoustical Consultants (AAAC) website provides more information: www.aaac.org.au

OTHER INFORMATION

To purchase a copy of the Australian Standard, please click on the link to the SAI Global InfoStore: infostore.saiglobal.com/store

The Department of Infrastructure and Regional Development provides a consolidated list of suppliers in Sydney and Adelaide for regular maintenance of noise insulation equipment and fittings, supplied under the Government's Noise Insulation Programs: www.infrastructure.gov.au/aviation/environmental/insulation

The 'Your Home' website details information on noise control: www.yourhome.gov.au/housing/noise-control

Adelaide City Council has produced a Noise Technical Fact Sheet: https://www.cityofadelaide.com.au/city-living/home-property-management/local-nuisance/resources

Perth Airport has an information booklet on its website on reducing the impact of aircraft noise: www.perthairport.com.au/Files/Reducing_Aircraft_Noise_in_Existing_Homes.pdf

15-151AUG Corporate Communication

CONTRAILS, WHAT ARE THEY?

Condensation trails or 'contrails' are line-shaped white cloud streams that are sometimes visible behind jet aircraft, normally when cruising at high altitude.

HOW IS A CONTRAIL FORMED?

Jet aircraft emit a range of gases in flight, including water at hish temperatures, vapour and sulphur particles. At the high altitudes at which jet aircraft cruise (normally above 26 000ft or 8 000m), the air is very cold.

Colder air is less able to hold water vapour. Therefore, if there is a large amount of water vapour in the air (high humidity), it rapidly condenses on sulphur particles that have come out of the aircraft engine, turning into droplets of water. Water vapour emitted by the aircraft engine will also turn into droplets of water in the same way.

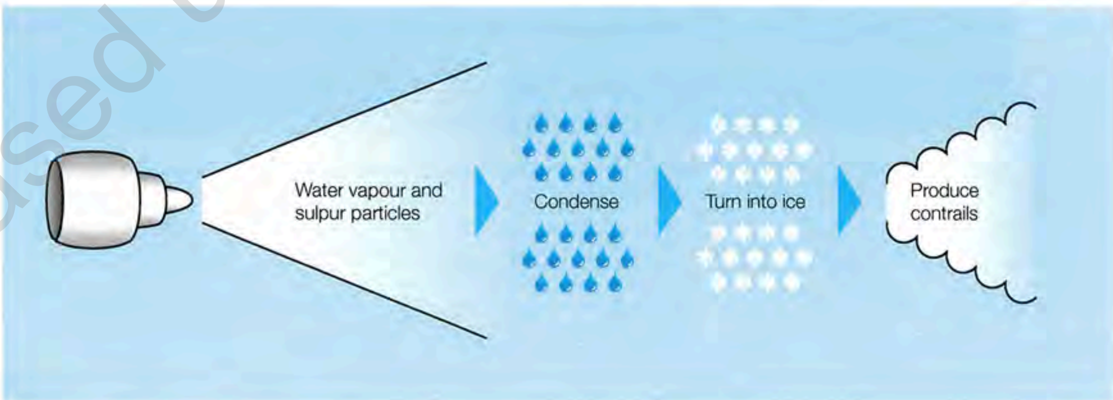
At such high altitudes, where the temperature is far below freezing, the droplets will quickly form ice particles, making up a white contrail. Being made from ice, contrails are harmless to health. Eventually, when conditions become dry enough (lower humidity levels), the ice particles will evaporate, meaning that they do not reach the ground.

WHY WILL A CONTRAIL LAST FOR A PERIOD OF TIME?

The length of a contrail depends on atmospheric conditions. If humidity is low, with little water vapour in the air to turn into ice, the contrail will be short lived. The few ice particles that are formed will quickly evaporate and mix into the surrounding atmosphere.

If, however, the humidity is high, as is often the case in the east and north of Australia, the large amount of water vapour present in the atmosphere will readily condense on the sulphur particles emitted along the track of the jet aircraft.

The newly formed ice particles will grow in size by taking water from the surrounding atmosphere. As a result, these contrails can last for hours, extending long distances behind the aircraft. Air turbulence, caused by winds or by other aircraft, can also cause the contrails to spread out, sometimes reaching several kilometres in width and 200-400 metres in height. This means that they can develop into extensive cirrus clouds that are indistinguishable from naturally occurring clouds.



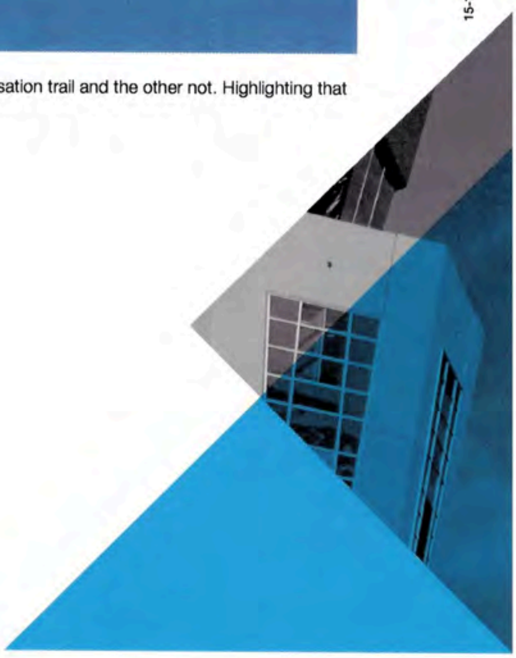
Sometimes a jet aircraft leaving a persistent contrail will appear to be close to another that has no contrail. This is normally because the aircraft are at different altitudes, which cannot be perceived from the ground. The air around the higher aircraft will have greater humidity, because it is colder than the air around the lower aircraft.

CONTRAILS MAY BECOME MORE PREVALENT

As air traffic continues to increase, including in areas of high humidity, it is likely that more persistent contrails will be formed. On the other hand, international regulations already minimise the emissions of impurities from jet engines, so that sulphur makes up less than 0.05% of jet fuel by weight. It is likely that improvements in engine efficiency will reduce this even further, so that in future, there may be fewer particles emitted from jet aircraft that help form the ice that creates contrails.

Above: Figure depicts two aircraft on the same track, at different altitudes, one creating a condensation trail and the other not. Highlighting that the atmospheric conditions create the condensation trail.

15-154AUG Corporate Communication



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HELICOPTER OPERATIONS

Helicopter operations require flexibility, so that sometimes helicopters are required to fly over residential areas that are rarely flown over by other aircraft. This means that noise from helicopters can be particularly noticeable to people who are not accustomed to aircraft noise on a regular basis.

This factsheet explains how helicopters operate and what action can be taken to reduce their noise impact.

At all times, the safe operation of aircraft is the primary concern of air traffic control and pilots.

Helicopters enable services to be provided that are of benefit to communities, including fire fighting, crime prevention, search and rescue, construction and media coverage.

CAUSE OF HELICOPTER NOISE

The main cause of noise from a helicopter is the rotors, especially when a helicopter hovers for a prolonged period over a single location. Most helicopters (those registered since December 1990), are certified to international noise standards which are implemented in Australia through the *Air Navigation (Aircraft Noise) Regulations 2018*.

These noise standards apply to the design and production of aircraft and specify the amount of noise that may be emitted by an aircraft model/ type. The regulations are administered by the Department of Infrastructure and Regional Development.

A small number of helicopters registered continuously before December 1990 do not require a noise assessment as part of their certification process.

FLY NEIGHBOURLY AGREEMENTS

Several airports and airfields have established Fly Neighbourly Advice or Fly Neighbourly Agreements (FNAs). These are established between aircraft operators and communities or authorities (normally airports or local councils) to assist in reducing the impact of aircraft noise on local communities. These agreements have proved effective at raising awareness among operators of noise minimisation practices.

FNAs for helicopter operators will normally include some or all of the techniques in the Helicopter Association International's Fly Neighborly Guide (new.rotor.com/portals/1/Fly%202009.pdf) such as avoiding noise sensitive areas by following unpopulated routes (for example, waterways), or areas with high ambient noise levels such as highways.

HOVERING OVER BUILT-UP AREAS

Wherever possible, helicopter pilots should avoid hovering over populated areas. This includes choosing locations over freeways, commercial areas and industrial precincts. Such advice is often included in FNA agreements.

If a helicopter pilot wants to cross a 'controlled' zone around an airport, it is sometimes necessary for air traffic control to hold the helicopter in one place until it is safe. This is why sometimes helicopters have to hover over locations when there is no obvious reason to do so.

HEIGHT OF HELICOPTER OPERATIONS

At most airports or helipads, standard departure and arrival procedures ensure that as far as possible, helicopters do not fly low over residential areas. Helicopters will be at lower levels when in process of take-off and landing, but once in flight, they should not fly over populated areas below 1000 feet (ft).

Helicopters may fly below these levels within specified areas, though most helicopters are forbidden from flying at less than 500ft (152m) above the ground, unless during take-off or landing. This helps to reduce their noise impact.

Occasionally, helicopters need to fly at lower levels. This could be, for example, for law enforcement, search and rescue, surveying or construction purposes.

If a helicopter operator needs to fly below 500ft for private operations or aerial work operations, authorisation is required from the Civil Aviation Safety Authority (CASA).

In addition, helicopters that are being used in response to an emergency are permitted to operate outside normal procedures, should the circumstances demand.

HELICOPTER TRAINING

Pilots are required to undertake set procedures when training to ensure that they have all the necessary skills to fly safely. When conducted in the vicinity of a helipad, this process is called circuit training.

Level flight circuit training (ie. not take off or landing) for helicopters cannot take place less than 500 ft (152 m) above the ground. Additionally, operators and training organisations will limit the number of circuits, hours, and the number of aircraft permitted to fly over residential areas to help reduce the impact of helicopter noise.

LANDING SITES

Helicopter landing sites (HLSs) are subject to land use planning and development approval processes. State governments are responsible for policies relating to the siting of HLSs and local governments generally approve or decline planning applications.

CASA has published Guidelines for the Establishment and Use of HLSs, which take into account noise considerations, to assist planning authorities, available at https://www.casa.gov.au/files/922pdf

WEBTRAK

Historical and near real-time noise data for eight Australian airports is displayed by Airsevices WebTrak

service, available at www.airservicesaustralia.com/aircraftnoise/webtrak

WebTrak provides information about where and how high aircraft — including helicopters — fly over metropolitan areas.

MORE INFORMATION

The Civil Aviation Safety Authority - www.casa.gov.au

Department of Infrastructure and Regional Development - www.infrastructure.gov.au

International Civil Aviation Organization - www.icao.int

Helicopter Association International - www.rotor.com

15-155AUG Corporate Communication

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CIRCUIT TRAINING

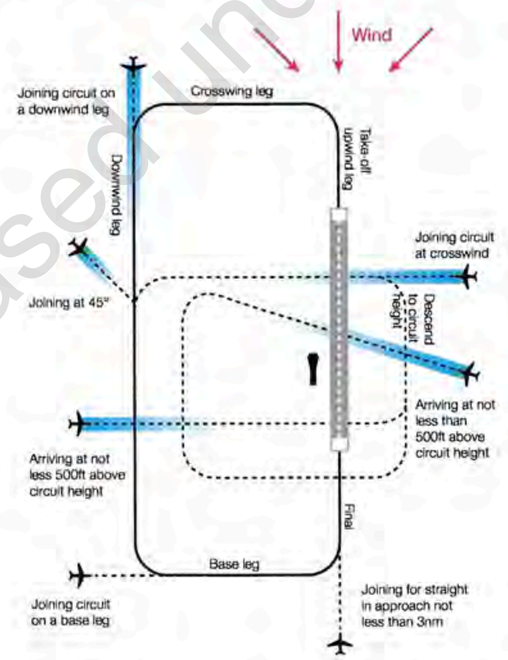
Circuit training is the first stage of practical pilot training focused on take-offs and landings. It involves the pilot making approaches to the runway, touching down and then applying power to take off again.

This is undertaken in accordance with Civil Aviation Safety Authority (CASA) Regulations which are consistent with international practices.

Circuit training is undertaken at most airports, particularly regional and general aviation aerodromes. Each airport makes its own determination about the hours of the day or days of the week that training may be undertaken. This is based on factors including pilot demand, the number and time of other regular flights into and out of the aerodrome, runway capacity and configuration, availability of air traffic control services and the type of navigational equipment available at the aerodrome.

Training during both day and night is important for developing pilot competencies, as is experience with using different types of navigational aids.

Figure 1 Left hand training circuit.



As different aerodromes offer different facilities, the numbers and timing of circuit training flights varies between locations.

A training circuit consists of five legs – the take-off, crosswind, downwind, base and final approach to the runway. A simplified representation is shown in Figure 1. The take off and final stage of the circuit is flown into the wind, as this is the safest way for an aircraft to operate. The direction of the training circuit depends on local terrain and the position of the runway(s) at the airport. The aircraft symbols and dotted lines shown in Figure 1 indicate recommended ways for an aircraft to join the circuit pattern.

LEFT HAND CIRCUITS

Figure 1 depicts a left hand circuit with the aircraft turning left after take-off and flying anticlockwise. This is the most common type of circuit operation.

RIGHT HAND CIRCUITS

Where a right hand circuit is used, a pilot turns right after take-off for a clockwise circuit. This may occur because of high terrain restricting circuit operations to one side of the runway, regardless of the wind direction. Another example of the use of a right hand circuit is an airport which has parallel runways, such as Bankstown, Parafield or Moorabbin. During times when air traffic control services are provided, circuit operations can be conducted off both parallel runways at the same time. This means both left and right hand circuits may be flown concurrently.

TRAINING AIRCRAFT

There are three categories of training aircraft based on the aircraft's speed as shown in Table 1. Each category has a different downwind height requirement measured above the ground level at the airport. This helps separate aircraft that perform differently. Higher performance aircraft fly larger and longer circuits at higher altitude than lower performance aircraft.

AIRCRAFT JOINING AND DEPARTING A CIRCUIT

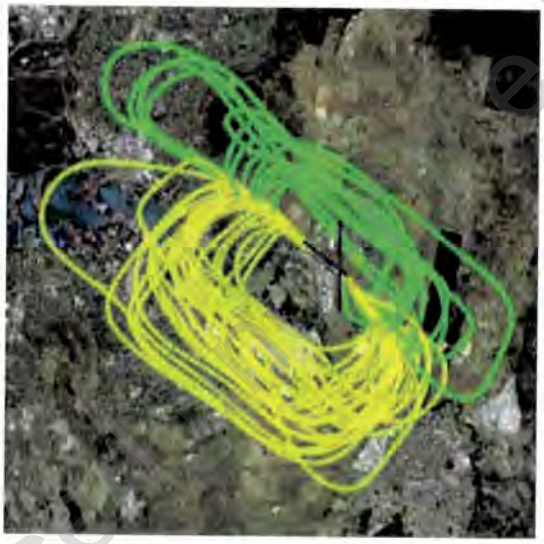
At airports without a control tower, CASA regulations specify how an aircraft should join a circuit when approaching the airport from outside its local area. This is done by flying over the runway at least 500ft above the high performance circuit or by joining the circuit at the beginning, end, or partway along (at a 45o angle to) the downwind leg. If the circuit is clear, an arriving aircraft can join the final approach from three nautical miles (5.6km) out.

At locations with an air traffic control tower pilots must follow the instructions of air traffic control regarding the height they fly and how they may join or depart the circuit.

Arrival paths in the circuit have been designed to give pilots the best visibility of other aircraft in the circuit or approaching the airport from outside the circuit. The approach paths are shown as dotted lines in Figure 1.

Aircraft can depart from the circuit by extending one of the four legs and are only allowed to turn away from the extended leg when well clear of the circuit.

Figure 2 Typical variations in circuit pattern. The yellow circuit depicts circuits when the wind is blowing from the north, whereas the green circuit depicts circuits when the wind is from the south.



Aircraft doing circuit training at airports without a control tower should give way to commercial aircraft, such as regular passenger aircraft. In this case the training aircraft will extend one of the circuit legs to allow the commercial aircraft to land.

AIRCRAFT NOISE IMPACTS

All aircraft operating in Australia, including training aircraft, must meet international noise standards.

There are no regulated hours for circuit training, but most airports have their own limitations which prohibit circuits during the late night to early morning, typically 10pm to 7am. Many airports publish this information on their website.

The circuit length, and therefore the area overflown, depends on how quickly the aircraft can climb to the required height for the downwind leg as outlined in Table 1. This length varies between aircraft and is affected by meteorological conditions (including wind, cloud cover, and temperature), other aircraft in the circuit, air traffic control requirements and pilot proficiency.

The size and location of the circuit is controlled to ensure the safety of all aircraft operations at the airport. This may result in training being undertaken over populated areas, especially where these are in close proximity to the aerodrome.

For example, variations for circuit patterns are shown in Figure 2. These circuit maps were collected at an airport over a 25 day period.

FURTHER INFORMATION

Further information is available from:

- Civil Aviation Safety Authority website
  www.casa.gov.au
- Airservices website
  www.airservicesaustralia.com/aircraftnoise/aircraft-operations/circuit-training
- Department of Infrastructure and Regional Development website
  www.infrastructure.gov.au/aviation/general

Table 1 Circuit height for three categories of training aircraft. *Height is measured above the airport level.

Type of aircraft	Standard circuit speed range	Standard circuit height* (downwind leg)
High performance (including jets and many turboprops)	150-200kts (280-320 km/hr)	1500ft (450m)
Medium performance	55-150kts (100-280km/hr)	1000ft (300m)
Low performance (including helicopters)	Less than 55kts (100km/h)	500ft (150m)

16-086JUNE Corporate Communication

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AUSTRALIA'S AIRCRAFT NAVIGATION MODERNISATION PROGRAM

With the rapid growth in air traffic and a resulting need to ensure our airspace is managed as safely and efficiently as possible, Australia is at the forefront of a navigation modernisation effort to transition pilots from using ground-based navigation aids to satellites as their primary means of navigation.

Mandated by the Civil Aviation Safety Authority (CASA) since 4 February 2016, all aircraft operating under Instrument Flight Rules (IFR) are required to navigate primarily using satellite-based means within Australian airspace.

In accordance with the CASA mandate, Airservices is redesigning some of its landing approaches at every airport around the country to ensure we continue to have the safest and most efficient air traffic management system possible, meeting the expectations of airspace users and the travelling public into the future.

As part of this transition, nearly half of the 400 ground-based navigation aids will be decommissioned over time with the remaining to operate as a back-up network to the satellite navigation system.

Types of ground-based navigation aids include Non-Directional Beacon (NDB), a radio transmitter that sends a low frequency signal containing no inherent directional information; VHF (Very High Frequency) Omni-Directional Range (VOR) that sends short-range radio signals enabling an aircraft to locate its position and stay on course between airfields; and Instrument Landing System (ILS), a highly accurate navigation aid used when landing at an airport in poor weather or low visibility.

Airservices current air traffic management system relies on ground-based navigation aids. This restricts aircraft to flying direct paths over ground-based radio beacons and has shaped the way we manage air traffic. Inefficiencies stemming from this create unnecessary fuel consumption, excess carbon emissions, longer flight time and increased noise impact.

In the last decade, a range of new satellite-based navigation systems have been introduced making air travel safer, cleaner and more dependable. These new systems require little or no ground infrastructure. The type of navigation technology and the level of sophistication used by airlines and commercial operators varies greatly.

ON APPROACH

On average, commercial aircraft spend just four percent of their total flying time in the final approach and landing phases of flight (last 18 km before landing).

Landing is the most challenging phase of flight for pilots as they descend to a runway. Automated flight management systems in conjunction with high-precision navigation technology help to reduce pilot workload greatly and increase safety.

Airports have a range of navigation systems in place for pilots to use, with larger airports generally having more systems available. These systems can be a mix of both ground-based and satellite-based technology. Some navigation systems with a lower level of lateral and vertical accuracy can use the same flight path corridor, while others systems with higher precision are more likely to have their own flight path corridor which is sometimes affords shorter approach paths.

The type of navigation system used by an aircraft when landing will depend on variables such as the level of visibility, weather conditions, aircraft avionics fitment, crew training, airline operating procedures and civil aviation regulations, which can have different requirements for domestic and international flights. Some airline operating procedures have links to insurance requiring their pilots to use the highest form of navigation technology available regardless of circumstances.

Decisions on which landing technology and flight path an aircraft will use are made by pilots and air traffic control around 30 minutes before landing. This assists air traffic controllers with sequencing aircraft for landing with other aircraft taking off from an airport. The decision may change as the aircraft gets closer to landing due to a range of influences.

For all pilots, civil aviation regulations require the runway to be clearly visible at a specified altitude and distance from the runway prior to landing. This requirement is known as the 'minima'. At the minima, should a pilot not be able to see the runway, then the approach will be aborted and reattempted. The altitude and minimum distance of the minima varies between airports and within the same flight path corridor depending on the precision of the navigation technology.

PERFORMANCE BASED NAVIGATION

In recognition of the need to manage the projected global growth in air transport capacity, the International Civil Aviation Organisation (ICAO) has established a series of objectives to increase the capacity and efficiency of air navigation. While interdependent with safety, this objective is focussed primarily on transitioning to Performance-Based Navigation (PBN) systems.

PBN describes the broad range of navigation technologies that uses satellite. Each type of PBN technology has prescribed performance requirements to guide an aircraft flying with its autopilot on within a set tolerance of lateral and vertical accuracy.

HORIZONTAL AND VERTICAL GUIDANCE

All forms of landing navigation technology are used by pilots for horizontal and vertical guidance to the runway. Ground-based systems have a lower level of precision and are unable to be used in automated landings and also have higher minimas. Satellite-based navigation systems have much greater precision and are able to be automated and have much lower minimas.

SATELLITE-BASED NAVIGATION

CASA has determined that all methods of satellite-based navigation would be formally known in Australia as being a form of Required Navigation Performance, with each technology having its own prescribed performance requirements and specification.

There have been two broad forms of satellite-based navigation used by aircraft for landing: Required Navigation (RNAV), which provides horizontal guidance only, Required Navigation Performance - Authorisation Required (RNP-AR), known in Australia as 'Smart Tracking', which provides both horizontal and vertical guidance.

A new navigation system called Barometric Vertical Navigation (BARO VNAV) has recently been developed to assist pilots when landing. BARO VNAV uses satellite signals to position an aircraft horizontally and barometric pressure to control the vertical descent to the runway.

According to recent ICAO and CASA requirements, the last few nautical miles of all final approaches to runways, including satellite-based approaches, must be in a straight line with the runway to ensure the highest level of safety is achieved. ICAO data shows that straight-in approaches to airports are 25 times safer than a circling approach, and that adding vertical guidance is a further eight times safer than an approach without.

In some instances, this will cause a change to the flight path corridor where current RNAV and ground-based approaches, that need to be replaced, are offset and not aligned with the runway. Exceptions can be made where terrain or other obstacles need to be avoided, however CASA have specifically ruled out continuing to use an existing or establishing a new approach flight path that is offset as a noise abatement measure.

At present, the only navigation technology that is not required to have a long runway aligned final approach is Smart Tracking. Unlike other technologies, satellite signals are continuously received by the equipment in the cockpit which enables aircraft to fly a curved flight path on autopilot with high precision in close proximity to the runway.

MORE INFORMATION

More information is available at www.airservicesaustralia.com/projects/aircraft-navigation-modernisation-program or by contacting the Noise Complaints and Information Service on 1800 802 584 (freecall).

NAVIGATION TECHNOLOGY COMPARISON

Ground-based

Without vertical guidance

Non-Directional Beacon (NDB)

- Low frequency radio signal transmission.
- Provides limited situational awareness information.
- Used enroute between airports and to mark the location of an airport.
- High minima altitude.

VHF Omnidirectional Range (VOR)

- Very high frequency radio signal transmission.
- Includes distance and weather information.
- Improved situational awareness than NDB for pilots.
- Used enroute between airports and to mark the location of an airport.
- High minima altitude but lower than NDB.

With vertical guidance

Instrument Landing System (ILS)

- Two antennas transmit signals to receivers in the aircraft cockpit, one for horizontal guidance and the other for vertical guidance.
- Must be runway aligned for 10 nautical miles.
- Low minima altitude – similar to Smart Tracking.

Satellite-based

Without vertical guidance

RNAV

- A basic form of satellite-based navigation in which equipment on board the aircraft calculates and follows a direct navigation path between two points.
- No reliance on ground-based navigation aids.
- No vertical guidance is provided.
- Medium minima altitude – lower than VOR.

With vertical guidance

BARO VNAV

- Satellite signals to position the aircraft laterally and changing barometric pressure to control descent to the runway.
- Not as accurate to the runway as ILS.
- Medium minima altitude – lower than RNAV.

Smart Tracking

- The most advanced form of satellite-assisted navigation. Aircraft track with high accuracy and are able to follow curved flight paths when close to landing - important when designing routes in congested airspace, around noise-sensitive areas or through geographically challenging terrain.
- Low minima altitude – similar to ILS.

16-087 JUNE Corporate Communication

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GOLD COAST AIRPORT AIRCRAFT NAVIGATION MODERNISATION PROGRAM

Airservices has embarked on a nation-wide program to assist aircraft navigation using satellite-assisted means when flying in Australian airspace. Landing procedures are being updated at over 50 airports across the country by 2018.

To maximise the benefits of satellite-based navigation systems, a series of changes are scheduled to occur at Gold Coast Airport to 2018 in the following broad groupings.

LINKS BETWEEN FLIGHT PATHS TO AND FROM THE NORTH AND EAST

The majority of commercial aircraft operating at Gold Coast Airport are travelling to and from destinations to the south. For this reason, the flight path network comprising of arrival and departure procedures are well established.

This is not the same for aircraft arriving to and from the north and east where there are 'gaps' between procedures off the coast. Aircraft are manually guided between these procedures by air traffic control which is an acceptable safe practice when traffic levels are low.

The ongoing growth in air traffic to and from the north and east now requires these flight paths to be linked up in order to ensure the highest levels of safety are maintained. Once this has occurred, pilots will be able to fly close to landing at the airport on autopilot without requiring the navigation assistance of air traffic control as currently occurs for aircraft travelling to and from the south.

Any change to flight paths will occur off the coast and are not likely to be noticeable from land.

SATELLITE-BASED PROCEDURES AS THE PRIMARY MEANS OF NAVIGATION FOR THE MAJORITY OF FLIGHTS

There have been two broad forms of satellite-based navigation used by aircraft for landing: Required Navigation (RNAV), which provides horizontal guidance only, Required Navigation Performance - Authorisation Required (RNP-AR), known in Australia as 'Smart Tracking', which provides both horizontal and vertical guidance.

A new navigation system called Barometric Vertical Navigation (BARO VNAV) has recently been developed to assist pilots when landing. BARO VNAV uses

satellite signals to position an aircraft horizontally and barometric pressure to control the vertical descent to the runway.

A Smart Tracking procedure will be established at the southern end of the airport which will be available for use by all suitably equipped aircraft. This will replace the existing Smart Tracking proprietary procedure which limits use to specified airlines and aircraft types. The Smart Tracking flight path will remain in its current location, offset to the east of the extended runway centreline.

For aircraft landing to the southern runway end, a BARO VNAV procedure will be established within the runway-aligned existing flight path corridor.

At the northern end of the runway, the existing offset RNAV procedure will be replaced with one that is more runway aligned. The portion of the flight path over water closest to the coastline and then over land will be within an existing flight path corridor.

The Non-Directional Beacon (NDB) and VHF Omni-Directional Range (VOR) procedures involve tracking towards the ground-based navigation aids which are adjacent to, rather than in line with the runway. As the positions of the NDB and VOR on the ground are some 400 metres to the west of the runway, it is not possible for their new flight paths to be fully runway aligned.

For this reason the new NDB/VOR flight paths will be five degrees to the east of runway alignment – currently 11 degrees east of centre to the north and nine degrees east of centre to the south).

FINALISE CONSULTATION FOR THE INSTRUMENT LANDING SYSTEM

The Instrument Landing System (ILS) proposal received Australian Government approval in January 2016. It is anticipated the system and its new flight path will be available for use by mid to late-2017.

In the three months prior to the system becoming operational, Airservices and Gold Coast Airport will provide follow-up information to remind the community about the purpose of the system, its expected level of use and the anticipated noise impacts of aircraft using this flight path.

REVISED NOISE ABATEMENT PROCEDURES

Noise abatement procedures are guidelines which aim to reduce the impact of aircraft noise on the community. They generally include procedures for preferred runway use and flight paths to reduce flights over residential areas.

Working with Gold Coast Airport, respective airlines and the community Airservices intends to revise the airport's noise abatement procedures to create a baseline of expectation for aircraft to use alternate landing technology to the ILS and instead to use satellite-based landing systems whenever possible as being preferred over ground-based navigation systems.

Finalising a draft change to the noise abatement procedures requires input from air traffic control to ensure the proposed wording is safe and practicable. The timing of any community discussion is yet to be determined.

COMMUNITY CONSULTATION

Airservices will present the Aircraft Navigation Modernisation Program for Gold Coast Airport to the community from June 2016 in conjunction with the airport's established community forums (Community Aviation Consultation Group and Aircraft Noise Abatement Consultative Committee) and its proposed Draft 2017-2021 Master Plan consultation.

Airservices messaging will emphasise the introduction of new navigation technology Australia-wide is non-discretionary and aimed to ensure the highest levels of safety assurance is achieved in accordance with ICAO and CASA requirements.

For Gold Coast Airport, the community will be kept updated with the program's key elements as they are progressively rolled out through to the end of 2017.

MORE INFORMATION

More information is available at www.airservicesaustralia.com/projects/aircraft-navigation-modernisation-program or by contacting the Noise Complaints and Information Service on 1800 802 584 (freecall).

SUMMARY OF INITIATIVES

North Landing Runway 14 – Departing Runway 32		
Replace existing RNAV with runway aligned RNAV	• CASA and ICAO requirement for increased runway alignment • Most of the existing and proposed flight path will remain over water • Aircraft currently intercept this approach off the coast near Surfers Paradise, crossing the coast between Burleigh Heads and Currumbin Creek meaning aircraft are not runway aligned until between Currumbin and Tugun • The new RNAV will have the over-water segment a further distance from the coast and be runway aligned from a point to the south of Burleigh Heads • Aircraft noise is expected to fall within the existing flight path corridor	August 2016
NDB/VOR straightened (5 degree offset)	• CASA and ICAO requirement for increased runway alignment • Aircraft currently break off the heading of 150 degrees when they become visual (before 700ft), then align visually with the runway - crossing the coast between Burleigh Heads and Currumbin and generally becoming aligned with the runway at a point between Currumbin and Tugun • New flight path will have five degree offset, reduced from 16 degrees • Aircraft noise is expected to fall within the existing flight path corridor for aircraft arriving north of the airport • This procedure is currently used very infrequently • Future use is expected to reduce to a maximum of nine flights in a full day, this runway is used for arrivals due to the increased availability of satellite-based procedures	August 2016
Instrument Landing System	• Received Australian Government approval in January 2016 • Aircraft will join the flight path at approximately Surfers Paradise • Will mostly be used in low visibility conditions • Increased noise impacts from Mermaid Waters to Burleigh Heads • Extensive community consultation occurred April-July 2015 • Follow-up community consultation will occur in the three months before the system becomes operational	Mid 2017
Standard Arrival Routes (STAR) from north Standard Arrival Routes (STAR) from east (NZ) Standard Instrument Departures (SID) to north	• Will join existing flight paths close to the airport • Reduced pilot and ATC workload – safety improvement • Provides for autopilot-managed tracking • All change is over water	Late 2017

South Landing Runway 32		
NDB/VOR straightened	▪ CASA and ICAO requirement for increased runway alignment ▪ Aircraft currently break off the heading of 310 degrees when they become visual, then track visually to align with the runway at a point generally between Chinderah and Terranora Creek ▪ New flight path will have five degree offset, reduced from 9 degrees ▪ Aircraft noise is expected to fall within the existing flight path corridor for aircraft arriving south of the airport ▪ This procedure is currently used very infrequently ▪ Future use expected to reduce to two flights in a full day this runway is used for arrivals due to the increased availability of satellite-based procedures	August 2016
Replace existing RNAV with BARO VNAV	▪ Provides vertical guidance for aircraft not equipped for Smart Tracking ▪ Will use same runway aligned flight path as the existing RNAV procedure ▪ Not expected to be any change in noise impact	Mid to late 2017
New Smart Tracking flight path for aircraft arriving from the north and east	▪ Existing Smart Tracking proprietary procedure is offset from the runway by nine degrees to the east of the runway centreline, forming a flight path corridor with the existing NDB/VOR procedure ▪ The new Smart Tracking procedure will be available for use by all suitably equipped aircraft and will replicate the location of the current proprietary procedure (remain offset by nine degrees) ▪ Providing for increased use of this technology ▪ Expected to reduce the number of aircraft using the straight-in arrival flight path, especially during low visibility conditions	Mid to late 2017
Standard Arrival Routes (STAR) from north Standard Arrival Routes (STAR) from east (NZ)	▪ Will join existing flight paths close to the airport ▪ Reduced pilot and ATC workload – safety improvement ▪ Provides for autopilot-managed tracking ▪ All change is over water	Late 2017
Other		
Update Noise Abatement Procedures	▪ Options to be considered by industry and the community are expected to be available by late 2016	Mid 2017

TIMELINE

June 2016

- Aircraft Navigation Modernisation Program for Gold Coast Airport presented to the community

August 2016

- Runway 14 - Replace existing RNAV with runway aligned RNAV
- Runway 14 - NDB/VOR straightened to five degree offset
- Runway 32 - NDB/VOR straightened to five degree offset

Mid 2017

- Update Noise Abatement Procedures

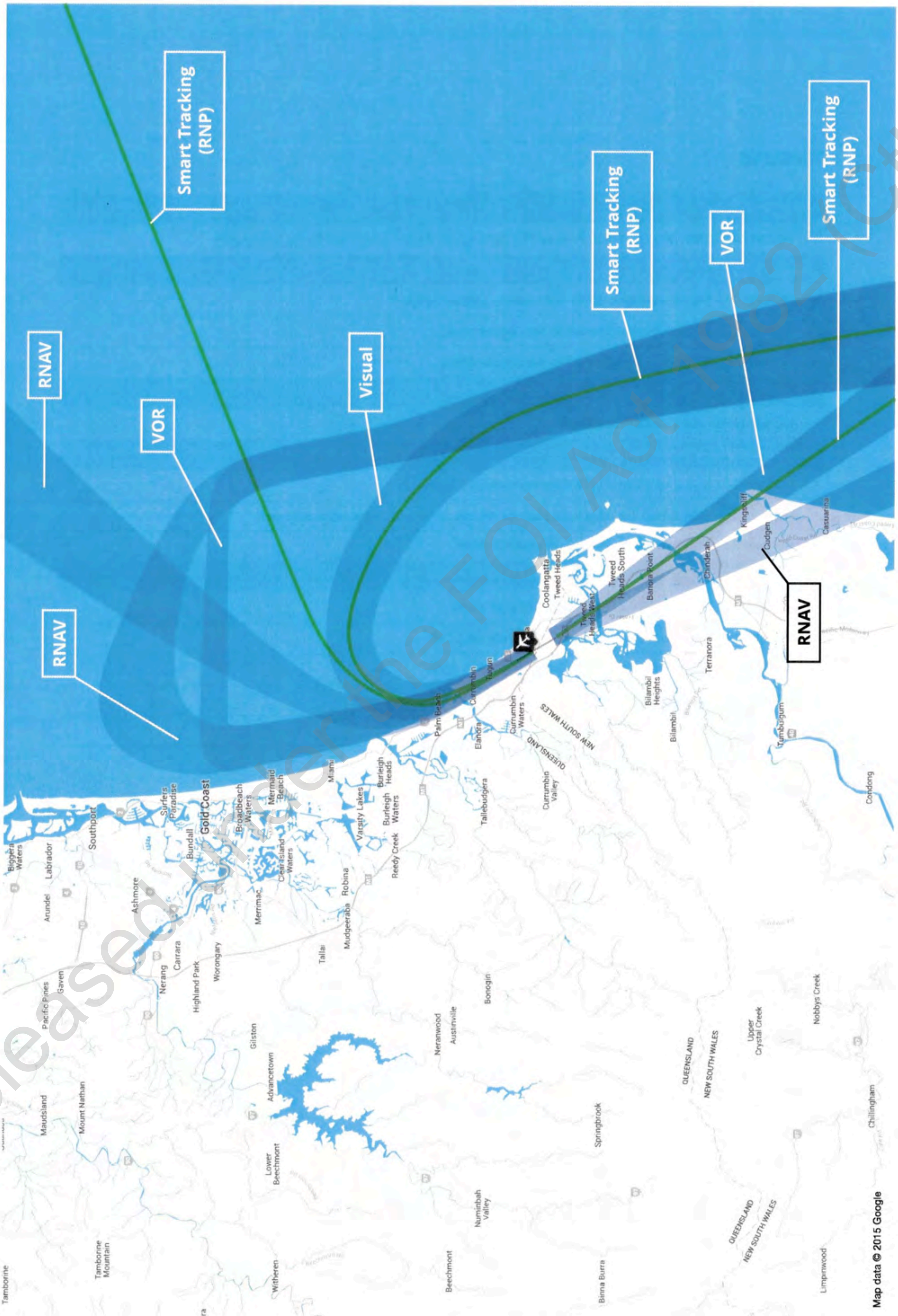
Mid to late 2017

- Runway 14 - Instrument Landing System commences operation
- Runway 32 - New Smart Tracking flight path for aircraft arriving from the north and east.
- Runway 32 – Replace existing RNAV with BARO VNAV

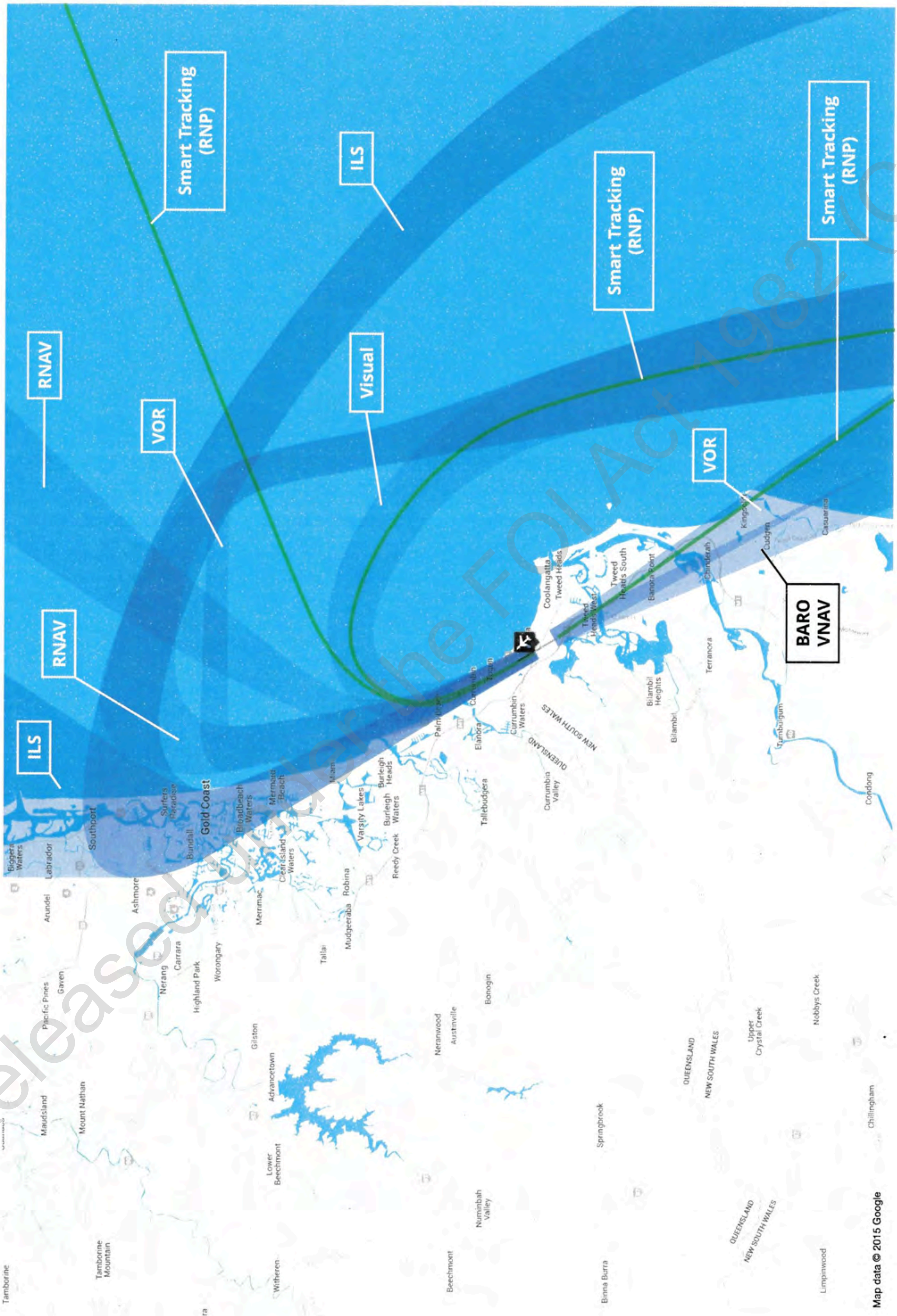
Late 2017

- Runway 14 - Standard Arrival Routes (STAR) from north
- Runway 14 - Standard Arrival Routes (STAR) from east (NZ)
- Runway 14 - Standard Instrument Departures (SID) to north
- Runway 32 - Standard Arrival Routes (STAR) from north
- Runway 32 - Standard Arrival Routes (STAR) from east (NZ)

Current flight paths



Future flight paths



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Changing runways at Sydney Airport to share the noise

connecting australian aviation

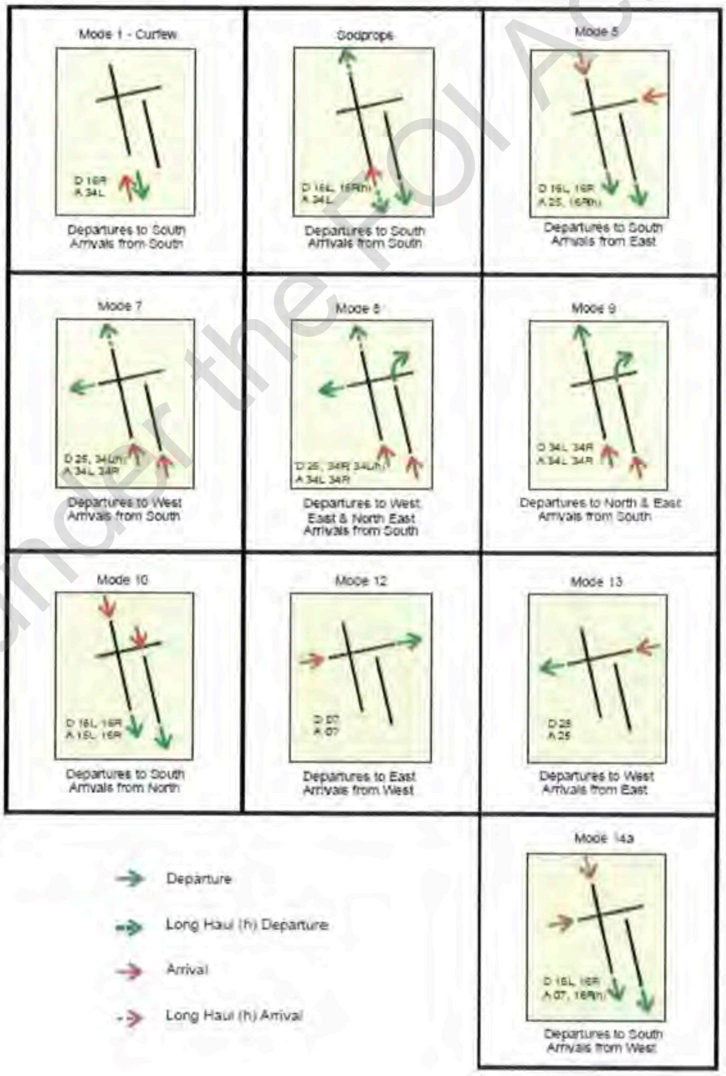
The purpose of this document is to show the variables and challenges that Sydney air traffic controllers face when deciding to use different runway modes. In summary, decisions on runway selection are based on safety, traffic management and weather. After these factors are taken into account, opportunities for noise sharing are considered and implemented when practical.

1.1 Background

The Long Term Operating Plan (LTOP) for Sydney Airport aims to minimise aircraft noise impacts on residents by ensuring aircraft arrive and depart over water and non-residential areas as much as possible. When this is not possible the objective is to provide breaks in the traffic (often called periods of respite) to communities by changing runways to share the noise.

LTOP provides 10 ways of operating the airport's three runways (as shown below). These options are referred to as modes. The LTOP modes are designed to provide a range of options to meet traffic demands, weather conditions and, as much as possible, for noise sharing.

Runway Modes of Operation



In deciding which mode to use, the safe operation of aircraft must not be compromised. Air Traffic Control (ATC) must meet all regulations and conditions set by the Civil Aviation Safety Authority (CASA) in accordance with international regulations. The main influence on aircraft operations is weather, especially wind direction, speed, and the presence and height of cloud.

Often during the day there are a number of activities that limit the opportunities to share noise even when the weather may allow it. These include aircraft traffic congestion, runway maintenance or works, maintenance of navigation aids and flight testing.

The runway modes also affect the amount of traffic that can be handled. In particular, the so-called 'noise sharing' modes which make use of the crossing runway will limit the number of aircraft movements due to the crossing of traffic or the use of a single runway.

Even if the weather is suitable, the amount of traffic or other factors may prevent or delay the use of a noise sharing mode.

1.1.1 A typical day of noise sharing

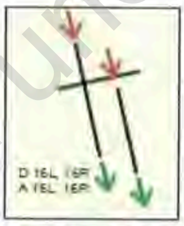
Table 1 below shows what happened on a particular day in June 2014, and is indicative of a "*typical day*".

After the end of the curfew at 6 am the airport continued operations with **Mode 7** (departures to the west and north and arrivals from the south). While **SODPROPS** is the most preferred noise sharing mode it was not able to be used due to there being too much downwind on Runway 16 (wind in the same direction as aircraft heading).

The airport then changed to **Mode 9** at 7:45 am. **Modes 9** and **10** are peak capacity modes with **Mode 9** being selected because of the wind direction. **Mode 9** was used until the peak period passed and then **Mode 13** was used to share the noise from 1:45pm until 4:00pm. This provided some respite for residents to the north of the airport, although a few of the large international flights still required the longer north-south runway.

At 4 pm the amount of traffic had increased and the wind was now from the south. Given the change in wind direction and the need for a mode with high capacity, **Mode 10** was selected. The peak traffic period continued until 8:30 pm when **Mode 5** was selected, and remained in place until the commencement of the curfew at 11 pm.

Table 1—Typical winter day of noise sharing

TIME	MODE	REASON
6.00 – 7.45	Mode 7  Departures to West Arrivals from South	The morning started cool and clear with a 20kph north-westerly wind. The wind presented too much downwind on Runway 16 to be able to use "SODPROPS" therefore **Mode 7** was chosen. This mode provides respite for the areas north-east and east of the airport while optimising capacity for arriving traffic.
7.45 – 13.45	Mode 9  Departures to North & East Arrivals from South	As the traffic congestion built up the ground traffic complexity increased (especially repositioning aircraft to and from terminals and maintenance areas). The use of the cross runway, (25) would only add to this complexity and result in delays. Therefore a parallel runway mode (**Mode 9**), was selected. As the wind continued from the north-west, ATC was unable to use **Mode 10**.
13.45 – 16.00	Mode 13  Departures to West Arrivals from East	The peak traffic period had passed and the wind direction and speed allowed a noise sharing mode to be selected. As the wind was now blowing from the west **Mode 13** was implemented (runway 25 for both arrivals and departures). Crosswind on both the parallel runways left this as the best possible option for ATC even though it has a limited capacity to manage traffic efficiently.
16.00 – 20.00	Mode 10  Departures to South Arrivals from North	**Mode 10** was implemented as the wind eased and swung to the south. The backlog of traffic and ground traffic complexity issues precluded the use of any other mode as ATC needed to effectively process traffic through the evening peak.
20.00 – 22.30	Mode 5  Departures to South Arrivals from East	Air Traffic Control decided that **Mode 5** could be effectively implemented until 10:30pm. After this time, the reduced traffic allowed the use of the curfew runway mode. Mode 5 was considered the most effective given the scheduled traffic, forecast weather conditions and noise sharing considerations. **Mode 5** provides noise respite for residents south, south-west, west and north-west. It also directs all departing aircraft (which are generally noisier than the arrivals) over Botany Bay.

TIME	MODE	REASON
22.30 – 23.00	Mode 1 - Curfew  Departures to South Arrivals from South	**Mode 1** (curfew operations) was implemented shortly after 10:30pm as the volume of arrivals decreased. Even though the curfew had not commenced, this mode was selected as it directs all arrivals and departures over the bay, away from the majority of Sydney residents.

1.1.2 A 'not-so-typical' day of noise sharing

No two days at Sydney Airport are the same. Sometimes, even when the weather might be the same as it was the day before, the runway modes used are different due to changed traffic conditions. Table 2 is another day in June 2014 but it is not a typical day for noise sharing.

At 6 am, due to strong northerly winds, a noise sharing mode could not be used, so **Mode 9** was chosen.

After the peak traffic period was over and the wind had swung around to a southerly, **Mode 10** was used. Unfortunately, as there was a flight testing aircraft scheduled to operate for the afternoon, a better noise sharing mode was not available. It was, however, possible to use a noise sharing mode after the testing and afternoon/evening peak had finished, even though there was bad weather at the time.

Flight testing is required at various times throughout the year to calibrate the navigation aids at the airport. This requires the use of a specially equipped aircraft to fly a series of approaches (often without landing) to ensure the navigation aids are working in accordance with regulated parameters. Without regular testing the equipment cannot be used, and this is why the aircraft needs to be afforded a degree of priority to complete their tasking. The aircraft, and crews, are programmed to conduct testing throughout Australia well in advance, which limits the flexibility for rescheduling. In these situations, air traffic controllers need to use a runway mode compatible with the flight testing aircraft's operations.

Table 2—A 'not-so-typical' winter day of noise sharing

TIME	MODE	REASON
5.15 – 12.45	Mode 9  Departures to North & East Arrivals from South	Early in the morning, before the curfew had finished, the downwind for Runway 16 was too strong to use Mode 1 or SODPROPS. Air Traffic Control could not use **Mode 7** due to the number of aircraft needing to be towed to and from the maintenance hangers or stand-off parking areas, which causes ground complexity when Mode 7 is in use. As the wind was from the north-west, **Mode 9** was used to avoid arriving aircraft experiencing long holding delays in the air.
12.45 – 20.00	Mode 10  Departures to South Arrivals from North	After the morning peak the wind was now from the south and the decision was made not to implement any noise sharing modes due to critical navigation aid flight testing on Runway 16. Unfortunately, the testing could not be rescheduled. The flight testing was completed at 2.00 pm, however the flight schedules showed that by 2.30 pm it would again be too busy for a noise sharing mode. Changing from one mode to another can take up to an hour as flights are programmed for a particular runway well before landing and takeoff. Because of this, Air Traffic Control had to continue to use **Mode 10**. After the afternoon peak wind was tending from the south-west and there was cloud and heavy showers forecast. This meant that **Mode 5** was the preferred noise sharing mode. However, this could not be implemented immediately due to the high levels of aircraft taxiing around the airport prior to departure or after arrival.
20.00 – 23.00	Mode 5  Departures to South Arrivals from East	Once the traffic on the ground reduced, **Mode 5** was used. The volume of arriving and departing aircraft was reduced due to heavy showers. At 11 pm, when the curfew began, **Mode 1** was used.

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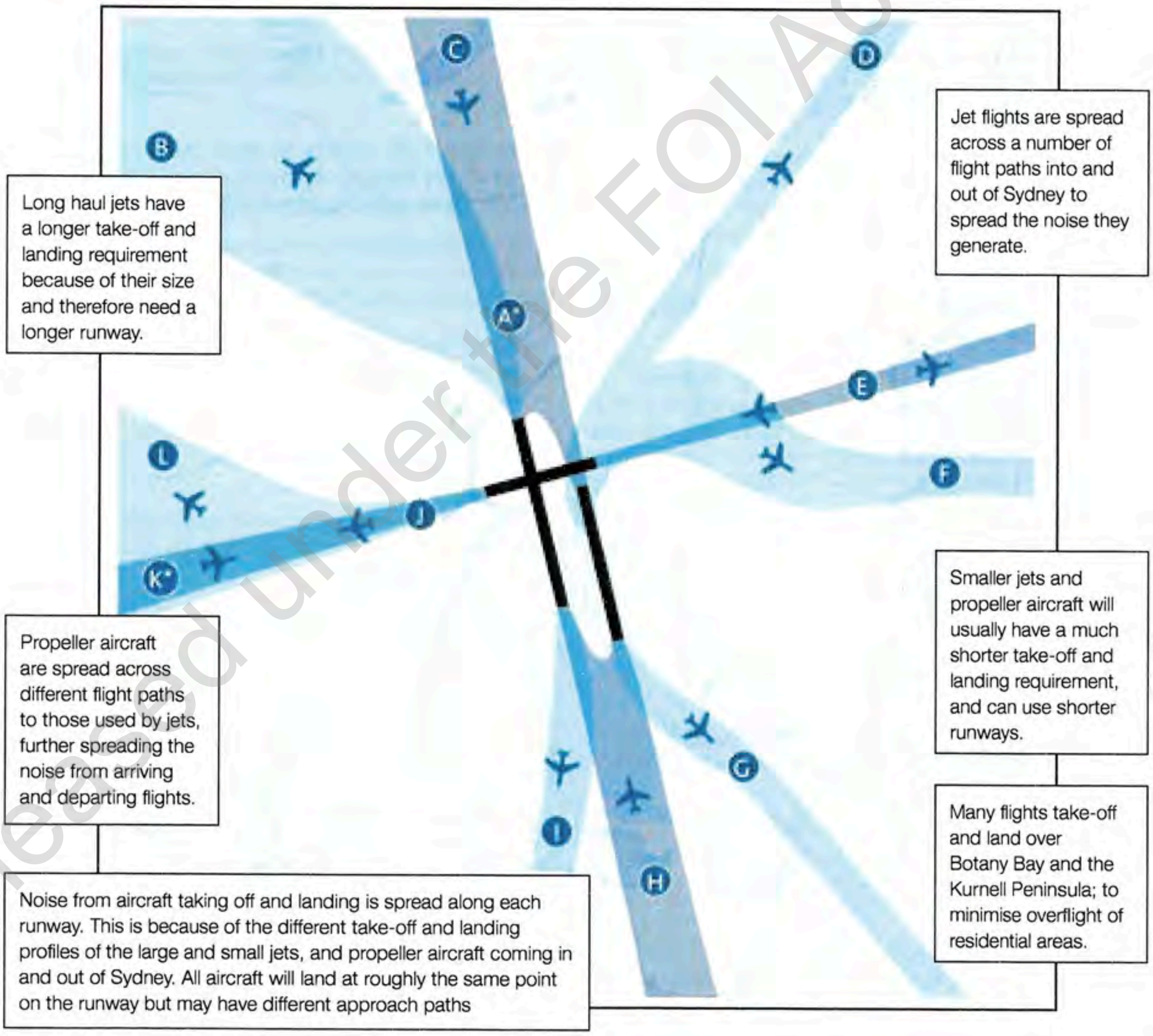
KEY FACTS ABOUT NOISE SHARING

What is the Long Term Operating Plan?

The LTOP is a program to manage aircraft noise from Sydney Airport. Its aims are to make sure aircraft flights are sent over water and non-residential land, as much as possible. Where this is not possible, the LTOP aims to spread the noise across communities in Sydney and provide periods of respite from aircraft noise. LTOP provides 10 different ways of using the Airport's three runways and associated flight paths known as Runway Modes of Operation.



These are general depictions of the busiest flight paths at Sydney Airport for aircraft operating at altitudes lower than 5000 feet above sea level. Aircraft also frequently overfly the white areas on this chart.

Importance of Sydney Airport

On average, 850 flights either arrive or depart Sydney Airport each day; adding up to over 310,000 flights a year (2012).

Airservices Australia is constantly balancing the need to share the aircraft noise from Sydney Airport, with the need to keep flights moving in and out of Sydney safely. This is important as it has an impact on how soon families can be reunited, Australian businesses can continue to trade with our neighbours, and our national and international visitors can experience the best of what Sydney and New South Wales has to offer.

As well as being an important gateway for trade and tourism, Sydney Airport contributes billions of dollars annually into Sydney households and the NSW community: It handles 45 per cent of international passengers and $36 billion in air freight. The Airport's contribution to direct employment – full time and part time – is 75,580 jobs, plus indirect employment of 130,550[1]. It makes a direct contribution of $8 billion in NSW Gross State Product. With flow-on impacts taken into account, the airport's economic contribution increases to $16.5 billion.

How is noise shared across the different communities living in Sydney?

Aircraft noise is shared between different areas of Sydney following the Sydney Airport Long Term Operating Plan (LTOP). The LTOP is designed to place as many flights as possible over water (55 per cent to the south) and the remaining flights to be shared in the other three directions. The LTOP has the following targets for aircraft movements:

- 17% of movements to the North of the Airport
- 13% of movements to the East of the Airport
- 15% of movements to the West of the Airport
- 55% of movements to the South of the Airport

How does Airservices Australia decide which runways to use to spread aircraft noise across Sydney?

Safety is at the centre of Airservices approach to managing the movement of aircraft in and out of Sydney. However Airservices manages runway usage as far as possible to share noise, within the constraints of traffic demand and weather.

Weather, in particular wind direction and strength and rain, is a major factor in deciding which runways can be used for take-offs and landing. While aircraft operate under the direction of Air Traffic Control, the pilot remains responsible for the safety of the aircraft at all times and as such may request the use of a specific runway for take-off or landing.

For a safe take-off and landing an aircraft needs to fly into the wind or with very little tailwind.

So, if the wind is blowing to the north, aircraft usually take-off and land to the south; when the wind is blowing to the south, aircraft usually take-off and land to the north.

The same rule applies to flights taking off and landing to the east and west.

Rain is an important factor because safety rules require that aircraft are unable to take-off or land with any tailwind on a wet runway.

Why can't all flights in and out of Sydney Airport be evenly spread across the north/south, and east/west runways?

Apart from the weather, the mix and capabilities of the different aircraft that take-off and land at Sydney need to be considered for the safe operation of flights in and out of Sydney.

The parallel north/south runways have a much higher traffic capacity than the single east/west runway. Whilst it is possible to use the east/west runway for arrivals or departures during periods of low traffic demand, the north/south runways need to be used in busy periods allowing similar aircraft to be grouped together for either runway.

Long haul aircraft, which will be heavily loaded with fuel, cargo and passengers are required to use the longer (north/south) runway to operate safely.

Air traffic controllers need to leave more space between aircraft in the air and on the ground in poor weather conditions, to maintain the safe operation of different aircraft arriving and departing Sydney. So a range of weather conditions and weather quality (visibility and cloud cover, as well as wind direction and speed) determine which runways are the safest to use.

Complexity with ground operations can at times mean use of the East-West runway will impair both the safety and efficiency of aircraft operating on the ground around the terminals and taxiways.

The capacity of the airport when using only one runway (east-west) is significantly reduced in comparison to using two runways (north-south), so there will always be a bias towards north-south.

1 Source: Sydney Airport Economic Impact Report at http://www.sydneyairport.com.au/corporate/about-us/economic-impact-report.aspx

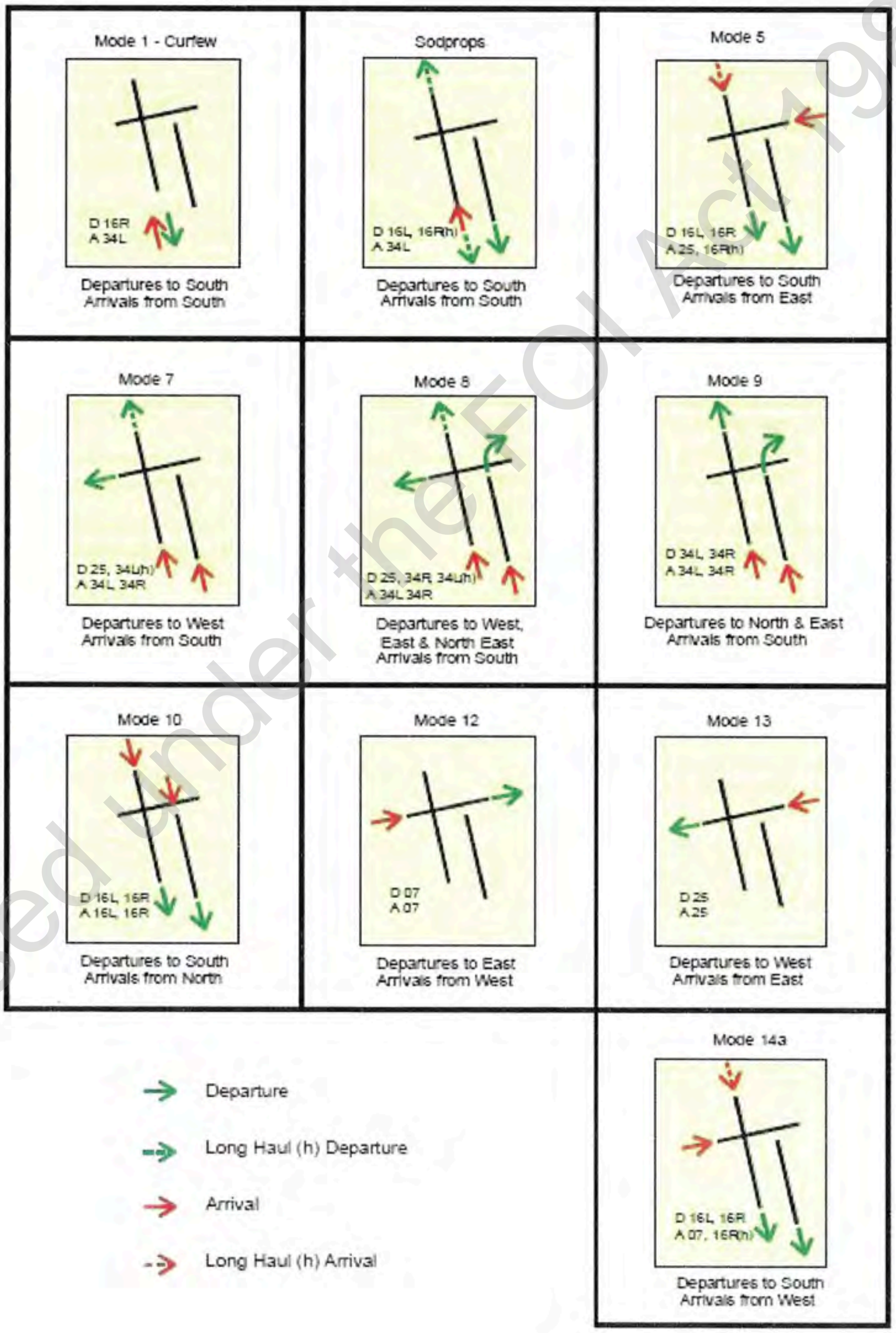
Movements over the North =16L(arr) + 16R(arr) + 34L(dep)

Movements over the South =16L(dep) + 16R(dep) + 34L(arr) + 34R(arr)

Movements over the East =07(dep) + 25(arr) + 34R(dep)

Movements over the West =07(arr) + 25(dep)

Runway Modes of Operation



How well are the LTOP noise sharing targets being met?

Many of the noise sharing aims of the Long Term Operating Plan are being met. The south and east targets are usually met, but the north and west targets have never been met.

Once demand for use of the airport (i.e. flights per hour) reaches approximately 55, it is no longer possible to use the east/west runway. The only way to get flights through the airport, during these peak times, is to operate the two (north/south) runways in parallel.

These factors also affect which combination of runways Airservices can use on any given day, or hour of the day. Airservices cannot use the lower volume noise sharing modes of runway operation during peak periods.

However, what Airservices does to spread aircraft noise is to split the two north-westerly flight paths (tracks) from Sydney Airport so noise from jet departures to the north are actually spread across the northern and western suburbs of Sydney. Splitting these tracks and incorporating turns based on the height of different aircraft, rather than their distance from the airport minimises the noise of flight paths over the northwest.

The noise sharing targets for Sydney Airport were developed in 1996 based on a series of computer models. These models looked at the capacity of each runway and an analysis of historical weather data. The modelling showed that:

- It is difficult to accurately forecast future levels of runway use with a high degree of certainty (particularly given changes in the weather, and the changing mix of aircraft that use Sydney Airport).
- The forecast growth in aircraft movements is projected to limit the ability of air traffic controllers to use noise sharing modes for aircraft arrivals and departures.
- Information on levels of runway use must be considered in combination with flight path maps or some form of noise contours to assess the actual distribution of aircraft noise, compared to the targeted distribution of aircraft noise.
- This is important because arriving and departing aircraft do not necessarily maintain the runway heading when they are clear of the airport. Different aircraft take different turns as they exit Sydney Airport, with slower aircraft taking a wider turn and faster aircraft a more straight flight path. Having aircraft peel off at different points once they have left Sydney Airport is important to maintaining a safe distance between arriving and departing aircraft, as well as allowing their safe operation in different wind and weather conditions.

A 2005 independent analysis of LTOP performance by Airways International commissioned by Airservices Australia found that the implementation has been 'reasonable considering the complexity of LTOP in all its aspects'

Where can I get more information?

There are a range of sources you can go to for more information on the Long Term Operating Plan at Sydney Airport.

- Fact sheets available from Airservices: www.airservicesaustralia.com/aircraftnoise/factsheets
- Sydney Operations Reports: www.airservicesaustralia.com/publications/reports-and-statistics/sydney-airport-operational-statistics
- Airways International Report on LTOP Performance www.sacf.infrastructure.gov.au/LTOP/index.aspx
- ANO Assessment of Aircraft Noise Information (Sydney) – Airservices Australia March 2012 www.ano.gov.au/reportsstats/reports/assessment_aircraft_noise_sydney.pdf
- SACL Master Plan www.sydneyairport.com.au/corporate/master-plan.aspx
- Noise Complaints and Information Service (NCIS)
  - 1800 802 584 (free call), an interpreter service is also available on 131 450
  - Our online form at: https://complaints.bksv.com/asa
  - Mail to Noise complaints and Information Service, PO BOX 211 Mascot NSW 1460

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12-117JUN Corporate Communication

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NOISE COMPLAINTS AND INFORMATION SERVICE

Airservices is responsible for managing complaints and enquiries about aircraft noise and operations through our Noise Complaints and Information Service (NCIS). This service is the Australian aviation industry's main interface on aircraft noise and related issues for the community.

Complaints and enquiries help identify issues of concern and possible opportunities for improvements. When analysing the information received from complaints and enquiries, we focus on the number of complainants and the issues raised by them, rather than the number of contacts received from each person.

Our process

If you make a submission to the Noise Complaints and Information Service, a Complaint Specialist will review it and determine the appropriate response and/or action.

We will contact you within 21 days if you have:

- asked a relevant question; or
- raised a noise issue to which we can reasonably respond.

If you have contacted us previously and received a response, we may not respond further if there is no additional information that we can reasonably provide.

Further information about lodging complaints and enquiries and about aircraft noise issues is available from our website: http://www.airservicesaustralia.com/aircraftnoise

Interpreter assistance

If you require assistance in the interpretation of Airservices information or you require interpreter assistance in making a complaint or enquiry, please contact the Telephone Interpreter Service (TIS) on 131 450.

Reports

Quarterly Aircraft Noise Information Reports are available from our website: http://www.airservicesaustralia.com/publications/noise-reports/noise-reports/ These Reports contain information and statistics about complainants and issues, aircraft movements, runway usage, night movements and noise improvements that have been implemented or are being investigated.

Managing your complaint to the NCIS

Noise Complaints and Information Service responsibilities	What we ask of you when you make a complaint
We are responsible for: • providing assistance if you require help to make a complaint • handling your complaint professionally, efficiently, fairly and impartially • keeping you informed of our progress and any actions taken • giving you reasons for our decisions • taking all practicable steps to ensure that you are not subjected to any detrimental action in reprisal for making your complaint • treating you with courtesy and respect • giving you adequate warning of the consequences of unacceptable behaviour.	We ask you to: • provide us with a clear idea of the problem and the solution you want • be honest in all communications • give us all the relevant information you have (or know about) at the beginning • tell us new facts, or let us know if you no longer want our help • cooperate with us to help us try to finalise your complaint • treat us with courtesy and respect • inform us of changes in your contact details • let us know if you need an interpreter or other help in accessing our service.

Complaint Finalised

If you are dissatisfied with our response or procedures at the conclusion of the complaint handling process you may apply to the Aircraft Noise Ombudsman for a review. The contact details are provided below to assist you.

Aircraft Noise Ombudsman

Postal Address: GPO Box 1985
Canberra City ACT 2601
Telephone: 1800 266 040
Website: http://ano.gov.au

Not sure where to take your complaint?

Visit the Australian Government's aviation information resource website at **http://www.aviationcomplaints.gov.au** to find the right place for queries about aviation issues.

Name	Description	Assigned User	Assigned To	Date Created	Date Modified	Subject	Body
Perth 06/24 use (not rwy closure)	Perth 06/24 use NOT rwy closure			22/03/2017 10:42	23/03/2017 13:32	Noise Complaints and Information Service submission: Case	Dear As you have previously contacted Airservices when Perth Airport has closed the main runway for maintenance, I am writing to advise you that a further program of closures is currently underway in order to connect and commission new lighting. When the main runway is closed, the crossing runway will be used instead. This will result in increased traffic over your area at these times. The runway closures are scheduled to occur between 6 February and 25 March 2017. Unless there is an emergency or adverse weather, the main runway will be closed between 8 am and 5 pm as follows: 6 - 18 February 20 - 25 February 27 February - 4 March 7 - 11 March 13 - 18 March 20 - 25 March For further information about runway closures and schedules for maintenance, please visit Perth Airport's Runway Works webpage at: https://www.perthairport.com.au/Home/corporate/planning-and-projects/runway-works Should you choose to contact the Noise Complaints and Information Service about the runway closure we will make a note on your existing case about this issue, however we would not expect to respond as we have no additional information to provide. Yours sincerely The Noise Complaints and Information Service Team Airservices Please do not reply to this email as this address does not receive incoming emails. Your reply will not be delivered. Should you wish to contact us please use our online Noise Complaints, Enquiries and Feedback Form: https://complaints.bksv.com/asa Other contact methods are set out on our website: http://www.airservicesaustralia.com/aircraftnoise/about-making-a-complaint/how-to-make-a-complaint/
06/24 south west runway closure	Runway closure template for south west end of Rwy 06/24			17/09/2018 10:49	17/09/2018 11:05	Noise Complaints and Information Service submission: Case	Dear Please find attached details of upcoming community engagement activities associated with the Hobart Design Review. Yours sincerely The Noise Complaints and Information Service TeamAirservices Australia Please do not reply to this email as your reply will not be delivered. Please contact us using one of these methods:Online form: https://complaints.bksv.com/asa Telephone: 1800 802 584 (freecall) | Post: PO Box 211, Mascot, 1460 Web: http://www.airservicesaustralia.com/aircraftnoise/about-making-a-complaint/how-to-make-a-complaint/
Perth Rwy 06/24 use + rwy closure dates				23/03/2017 15:31	23/03/2017 15:31	Noise Complaints and Information Service submission: Case	Dear As you have previously contacted Airservices when Perth Airport has closed the main runway for maintenance, I am writing to advise you that a further program of closures is currently underway in order to connect and commission new lighting. When the main runway is closed, the crossing runway will be used instead. This will result in increased traffic over your area at these times. The runway closures are scheduled to occur between 6 February and 25 March 2017. Unless there is an emergency or adverse weather, the main runway will be closed between 8 am and 5 pm as follows: 6 - 18 February 20 - 25 February 27 February - 4 March 7 - 11 March 13 - 18 March 20 - 25 March For further information about runway closures and schedules for maintenance, please visit Perth Airport's Runway Works webpage at: https://www.perthairport.com.au/Home/corporate/planning-and-projects/runway-works Should you choose to contact the Noise Complaints and Information Service about the runway closure we will make a note on your existing case about this issue, however we would not expect to respond as we have no additional information to provide. Yours sincerely The Noise Complaints and Information Service Team Airservices Please do not reply to this email as this address does not receive incoming emails. Your reply will not be delivered. Should you wish to contact us please use our online Noise Complaints, Enquiries and Feedback Form: https://complaints.bksv.com/asa Other contact methods are set out on our website: http://www.airservicesaustralia.com/aircraftnoise/about-making-a-complaint/how-to-make-a-complaint/

Perth Rwy 03/21 Closure south-west	Perth Runway Closures complainants to the south-west			8/03/2017 9:29	8/03/2017 9:47	Noise Complaints and Information Service submission: Case	Dear As you have previously contacted Airservices when Perth Airport has closed the main runway for maintenance, I am writing to advise you that a further program of closures is currently underway in order to connect and commission new lighting. When the main runway is closed, the crossing runway will be used instead. This will result in increased traffic over your area at these times. The runway closures are scheduled to occur between 6 February and 25 March 2017. Unless there is an emergency or adverse weather, the main runway will be closed between 8 am and 5 pm as follows: 6 - 18 February 20 - 25 February 27 February - 4 March 7 - 11 March 13 - 18 March 20 - 25 March For further information about runway closures and schedules for maintenance, please visit Perth Airport's Runway Works webpage at: https://www.perthairport.com.au/Home/corporate/planning-and-projects/runway-works Should you choose to contact the Noise Complaints and Information Service about the runway closure we will make a note on your existing case about this issue, however we would not expect to respond as we have no additional information to provide. Yours sincerely The Noise Complaints and Information Service Team Airservices Please do not reply to this email as this address does not receive incoming emails. Your reply will not be delivered. Should you wish to contact us please use our online Noise Complaints, Enquiries and Feedback Form: https://complaints.bksv.com/asa Other contact methods are set out on our website: http://www.airservicesaustralia.com/aircraftnoise/about-making-a-complaint/how-to-make-a-complaint/
GC short helicopter trip	Gold Coast Airport short helicopter trip email template			10/04/2018 11:09	10/04/2018 11:18	Noise Complaints and Information Service submission: Case	Dear I write in response to your submission to the Noise Complaints and Information Service about short helicopter flights over and close to your suburb of Bilinga. I am very sorry to learn that you are being disturbed by helicopter noise. We have conducted a comprehensive investigation of the concerns raised by yourself and others and I am enclosing a copy of the Investigation Report that sets out our findings. Airservices role is discussed in section 3 of this report. The issues raised in complaints are analysed in section 4. Section 5 explains how these flights are managed by air traffic control and the constraints and limitations in doing so. Discussion and our findings are in section 6. Unfortunately, no safe, practical or feasible changes to the way air traffic control manage these flights were identified in our investigation. Please read our report for a full discussion of the reasons why this is the case. I am sorry that we are not able to take any action to alleviate the helicopter noise at this time. However, please be assured that, should a potential way of improving the noise situation come to light in the future, we will investigate it. Thank you for bringing your concerns to our attention. Yours sincerely The Noise Complaints and Information Service TeamAirservices Australia Please do not reply to this email as your reply will not be delivered. Please contact us using one of these methods:Online form: https://complaints.bksv.com/asa Telephone: 1800 802 584 (freecall) | Post: PO Box 211, Mascot, 1460 Web: http://www.airservicesaustralia.com/aircraftnoise/about-making-a-complaint/how-to-make-a-complaint/
B&K font test template	Please ignore this email test template			30/03/2017 11:50	31/03/2017 8:35	default font test template	Dear On 23 November 2015 a Cathay Pacific Airways Boeing 747-8F aircraft from Sydney landed at Brisbane West Wellcamp Airport at 2:45pm and departed for Hong Kong at 4:45pm. It was the first time an international flight has departed from Australia's newest airport and the first time Cathay Pacific Airways has operated a cargo service into an Australian regional centre. Brisbane West Wellcamp Airport intends that regular scheduled freight services will commence in the first half of 2016. Further details of flight schedules will be made available closer to the date: http://www.wellcamp.com.au/ We can pass your details to Brisbane West Wellcamp Airport so that they can provide you with further information. If you agree to this, please advise us as soon as possible.