VANCOUVER AIRPORT AUTHORITY

Beyond, Every Day.

VANCOUVER INTERNATIONAL AIRPORT

NOISE MANAGEMENT REVIEW OF BEST PRACTICES

17 MAY 2013

PREPARED BY: AIRBIZ

FINAL DRAFT

INTRODUCTION

The Vancouver Airport Authority ("Airport Authority") is a not-for-profit private corporation that operates the Vancouver International Airport ("YVR"), in the best interest of the Province, under a long term ground lease with the Federal Government.

Under the ground lease, the Airport Authority is delegated responsibility to manage noise from aircraft operating at YVR, within a 10 nautical mile area around the airport.

To achieve this, the Airport Authority has a comprehensive Aeronautical Noise Management Program (the "Program"). The strategic objective of the Program is to ensure that YVR remains a viable 24-hour gateway and contributes to the economic development of the region.

A key component of the Program is the Noise Management Plan ("NMP"). The NMP must be approved by Transport Canada and serves to identify initiatives to address and manage noise associated with airport operations.

In 2008, during the development of the 2009-2013 Noise Management Plan, the Airport Authority commissioned a study to review industry best practices related to airport noise management. The final version of that report can be found on the airport's website at:

http://www.yvr.ca/en/community-environment/Noise-management/reporting.aspx

The Airport Authority is now in the process of creating a new Noise Management Plan for the years 2014-2018.

As part of this process, the Airport Authority commissioned Airbiz Aviation Strategies to conduct a similar review. This report complements and updates previous research.

ABOUT AIRBIZ

Airbiz is an independent international specialist aviation consultancy.

The firm has accumulated over 30 years experience in the aviation industry. Airbiz has successfully completed over 2000 projects and studies in 40 countries, on 5 continents.

Airbiz is a member of the international aviation domain and a world business partner of the Airport Council International. We work globally.

Airbiz has extended experience and expertise in all aspects of aircraft noise impact assessment using the Integrated Noise Modelling (INM) and Transparent Noise Information Package (TNIP) which are based on scenarios developed for demand forecast, flight tracks, fleet mix and operational procedures.

Airbiz has prepared airport noise management plans, and provided evidence on aircraft noise impacts at planning and environmental hearings in a range of jurisdictions.

SCOPE AND METHODOLOGY

To help identify initiatives for the 2014-2018 Noise Management Plan, the Airport Authority commissioned Airbiz to:

- Review industry best practices related to airport noise management;
- Summarize practices for consideration at YVR assessing implementation issues, potential effectiveness, and associated cost to all stakeholders (e.g. Air Navigation Service provider, regulator, communities, operators, Airport Authority, etc.);
- Review and summarize new and emerging technologies or operational procedures that may affect aircraft noise in the future; and
- Review and summarize trade-offs between emissions and noise with respect to advancements in engine technology and airspace management.

Airbiz Aviation Strategies used several sources to identify industry "Best Practices" for consideration by the Airport Authority.

Airbiz's approach included interviews with several airports and aviation stakeholders in Australia and New Zealand. In addition, Airbiz reviewed material available in the public domain from a range of additional airports worldwide. From this assessment, a series of practices were identified for potential implementation at Vancouver International Airport.

A series of policy and technology enhancements were also reviewed to identify external factors which could directly or indirectly assist the Airport Authority in mitigating the impact of aircraft noise in the vicinity of the airport while meeting its strategic business objectives, including remaining a viable 24-hour facility.

This report also features discussion on community outreach which was developed with the support of David Southgate, previously an "environmental bureaucrat" at the Australian Department of Infrastructure , and a champion of the transparent description of the impact of noise on communities through the development of alternative metrics and active community engagement. He was also the Australian Government representative on the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) from 2004 to 2012.

The review concludes with a summary of best practices that might be applied at YVR.

REPORT OUTLINE

Part 1 – Policy and Technology

Noise Certification Standards

- Development History
- ICAO's Balanced Approach
- Chapter 14 Standards

Air Navigation Technology

- RNP, RNAV
- OPD

Aircraft and Engine Technology

- Recent Engine Development Trends
- Geared Turbofan
- Open Rotor
- Winglets/Sharklets
- Biofuels
- Fleet Renewal

Part 2 - Airport Case Studies Review

- Night Movements
- Over-flights
- Community Outreach and Multimedia Tools
- Noise Advisory Board Governance
- Compatible Land-Use Planning
- Other Noise Abatement Procedures

Part 3 – Consultation and Communication

- Communication Principles
- Noise Advisory Board Governance
- Multimedia Tools
- Noise and Emission Trade-Offs

Part 4 – Summary of Best Practices

- Implementation Requirements
- Potential Effectiveness
- Associated Costs to Stakeholders

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PART I

POLICY & TECHNOLOGY

INTRODUCTION

This section reviews a range of developments external to YVR in regards to new and emerging technologies and policies.

These are described at a high level with a specific focus on how these may positively (or negatively) affect the environment surrounding YVR.

HISTORY - JETS

Balanced Approach to Noise Reduction

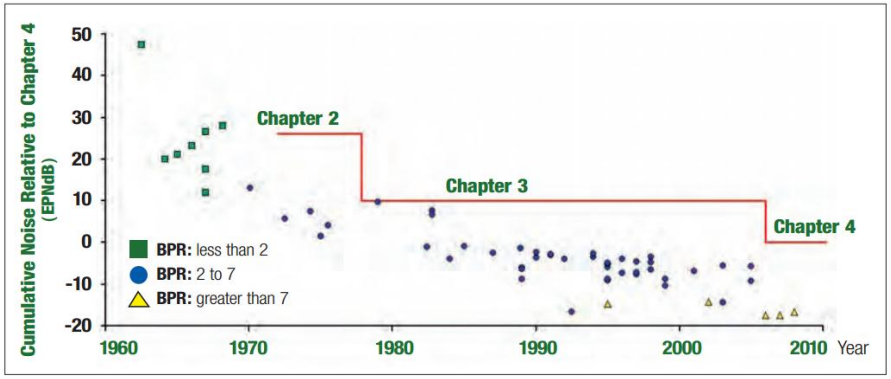
ICAO is an agency of the United Nations that oversees and adopts standards and recommended practices concerning all aspects of international aviation to ensure safe and orderly growth. In 2001, the 33rd ICAO Assembly adopted Resolution A33/7 which endorsed the concept of a "balanced approach" to aircraft noise management (see ICAO document 9829 updated 2007) by identifying the noise problem at an airport and then analysing the various measures available to reduce noise through the exploration of four principal elements:

- reduction of noise at source (quieter engine and aircraft design);
- land-use planning and management;
- noise abatement operational procedures; and
- operating restrictions.

ICAO has developed policies on the implementation of each of these elements, as well as on noise charges.

Reduction at source

The first certification standards for jet aircraft, issued in ICAO Annex 16, Chapter 2, became applicable in 1972. This standard prescribed noise limits to be achieved at three measurement points: sideline; approach; and take-off.



Progress made in noise reduction at source since implementation of aircraft noise Standards - by engine bypass ratio (ICCAIA 2008)

New quieter noise standards (Chapter 3) were introduced in 1977 for new aircraft models and 1981 for derivatives of existing aircraft. This involved a reduction of limits by 16 EPNdB for light aeroplanes and 10 EPNdB for heavy aeroplanes (Based on the sum of three (3) certification measures - sideline, approach, and flyover).

Chapter 4 standards for new jets were accepted in 2001 for application in 2006. It required a cumulative (sum of margins at all three measurement locations) reduction of 10 EPNdB compared to Chapter 3.

In Canada, under Federal legislation Chapter 2 aircraft have been phased-out since 2002 other than exceptions involving aircraft operating to parts of Northern Canada.

HISTORY – HELICOPTERS AND PROPELLER AIRCRAFT

Helicopters and propeller aircraft are also subject to noise certification per ICAO's Annex 16.

For helicopters, standards were introduced in 1981 in Chapter 8 of Annex 16. A new standard for light helicopters (under 3,175 kg) was introduced in 1993 in Chapter 11. The last review of helicopter noise certification was completed in 2002 when increased stringency was introduced.

For light propeller-driven aircraft, Chapter 6 (<8,618 kg) standards were introduced in 1975 before being superseded by Chapter 10 for aircraft entering service after 1988. Additional stringency was introduced in 2002.

For heavy propeller-driven aircraft (>8,618 kg), they initially were certified under Chapter 3 before the Chapter 4 standards were introduced in 2006. The noise standards for heavy propeller-driven aircraft are therefore the same as for all subsonic jet aircraft.

No recent discussions have occurred on tightening standards for Chapter 8, 10 and 11.

NEW CHAPTER 14 NOISE STANDARDS (CAEP/9)

In February 2013, the International Civil Aviation Organization's (ICAO's) Committee on Aviation Environmental Protection (CAEP) delivered an agreement on the certification procedures supporting a new CO_2 standard for aircraft, as well as a new global noise standard.

Emissions

The agreement on the new certification procedures follows on from a related CAEP decision in July 2012 when the group agreed on the aircraft CO_2 standard's first milestone – a metric system that can be used to characterize the CO_2 emissions from aircraft of varying types and technologies.

Noise

The agreed new noise standard (Chapter 14 of Annex 16) will be cumulative 7EPNdB below ICAO's current Chapter 4 standard and will be applicable to new-design aircraft entering into service from 2017 for aircraft greater than 55 tonnes and from 2020 for aircraft under 55 tonnes.

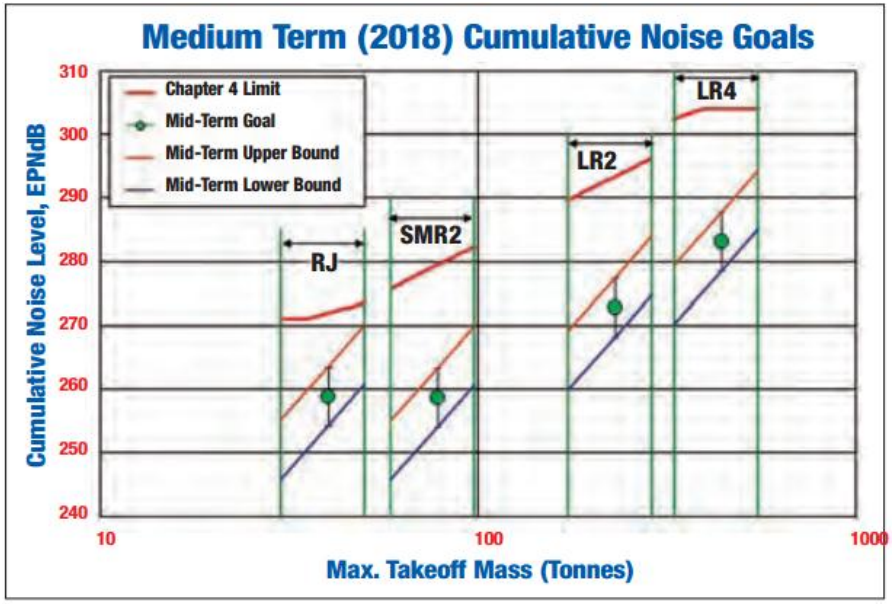
The 7EPNdB corresponds to the sum of margins at the sideline, approach and flyover measurement locations. As the adjacent table and graph illustrate, an independent expert panel had concluded that the new standard could have been significantly more than what was agreed to (For example, the Bombardier CS100 is projected to be operating 21 EPNdB cumulatively below Chapter 4).

The most significant impact on noise exposure will therefore be associated to a future voluntary or potentially imposed phase-out of marginally compliant or noisier Chapter 3 aircraft combined with the gradual entry in service of aircraft operating at levels lower than the new Chapter 14 standards.

Independent Expert Panel aircraft noise reduction technology goals

Aircraft Category	Margin to Chapter 4 (EPNdB)	
	Medium Term (2018)	Long Term (2028)
Regional Jet	13.0±4.6	20.0±5.5
Small-Medium-Range Twin	21.0±4.6	23.5±5.5
Long-Range Twin	20.5±4.6	23.0±5.5
Long-Range Quad	21.0±4.6	23.5±5.5

Independent Expert Panel aircraft noise reduction technology goals (ICAO)



Medium term technology goals for noise reduction technology (ICAO)

AIRCRAFT RETIREMENTS

Older and noisier aircraft that are still in active operation will phase-out over time either through voluntary or potentially mandatory means.

Mandatory

A mandatory phase-out is one that is introduced through legislation.

For Chapter 2 phase-out, it started by an ICAO recommendation issued to member states in 1990 to introduce a partial phase-out by 1995 and to complete it by 2002.

Phase-out process for Chapter 2 aircraft was associated with a Chapter 3 re-certification process (i.e. adding a hush kit to Chapter 2 aircraft in order to comply to Chapter 3). While hush kits are a costly addition because they add weight and therefore reduce fuel efficiency for the aircraft, this modification allowed Chapter 2 aircraft to meet Chapter 3 standards, in most cases just barely.

Some airports around the world have already taken a step towards restricting marginally compliant Chapter 3 aircraft (those initially certified as Chapter 2) for operating at their facility.

Mandatory phase-out is therefore a lengthy process associated with very slow gains.

Voluntary

A voluntary phase-out is one initiated by carriers primarily for commercial reasons.

Older aircraft are not only noisier, they are also less fuel efficient and often require a higher level of maintenance. As the fuel prices go up, this becomes a significant incentive for a carrier to renew its aircraft fleet.

For some airlines, renewing its fleet periodically is a key requirement to maintain their brand loyalty and attractiveness.

In some cases, noise surcharges are implemented by airports or national regulatory bodies which add to the economic impact on operating carriers and may affect fleet renewal plans.

Voluntary phase-out therefore generally provide more significant and timely benefits in regards to the reduction in noise and emissions.

The following pages provide examples of retirement trends across the industry due to a combination of mandatory and voluntary phase-out initiatives. The Boeing 727 and 737-200 were the two (2) earliest aircraft affected by the Chapter 3 standards and that are still flying in Canada.

AIRCRAFT RETIREMENTS – BOEING 727

The earliest fleet retirement pattern to analyze is the Boeing 727, of which over 1,800 were delivered worldwide between 1963 and 1984.

By 2012, 1,356 (or 75%) have been retired, with an average age at retirement of 29.1 years.

There are currently 25 Boeing 727 aircraft registered in Canada, with the main operators being:

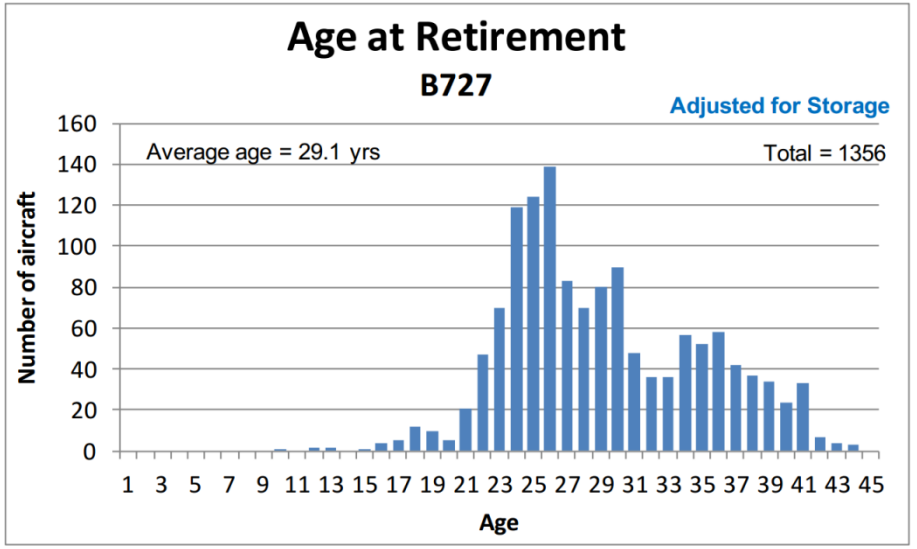
- Cargojet (11)
- Kelowna Flightcraft (Purolator) (12)

The average manufacturing year for these aircraft is 1978 (from 1973 to 1981). Kelowna Flightcraft's fleet is generally older (average of 1976) than Cargojet's fleet (average of 1979).

Considering that over time, retirement age has been increasing and that freighter aircraft tend to have a longer lifecycle, Boeing 727 aircraft are expected to be able to operate until 2020.

However, Morningstar (FedEx) has completed a fleet modernization program in 2011, replacing its Boeing 727s with Boeing 757s.

In 2012, there were approximately 1,780 operations of Boeing 727s at YVR, which represents less than five movements per day on average. Of those, 848 movements occurred between 10:00pm and 7:00am which represents less than three movement per night on average. The majority of these operations are arrivals, which is a quieter mode compared to take-off.



Age of Retirement – B727 (Avolon.aero)

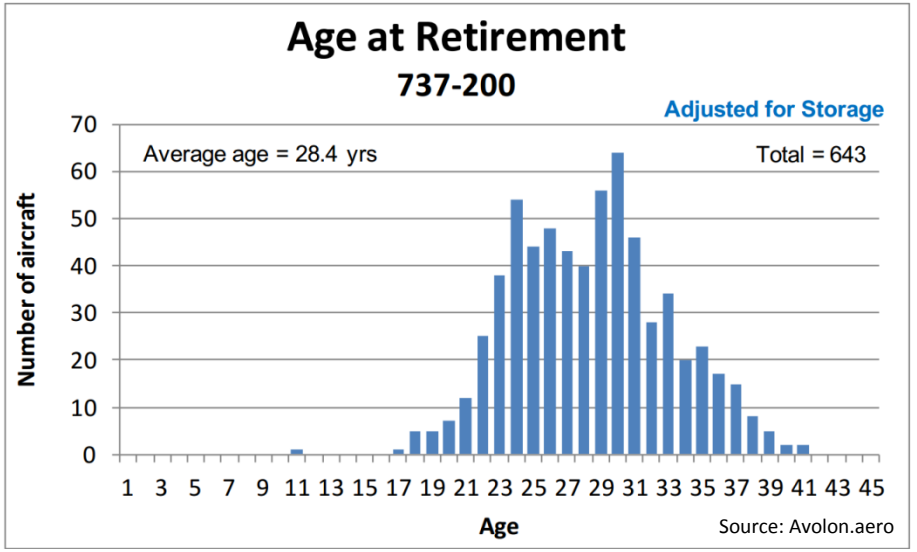
B727 (Cargojet)

AIRCRAFT RETIREMENTS – BOEING 737-200

The Boeing 737-200 is marginally older than the Boeing 727 with more than 1,100 deliveries between 1967 and 1988, 643 (or 58%) of which have been retired, with an average age at retirement of 28.4 years.

There are currently 26 Boeing 737-200s registered in Canada.

- Air North (3)
- Canadian North (8)
- First Air (7)
- Air Inuit (2)
- Nolinor (3)
- Xstrata (2)
- JLAL (1)



Age of Retirement – B737-200 (Avolon.aero)

The average manufacture year of the Boeing 737-200 fleet in Canada is 1981. This indicates that the existing fleet has reached the average age of retirement. However, these aircraft could fly until 2020 based on an assumed 40 year old retirement age.

In 2012, there were 288 operations of Boeing 737-200 at YVR, which represents less than one movement per day on average. Of those, only 11 movements occurred between 10:00pm and 7:00am.

B737-200 (Canadian North)

FLEET RENEWAL

As aircraft retire from service, new aircraft enter the market through fleet modernization. These plans are generally part of a broader airline growth strategy which incidentally leads to the introduction in service of generally more efficient and quieter aircraft.

Fleet renewal can allow an airline to operate new routes (for example Westjet Encore with the introduction of the Dash8-Q400) or to upgauge its aircraft on an existing route.

Several examples are identified on the following page and show how some of these commercial decisions may have positive impacts on noise mitigation.

The Airport Authority should continue to monitor airline fleet renewal plans on an ongoing basis to determine the gains that will be gradually be made over time in regards to noise emissions reduction.

Air Canada Rouge A319

Source: Air Canada

Air Canada B787-8

Source: Air Canada

WestJet Dash8-Q400

Source: Westjet

FLEET RENEWAL / ADDITIONS

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Westjet

- 20 orders for Dash8-Q400 (options for additional 25)
- Inaugural routes to Victoria and Fort St-John

Air Canada

- A319 and Boeing 767 transferred to Air Canada Rouge for operations on leisure routes
- 37 Boeing 787-8 on order to replace gradually the Boeing 767s
- Additional 5 Boeing 777-300ER (higher density seating)

Eva Air

- Boeing 747-400 to be replaced by 2016 with Boeing 777-300ER
- EVA currently has a 3 times weekly service to Taipei departing at 2:20am

China Airlines

- A340-400 to be replaced by 2015 with either Boeing 777-300ER or A350-900
- China Airlines currently has a daily service to Taipei departing at 2:20am

China Airlines A340-300

Source: Avioners.net

Eva Air B747-400

Source: EvaAir

Air Canada Rouge B767-300

Source: Air Canada

PERFORMANCE BASED NAVIGATION (PBN)

Performance-Based Navigation (PBN) is comprised of Area Navigation (RNAV) and Required Navigation Performance (RNP) technologies and describes an aircraft's capability to navigate using performance standards rather than conventional standards which use ground based navigation aids.

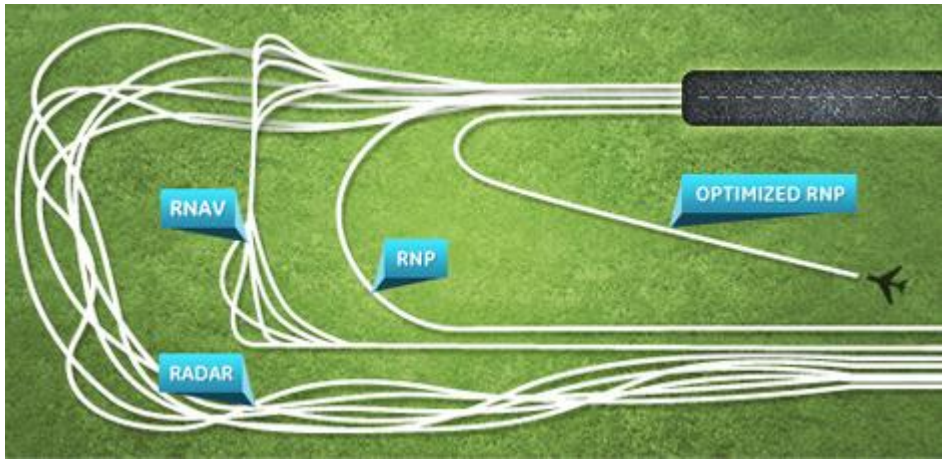
Area Navigation (RNAV)

RNAV allows an aircraft to navigate from point to point without reliance on ground-based navigation aids, using Global Navigation Satellite System (GNSS) to precisely guide the aircraft. RNAV procedures are typically used to provide terminal-area arrival procedures and instrument departure procedures. While RNAV paths are typically limited to straight lines, they represent an improvement over conventional, ground-based navigation in the sense that they allow an aircraft to fly a direct, straight route between two points.

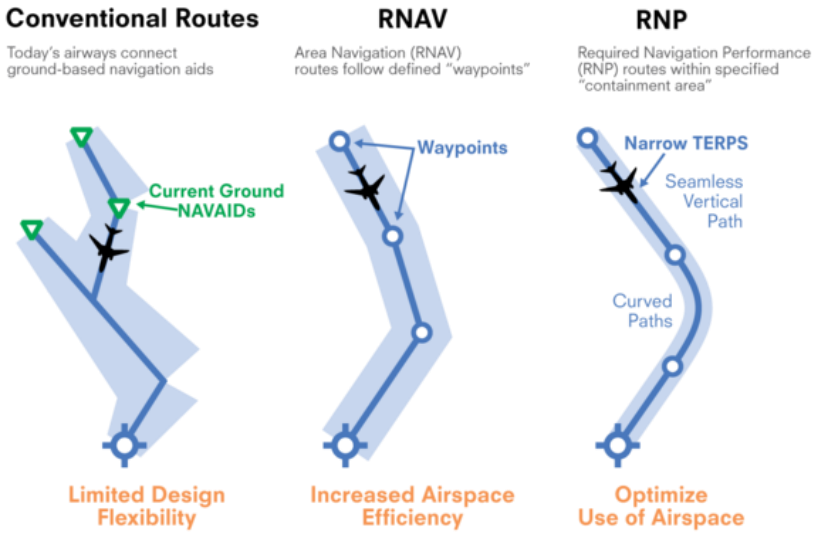
Required Navigation Performance (RNP)

RNP is RNAV with the addition of an onboard performance monitoring and alerting capability. RNP AR (Authorization Required), the highest-performing type of PBN procedure, offers the most benefit to users by allowing for predetermined, precise, curved flight paths that optimally navigate within an airspace to reduce track miles, conserve fuel, preserve the environment, and increase airspace capacity. RNP AR procedures require specific aircraft functionality and pilot crew training.

Because of its accuracy, RNP can lead to concentration of movements over specific areas. The development of RNP procedures should be assessed through a balanced approach between noise emissions and green house gas emissions.



NEXT GEN Components: RNAV/RNP (GE)

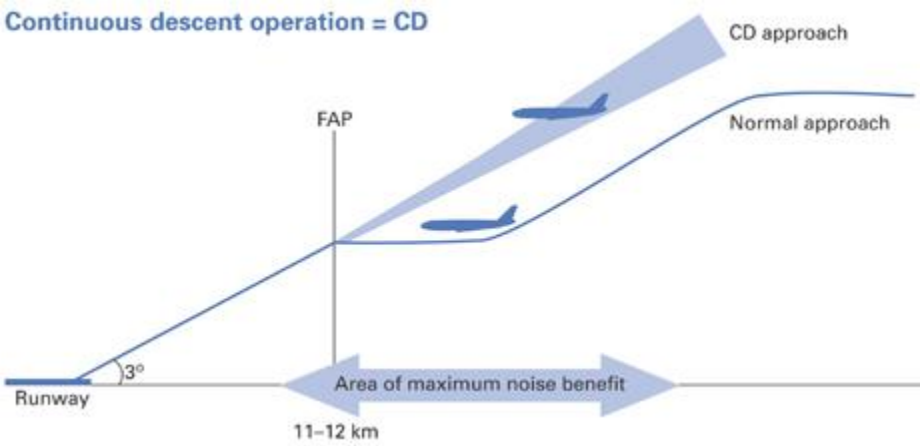


NEXT GEN Components: RNAV/RNP (Faa.gov)

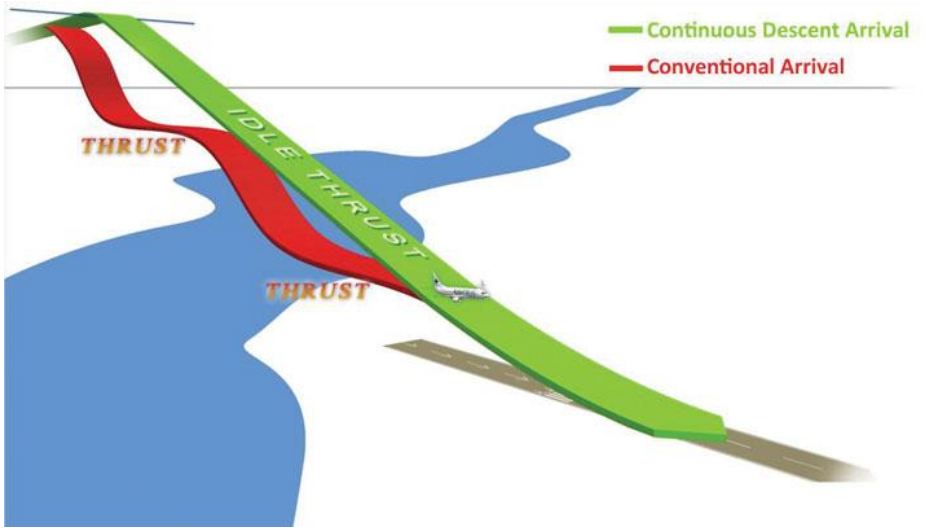
OPTIMIZED PROFILE DESCENT (OPD)

An Optimized Profile Descent (OPD), also called Continuous Descent Approach (CDA) is a procedure in which equipment onboard the aircraft chooses the optimum point to begin the aircraft's descent to landing. During the descent, the aircraft's flight computers select the lowest possible thrust setting (often flight idle) to keep the aircraft on the desired descent profile, adjusting for wind, temperature and other flight variables throughout the descent.

In this way, CO_2 emissions are reduced and the aircraft burns less fuel, as well as reducing noise emissions, especially in areas where the aircraft would have otherwise been at a lower altitude. The reduction in noise emissions is due to aircraft operating at higher altitudes with less thrust variation as every time an aircraft levels out it will increase thrust (see image adjacent).



Optimized Descent Profile (Helsinki-Vantaa Airport)



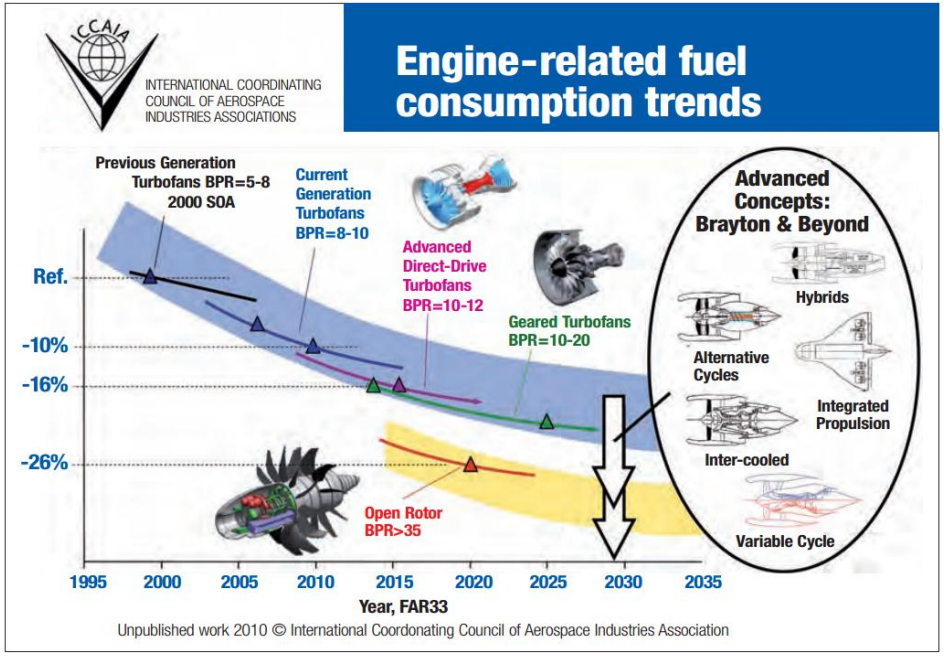
Optimized Descent Profile (GE)

ENGINE TECHNOLOGY

The single-most important component of aircraft noise reduction is associated with engine technology. Significant progress has been made since the early days of the jet age, not only in noise but also in fuel consumption, emissions and efficiency.

The next step in engine technology will involve the development of narrow body passenger aircraft equipped with geared turbofan technology from 2014 onwards.

The open rotor technology is also experiencing a rebirth although significant challenges will hinder its development. While other advanced concepts are also being considered, these are many years away from commercial applications.



History and future of engine fuel consumption trends (ICCAIA)

GEARED TURBOFAN

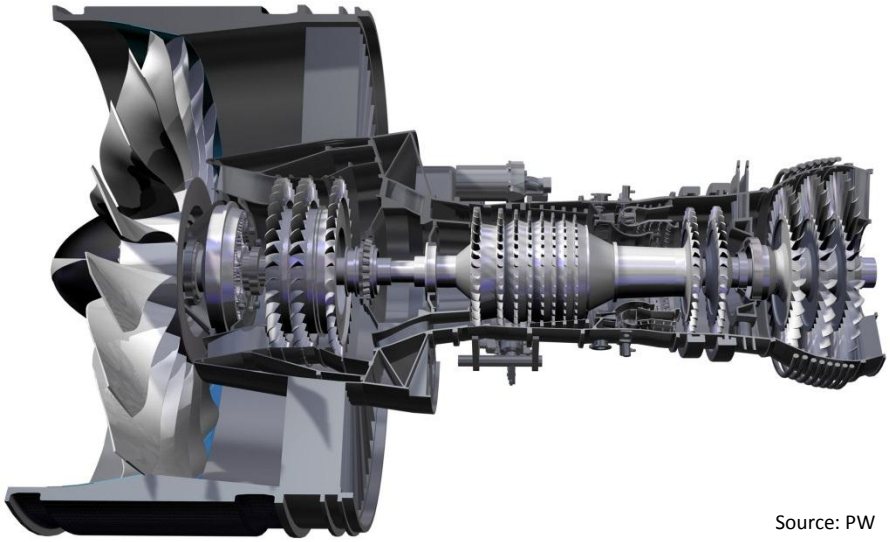
In a traditional turbofan engine, the fan is coupled with the Low Pressure (LP) shaft which results in the need for additional compression stages to create the thrust.

In a Geared Turbofan, fitting a reduction gearbox between the fan and the LP shaft allows the latter to run at a higher speed therefore allowing fewer stages to be used in both the LP turbine and the Intermediate Pressure (IP) compressor.

The gearbox between the fan and the shaft connecting the low-pressure compressor to the low-pressure turbine allows the selection of the best possible operating speed for each engine section.

Beyond fuel consumption (and greenhouse gases emissions), the Geared Turbofan technology means lower maintenance costs as well as lower noise emissions.

The following section shows commercial aircraft using the Geared Turbofan that will be entering service over the coming years including existing orders by airlines likely to operate at YVR.



Source: PW

GEARED TURBOFAN – FLEET RENEWAL

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Bombardier Cseries

- Entry in Service: 2014
- 40 orders by Republic (US Airways Express, Delta Connection)
- 12 orders by Porter Airlines (Options for 18)

Mitsubishi MRJ

- Entry in Service: 2015
- 100 orders by Skywest

Airbus A320neo

- Entry in Service: 2015
- Over 1,800 orders including 130 by American

Boeing 737max

- Entry in Service: 2017

Embraer E-jet (2nd Generation)

- Entry in Service: 2018

OPEN ROTOR

Open rotor engines (also called propfans) are an old concept but thanks to new technology are once again seen as a potential solution to enable significant emissions reductions for next generation aircraft. Reduction in fuel consumption and CO_2 emissions is predicted to be 25 to 30%. Easyjet, a European low-cost carrier had hoped to promote the concept with manufacturer by unveiling the EcoJet back in 2007.

A key obstacle is the need to comply to the recently agreed Chapter 14 noise standard which may be difficult because there is no nacelle to absorb and attenuate the noise generated. However, GE has recently completed wind tunnel tests on a subscale model which showed that the open rotor was 10-13dB quieter than Chapter 4 noise thresholds and 9% more fuel efficient than the ducted fan. Other significant challenges remain in relation to the airframe integration of various open rotor designs to determine performance and noise in a realistic configuration.

The timeframe for a commercial application of this engine concept is likely to be towards the 2030 horizon and will be dependant on decisions from Boeing and Airbus to undertake a significant re-engine program around its narrowbody fleet.

Source: SNECMA

Source: EasyJet

WINGTIP DEVICES (WINGLETS/SHARKLETS)

Beyond engine technology, other aircraft enhancements can contribute significantly to reduction in noise emissions, as well as in fuel consumption and associated CO_2 emissions.

Wingtip devices are such an enhancement used to improve the efficiency of fixed-wing aircraft by reducing the aircraft's drag through the partial recovery of the tip vortex energy. This reduction in drag leads to improvements in range, payload and/or fuel consumption.

Although wingtip devices date back to the 1970s, recent improvements through blended winglets (or Sharklets for Airbus) have led to a reduction of fuel burn (and associated emissions) by over 3% on longer stage lengths for its A320. Boeing indicated that its dual-feather design (Advanced Technology Winglet) will cut fuel burn by as much to 1.5% on top of the 10-12% improvement already expected from other design features on the Boeing 737max, with the exact figures varying subject to stage length.

Furthermore, reduction in the noise footprint on take-off has been found to be approximately 6.5% by Boeing.

Sharklets (Airbus)

Source: Airbus

Advanced Technology Winglet (Boeing)

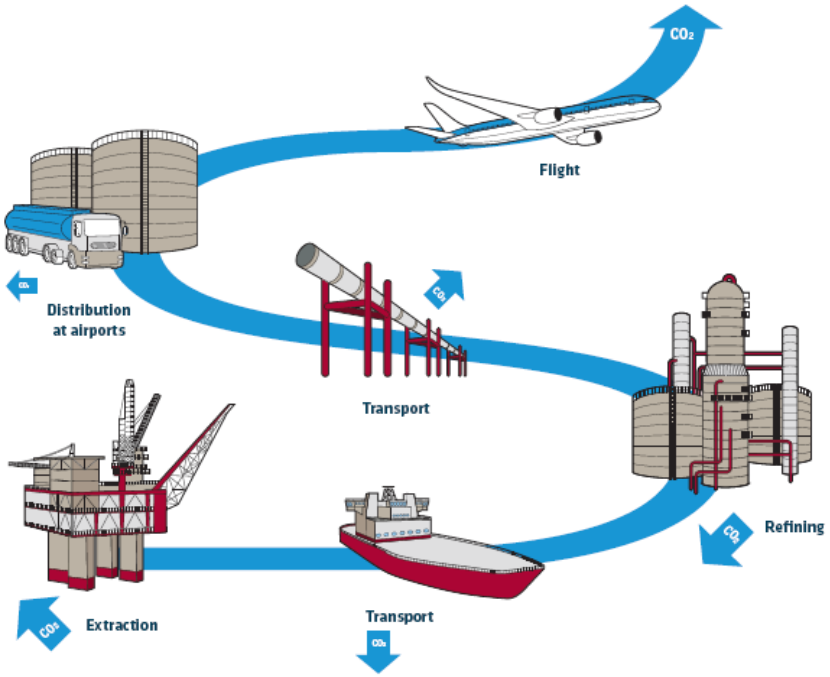
Source: Boeing

BIOFUELS

Unlike fossil fuels, biofuels are a type of fuel derived from renewable biological resources.

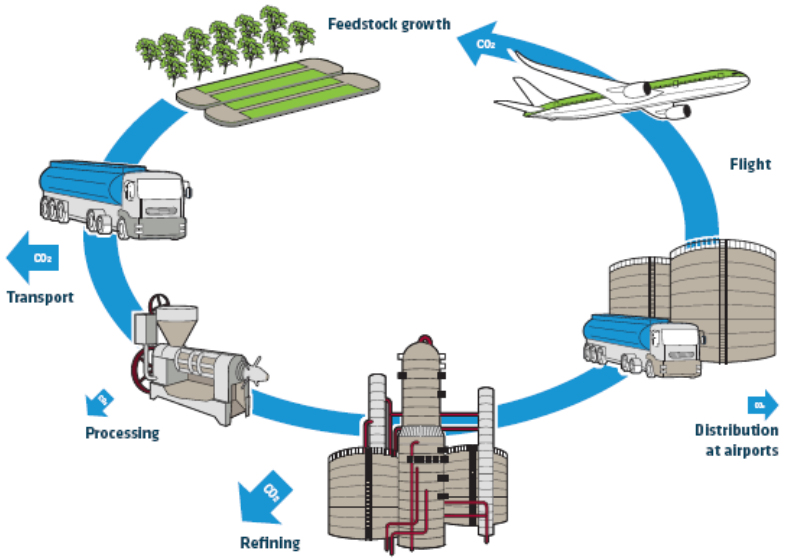
As it uses biological feedstock, the CO_2 produced through the production and consumption processes is reabsorbed by the grown feedstock.

Carbon lifecycle diagram: fossil fuels



At each stage in the distribution chain, carbon dioxide is emitted through energy use by extraction, transport, etc.

Carbon lifecycle diagram: biofuels



Carbon dioxide will be reabsorbed as the next generation of biofuel feedstock is grown.

Source: www.enviro.aero

BIOFUELS

The first generation of biofuels initially used food crops (e.g. corn, sugar cane, wheat). This competitive use of land between food crops and biofuel crops was identified as a contributing factor to the global food crisis of 2007-2008. Furthermore, first-generation biofuels are known to be unsuitable for aviation applications because of their inability to be used as a drop-in substitute to traditional Jet A-1 fuel.

Second generation biofuels are characterized by the use of non-food crops or biomass waste.

A third generation of biofuels specifically involves the use of algae such as kelp.

Several feedstock options have been used as biofuels including algae or non-food crops such as Camelina or Jatropha.

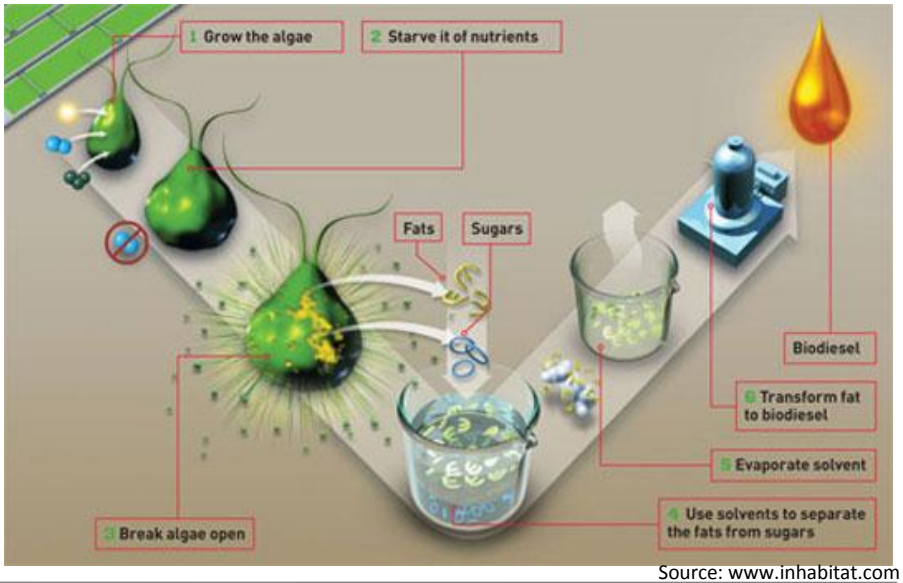
Porter Airlines conducted the first commercial biofuel flight in Canada on 17 April 2012 using a 50% blend of Jet A-1 fuel with a biofuel produced primarily from Camelina.

Air Canada conducted its first biofuel flight on 18 June 2012 using a 50% blend of Jet A-1 fuel with a biofuel produced primarily from recycled cooking oil.

For airports, the move to biofuels is expected to be fairly seamless because of the ability of Jet A-1 compatible biofuels to be dropped-in as a replacement which allows for its use in existing tankers and hydrant systems.

The use of biofuels will not improve aircraft noise performance but will support the overall discussion around trade-offs between green house gas emissions and noise.

Source: Porter Airlines



Source: www.inhabitat.com

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PART II

AIRPORT CASE STUDIES

INTRODUCTION

This section reviews case studies of practices at selected international airports.

Each airport is described at a high level, comparing some key operational parameters. This is followed by an assessment of some unique practices that were considered for possible application at YVR.

AIRPORTS INTERVIEWED & STUDIED

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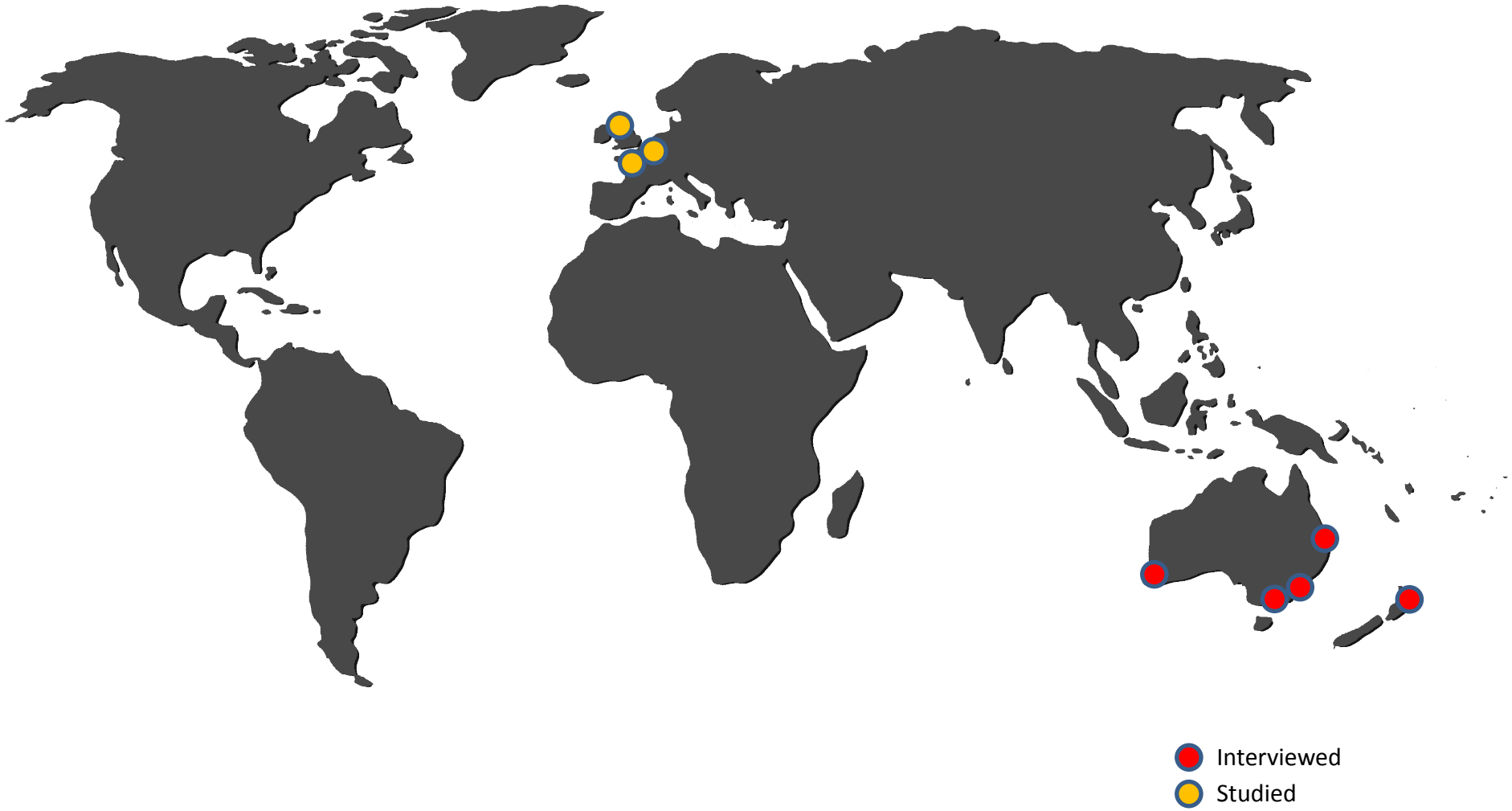

AUCKLAND, NEW ZEALAND

Auckland International Airport is the busiest airport in New Zealand and the main international gateway for the country. It was built in 1965 after relocating from Whenuapai, located North of Auckland.

The airport is planned to have a parallel runway North of the existing runway. Approval for the parallel runway was granted subject to a range of mitigation measures that are described in this section.

Population	1.5 million
Distance to city centre	14 km
Curfew	No
Noise Surcharge	No
Noise Contour Metric	DNL
National Standard	NZS 6805:1992 - Airport noise management and land use planning
2012 Annual Passengers	14 million
Website	www.aucklandairport.co.nz
Ownership Structure	Publicly-Traded Airport Company
Coordinates	37°00′29″S 174°47′30″E

AUCKLAND, NEW ZEALAND

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Key Airport Noise Management Measures

Noise Management	
Airport Curfew	None
Noise Quota	Dictated by noise contours
Noise Surcharges	None
Preferential Runways	Between 2300 and 0600 local time, use runway 23 for take off and runway 05 for landing.
Engine Run-up Restrictions	Maximum 7-day rolling average of Ldn 55 dBA and a Lmax 75 dBA between 10pm and 7am at any dwelling which is in the Main Residential Zone or which is outside the airport designated area and outside the aircraft noise areas.
Land-Use Planning and Insulation Schemes	Auckland International Airport Limited (AIAL) is required to offer acoustic treatment based on Annual Aircraft Noise Contours once Existing Buildings are within the Ldn 60 dBA contour and Ldn 65 dBA contour. Offers in the Ldn 60 dBA contour are 75% funded by AIAL and offers in the Ldn 65 dBA contour are 100% funded by AIAL. AIAL is required to offer acoustic treatment to existing homeowners inside a specified Ldn 57 dBA area affected by engine run noise. AIAL is required to fund up to 75% of the cost of acoustic treatment for new buildings at educational facilities.
Other Noise Abatement	-
Chapter 3 Aircraft Restrictions	None
Noise Monitoring	ANOMS with 3 fixed and 1 portable stations

AUCKLAND, NEW ZEALAND

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Community Outreach Initiatives	
Noise Advisory Board Structure	The purpose of the Aircraft Noise Community Consultative Group (ANCCG) is to consider, and where appropriate make recommendations to AIAL on aircraft noise issues and concerns that arise from the operation and activities at Auckland International Airport. Its membership consist of six (6) Local Board Representatives, one (1) Auckland City Council Representative, one (1) industry Representative, one (1) Airways Corporation Representative (ANS), two (2) Board of Airline Representatives of New Zealand (BARNZ), two (2) Auckland Airport representatives and one (1) Tangata whenua Representative ("People of the Land" or First Nations).
Noise Complaints Management	Auckland Airport supports a direct phone service for noise complaint located in the Apron Tower of the Airport which can be reached on a 24 hours service. Auckland Airport will record the complaint and add any information associated with the complaint, such as runway use and weather as well as contacting Airways Corporation New Zealand for comment. The complaint is then investigated to identify the cause of the noise. A written response outlining the results of the investigation is sent to the complainant.
Other Community Outreach Initiatives	AIAL is required to provide NZ$250,000 per annum to the Airport Community Trust who will distribute it to benefit the local community affected by aircraft noise and working or residing within the Airport Noise Areas.

AUCKLAND, NEW ZEALAND

This section highlights in additional detail some of the noise management practices undertaken at the Auckland International Airport in New Zealand.

Noise mitigation programme

The Manukau District Plan requires the company to offer acoustic treatment packages to owners of houses and educational facilities in noise affected areas. This applies to buildings completed before 10 December 2001, and the treatments reduce the amount of aircraft noise heard inside the buildings. Acoustic treatment packages can include the installation of ventilation systems, insulation and kitchen extractor fans.

Offers are made based on the annual aircraft noise contours and are made when noise reaches a specified level. In April of each year the airport company offers acoustic treatment packages based on the annual aircraft noise contours, and residents are contacted if they are eligible.

Every six months the airport company reports on progress with the noise mitigation programme.

Annual report on aircraft noise

Every year the airport produces a report for Auckland Council that describes and interprets the results of noise monitoring. This is a technical report on the performance of the noise monitoring system and the results that it produced.

Night Movements

Although the Northern Runway is yet to be built, noise mitigation measures have already been established as a condition to the approval for its construction.

Non-jet aircraft using the (future) North Runway between the hours of 11:00pm and 6:00am, and jet aircraft using the North Runway between the hours of 10:00pm and 6:00am, will not be allowed to depart or arrive to/from the east except in special cases.

Compatible Land-Use Planning

The Manukau District Plan creates zones in the community with varying maximum levels of noise allowed in each zone due to aircraft flight operations. These zones are:

- High aircraft noise area (HANA)
- Moderate aircraft noise area (MANA)
- Aircraft noise notification area (ANNA)

Properties in these areas have information on their land information memorandum (LIM) advising that they are in an area affected by aircraft noise. Auckland Airport monitors noise to ensure the maximum level of noise allowed in each zone is not exceeded.

Developers of new houses within the aircraft noise areas must include acoustic treatment measures in their designs. Auckland Airport is also required to provide acoustic treatment to existing houses in these areas once noise reaches certain levels.

AUCKLAND, NEW ZEALAND

Community Trust Fund

Most airports, including YVR, see themselves as an integral part of the community and therefore pride themselves in giving back in a range of ways.

For some airports, a formal concept of Community Trust Fund was created as a bidding condition for significant community infrastructure development projects.

For Auckland Airport, experience was drawn from a similar initiative in Manchester, United Kingdom to develop their own Community Trust Fund.

Manchester International Airport

When planning permission was given in 1997 for the second runway development, it was subject to a detailed Planning Agreement.

Among other things, the Agreement required the Airport to establish a Community Trust Fund in which it would invest £100,000 each year to invest in activities within the areas affected by the activities of Manchester Airport. In addition to the annual contribution by Manchester Airport, income is generated through noise fines levied to airlines.

The Trust has 8 Trustees, with one nominated by the airport, who disperse the funds to local interest groups in line with funding guidelines.

Auckland International Airport

The purpose of this Trust Fund, which was established in 2003, is to manage and distribute a "noise mitigation fund". A decision was made in the Environment Court in 2001 that the airport company would establish this Trust Fund as a condition of the company being granted approval to build a second runway.

The court decision directed the airport company to contribute $250,000 per annum (adjusted by the consumer price index each year) to the Trust Fund.

The Trust Fund is administered by five (5) trustees, two (2) of which are nominated by the airport company.

SYDNEY, AUSTRALIA

Sydney Airport is the busiest airport in Australia (by passenger movements) as well as the main international gateway. Since it began operations in 1920, it has progressively been expanded through land reclamation in Botany Bay and now covers an area of 907 hectares.

Following the commissioning of the third runway, significant outcry from the community led to the introduction of a range of mitigation measures that make Sydney Airport a unique case study.

Population	5 million
Distance to city centre	8 km
Curfew	Yes. Per Sydney Airport Curfew Act 1995
Noise Surcharge	No. In place from 1995 to 2006
Noise Contour Metric	ANEF, N70
National Standard	AS2021-2000: Aircraft noise intrusion - building siting and construction
2012 Annual Passengers	37 million
Website	www.sydneyairport.com.au
Ownership Structure	Publicly-Traded Airport Company 99-year long-term lease from the Federal Government, until 2097.
Coordinates	33°56′46″S 151°10′38″E

SYDNEY, AUSTRALIA

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Noise Management	
Airport Curfew	Yes. Per Sydney Airport Curfew Act 1995
Noise Quota	Yes. Maximum of 80 movements per hour
Noise Surcharges	None. Noise levy under the Aircraft Noise Levy Act of 1995 ceased in 2006.
Preferential Runways	Yes. Per Long Term Operating Plan and "noise sharing" arrangements.
Engine Run-up Restrictions	Yes. Comprehensive policy on operational rules with prior authorization requirement.
Land-Use Planning and Insulation Schemes	Local planning authorities use the ANEF contours to determine the compatibility of different land uses per AS2021-2000. Insulation program now closed but continues to be monitored. Sydney Airport noise insulation program has been an outstanding success with 4,083 homes and 99 public buildings insulated.
Other Noise Abatement	Airlines are subject to various noise abatement procedures.
Chapter 3 Aircraft Restrictions	Large, marginally noise compliant Chapter 3 aircraft are restricted from operating new services from 1 September 2010.
Noise Monitoring	The Sydney component of the NFPMS has twelve permanently installed Noise Monitoring Terminals (NMTs) which are strategically located around Sydney Airport. In addition to the permanent NMTs, there are portable NMTs which may be connected to the system for measuring aircraft noise data at temporary locations, as requested by the Sydney Airport Community Forum.

SYDNEY, AUSTRALIA

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Community Outreach Initiatives	
Noise Advisory Board Structure	Sydney Airport Community Forum (SACF). Membership covers broad community representation across all areas around the airport, the three levels of government and the aviation industry. SACF reports to the Minister and provides advice on noise sharing and managing the noise impacts of Sydney Airport. The independent chair and members of the committee are appointed by the Federal Minister.
Noise Complaints Management	Airservices Australia (Air Navigation Services Provider) manages noise complaints and enquiries about aircraft noise and operations at Sydney Airport through its dedicated Noise Complaints and Information Service (NCIS). The service is the Australian aviation industry's main interface for the community on aircraft noise and related issues. Complaints can be lodged using an online complaint form, the WebTrak system, a complaint Hotline (9am to 5pm), fax or post.
Other Community Outreach Initiatives	Multi-lingual communication tools. Webtrak Monitoring. Airport conducts extensive community engagement.

SYDNEY, AUSTRALIA

Background

Sydney Airport is Australia's busiest airport with 37 million passengers per year (2012). In order to meet the projected demand in traffic, the construction of a third runway was commissioned in 1989 and completed in November 1994.

The Environmental Impact Study of the third runway had heavily focussed on the use of Noise Exposure Forecasts (ANEF in Australia) and led many in the community to believe that living outside the contours was a confirmation that they would not be adversely affected. These contours were found to be useful for the purpose of land-use planning but in no way suitable to pre-empt annoyance from noise in the community.

Literally overnight after the opening of the runway, complaints increased significantly and public outcry led to a significant political backlash.

A Senate Committee on Aircraft Noise in Sydney was formed and identified many deficiencies in the way in which aircraft noise information had been conveyed to the public. This subsequently led to the introduction of a range of measures that have affected the development of the airport ever since:

- Sydney Airport Curfew Act 1995
- Sydney Airport Demand Management Act 1997 (80 movements/hour)
- Long Term Operating Plan (LTOP)
- Creation of the Sydney Airport Community Forum (SACF)
- Aircraft Noise Levy Act 1995
- Aircraft Noise Levy Collection Act 1995

Table 1.1 Sydney Airport Complaints

Year	Number of complaints	Average per month
1987	622	52
1988	1423	119
1989	1598	133
1990	1790	149
1991	1271	106
1992	1237	103
1993	1375	115
1994	12,977	1081 [a]
1995 [b]	43,035	4300

Notes to Table 1.1:

a Average monthly figure before the opening of the parallel runway: 105.
Average monthly figure after the opening of the parallel runway: 5964.

b Total to end of August 1995.

Source: Drummond (1996)

SYDNEY, AUSTRALIA

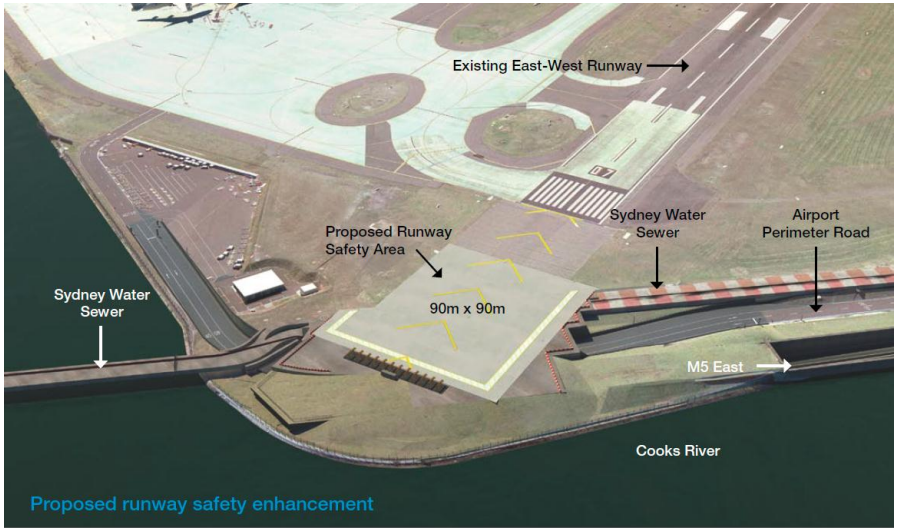
10 years after the commissioning of the new parallel runway, Sydney Airport was to undertake another significant infrastructure development project with would lead to temporary impacts on surrounding communities. From the lessons learned a decade earlier, Sydney Airport tackled this project very differently.

Major Development Plan (MDP) – Runway Safety Enhancements

Sydney Airport Corporation Limited (SACL) was required to construct a Runway End Safety Area (RESA) for Runway 25 in accordance with requirements introduced in 2003 by the Civil Aviation Safety Authority (CASA) and consistent with requirements of ICAO.

Runway 07/25 (east-west runway) provides crosswind capability as well noise sharing capability under the airports Long Term Operating Plan.

Under the proposed RESA construction plan, the runway had to be effectively closed for almost 10 months, leading to a temporary reduction in the ability to implement noise sharing and to changes to flight patterns over certain parts of the city.



Source: SACL

SYDNEY, AUSTRALIA

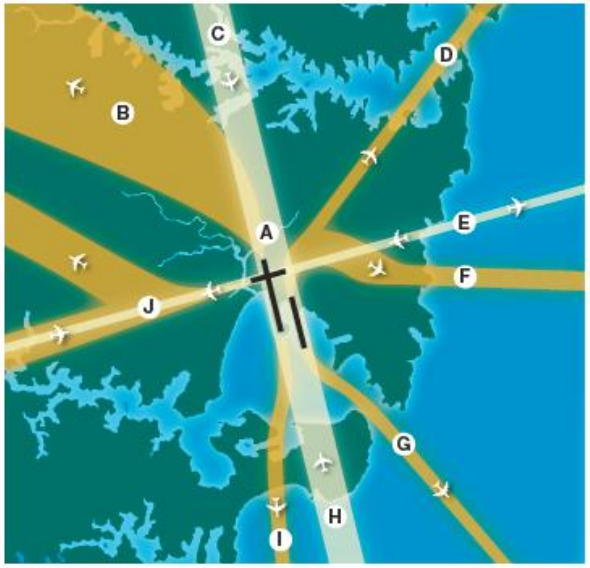
Consultations

During the public comment period, SACL used a range of techniques to provide the community and project stakeholders with information regarding the RESA proposal and to seek their feedback on key issues and concerns.

The following techniques were used:

- Public comment period on the Draft MDP
- Website information
- Community information line and project email address
- Newspaper advertisements
- Correspondence
- Information brochure letterboxed to around 100,000 households (at 3 stages during the project life)
- Draft MDP Summary booklet
- Frequently Asked Questions sheet
- Media release
- Stakeholder meetings
- Council presentations
- Door-to-door delivery of information
- Community and industry information sessions
- Project display

Existing approach and departure flight tracks used by aircraft



Estimated change in aircraft movements resulting from temporary closure of east-west runway*

Flight track	Average flight movements per day in 2006[1]	Maximum daily change in flight movements when east-west runway is temporarily closed	
		Aircraft preferentially assigned to runway 16R[2]	Aircraft preferentially assigned to runway 34R[2]
A[4]	143	+ 69	+ 38
B	46	0	+ 31
C	97	+ 69	+ 7
D	24	- 12	- 8
E	24	- 24	- 24
F	31	+ 4	+ 30
G	38	+ 46	+ 16
H	121	- 23	+ 38
I	106	- 20	- 50
J	39	- 39	-39

* Source: Sydney Airport Runway Safety Enhancement Project: Detailed Assessment of Noise Impacts, Hegglas Pty Ltd. (March 2006)

Source: SACL

SYDNEY, AUSTRALIA

Communications in Foreign Languages

Outreach to households speaking a language other than English is undertaken by SACL as part of major consultations and communications processes.

SACL used a range of techniques and provides information to target the following communities:

- Chinese
- Arabic
- Italian
- Vietnamese
- Greek
- Macedonian
- Spanish

Some techniques used for the dissemination of information were as follows:

- Newspaper advertisements
- Information brochure
- Community and industry information sessions

Community Update

Sydney Airport Master Plan 2009

معلومات عامة للمجتمع

خطة المشروع الرئيسية لمطار سيدني لعام ٢٠٠٩

Mail:
Mr Ted Plummer
Manager - Major Projects Consultation and Communications Sydney Airport Corporation Limited Locked Bag 5000 Sydney International Airport NSW 2020

Email:
masterplan@syd.com.au

Fax:
(02) 9338 4901
For further information please phone the Master Plan 2009 community information line on
1300 79 65 93
or Ted Plummer
at Sydney Airport on (02) 9667 6182.

welcome to Sydney

雪梨機場社區資訊更新

美好的未來，從現在開啓!

新規劃

更環保

更方便乘客

高效能

與社區民衆交談

想瞭解更多：

Welcome to Sydney

Source: SACL

SYDNEY, AUSTRALIA

Long Term Operating Plan (LTOP)

The LTOP was developed in the mid 1990s in response to community pressure to share the noise generated by aircraft using Sydney Airport.

A key feature of the LTOP is the runway rotation system. This system involves using different combinations of runways (runway modes) at different times of the day in an attempt to provide individual areas with periods of respite from aircraft noise. This system is in operation in all non-curfew hours at the airport.

There are three pillars on which LTOP is based, in order of priority:

1. Safety – of aircraft operations
2. Capacity – within the 80 movement / hour cap set by the Sydney Airport Demand Management Act 1997
3. Environment – noise sharing through the use of noise sharing modes.

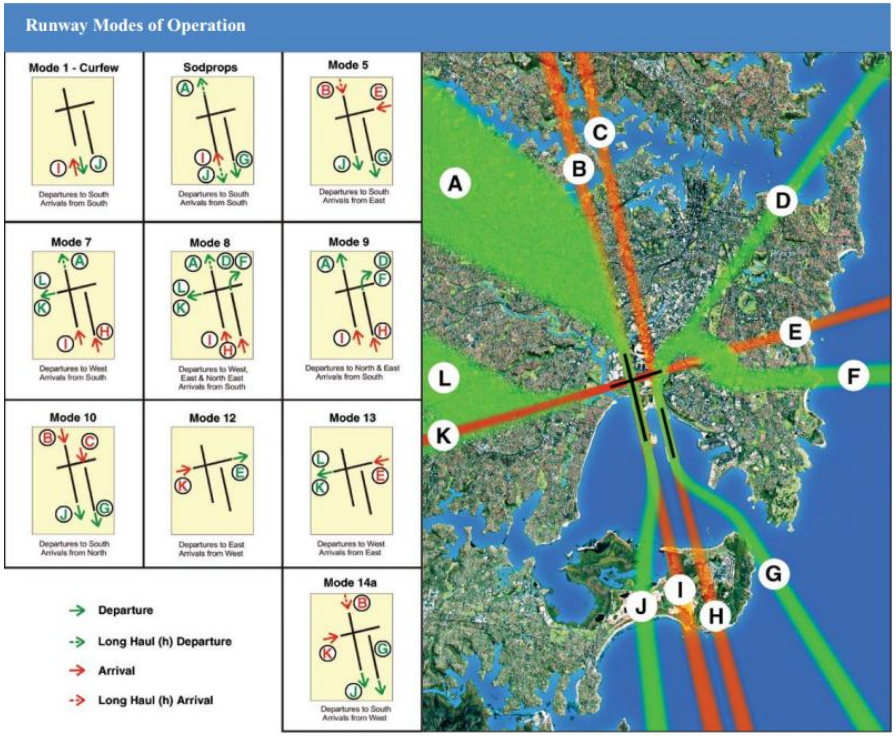


Illustration of the 10 different ways of using the Airport's three runways, called Runway Modes of Operation, under the Long Term Operating Plan (LTOP). The associated flight paths for aircraft arriving and departing from Sydney Airport are labelled A to L.

Source: Airservices Australia

SYDNEY, AUSTRALIA

Curfew Economic Impacts

A formal curfew was introduced at Sydney Airport through the Sydney Airport Curfew Act 1995.

The curfew operates from 11:00pm until 6:00am.

The principal categories of exceptions include small (less than 34,000kg) noise certificated propeller driven aircraft and 'low noise' jets. A specified number of operations per week are permitted by Chapter 3 domestic freight aircraft.

Under the current curfew arrangements, 24 landings are permitted per week between 5:00am and 6:00am by international passenger services provided they land over the water to the south of the Airport. During the curfew hours all aircraft must operate over Botany Bay, that is take-offs to the south and landings to the north. The curfew restrictions do not apply in cases of emergency.

This curfew has a significant economic impact to the region. According to the federal government's latest international visitor survey, each tourist spends almost $2,000 on a trip to Sydney, slightly less than in Melbourne. It was reported that if Sydney could accommodate a similar number of flights compared to Melbourne between the hours of 11:00pm and 1:00am, the economy of the State of New South Wales would receive a $300 million boost.

Similarly, it was reported that the economic benefits for Melbourne-Tullamarine of being curfew free has economic impacts of $590 millions annually on the State of Victoria's economy through visitor spending.

BRISBANE, AUSTRALIA

Brisbane is the third busiest Australian airport after Melbourne and Sydney. It was built in its current location in 1988 after relocating from nearby Eagle Farm.

More recently, Brisbane has undertaken a comprehensive Environmental Impact Study and extensive consultation around the development of a parallel runway for which approval was granted in 2007. Construction will take approximately eight (8) years because of the soft and waterlogged soil conditions which will require extensive extraction of sand from Moreton Bay and compacting to allow for civil works to proceed.

Population	2.2 million
Distance to city centre	8 km
Curfew	No
Noise Surcharge	Yes. For marginally compliant aircraft.
Noise Contour Metric	ANEF
National Standard	AS2021-2000: Aircraft noise intrusion - building siting and construction
2012 Annual Passengers	21 million
Website	www.bne.com.au
Ownership Structure	Private Non-Listed Airport Company 50-year long-term lease from the Federal Government, with an option for 49 years
Coordinates	27°23′00″S 153°07′06″E

BRISBANE, AUSTRALIA

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Noise Management	
Airport Curfew	None
Noise Quota	None
Noise Surcharges	25% additional landing charge on marginally noise compliant Chapter 3 aircraft
Preferential Runways	When demand permits, Runway 19 is preferred for landings and Runway 01 for departures. Non-jet aircraft can use Runway 14 for landings and Runway 32 for departures.
Engine Run-up Restrictions	Approval Required.
Land-Use Planning and Insulation Schemes	Local planning agencies use the ANEF contours to determine the compatibility of different land uses per AS2021-2000. No insulation program in place.
Other Noise Abatement	Take-off and landings are conducted above water and away from residential areas when possible.
Chapter 3 Aircraft Restrictions	Large, marginally noise compliant Chapter 3 aircraft were restricted from operating new services from 1 September 2010.
Noise Monitoring	The Brisbane component of the NFPMS has five permanently installed Noise Monitoring Terminals (NMTs) which are strategically located around Brisbane Airport. In addition to the permanent NMTs, there are portable NMTs which may be connected to the system for measuring aircraft noise data at temporary locations, if requested by the Brisbane Airport Consultative Committee.

BRISBANE, AUSTRALIA

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

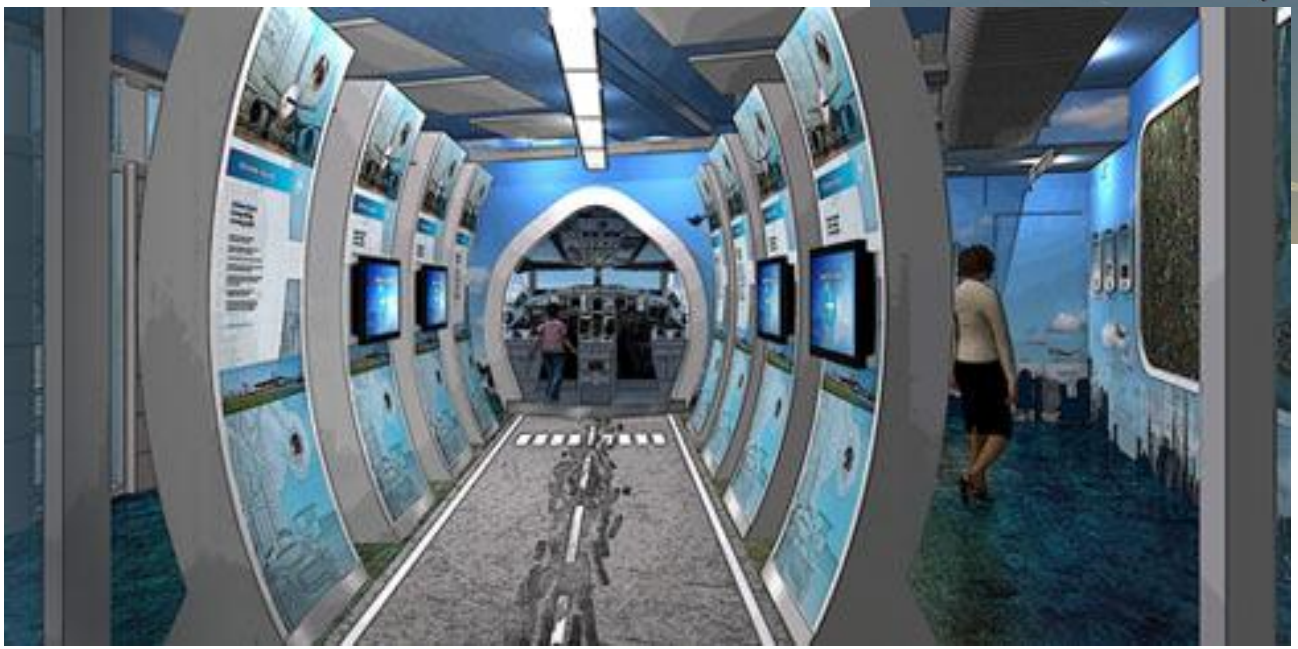
Community Outreach Initiatives	
Noise Advisory Board Structure	Brisbane Airport Community Aviation Consultation Group is a consultative forum independently chaired by Major General Peter Arnison (Retd). Membership of the BACACG is drawn across the Greater Brisbane Airport area, representing a distance of up to 15 kilometres. A member is nominated by each of the Federal House of Representative Members whose seats directly border the Airport and/or are within a 15 kilometre radius.
Noise Complaints Management	Airservices Australia (Air Navigation Services Provider) manages noise complaints and enquiries about aircraft noise and operations at Brisbane Airport through its dedicated Noise Complaints and Information Service (NCIS). The service is the Australian aviation industry's main interface for the community on aircraft noise and related issues. Complaints can be lodged using an online complaint form, the WebTrak system, a complaint Hotline (9am to 5pm), fax or post.
Other Community Outreach Initiatives	The Experience Centre (Brisbane Airport) Webtrak Monitoring (Airservices Australia) Planned community information exchange sessions held in high impact suburbs. Participation in and support of local community festivals and events.

BRISBANE, AUSTRALIA

The Experience Centre

Opened in 2010, the Brisbane Airport Experience Centre is located at the Airport Village and is home to a wealth of information about the airport's history, environmental initiatives, current operations and future expansion plans.

Designed as an interactive experience, the centre is the hub for information about Brisbane Airport. It is part of a larger Community Engagement Program that is also designed to support community projects, arts' excellence, new world sports and aviation education.



Source: BAC

BRISBANE, AUSTRALIA

Real Estate Disclosure

The Real Estate Institute of Queensland (REIQ) and Brisbane Airport Corporation (BAC) announced in November 2012 a partnership aimed at empowering property buyers and agents through mutual education around current and future flight paths in order to prevent situations where buyers make an investment without fully understanding current and future flight activity near that property.

The REIQ and BAC will use a collaborative approach to promote online tools that outline current flights paths and noise levels, in addition to future flight paths and areas of higher aircraft noise.

The two main tools available today are web-based and can be used without any knowledge of aviation.

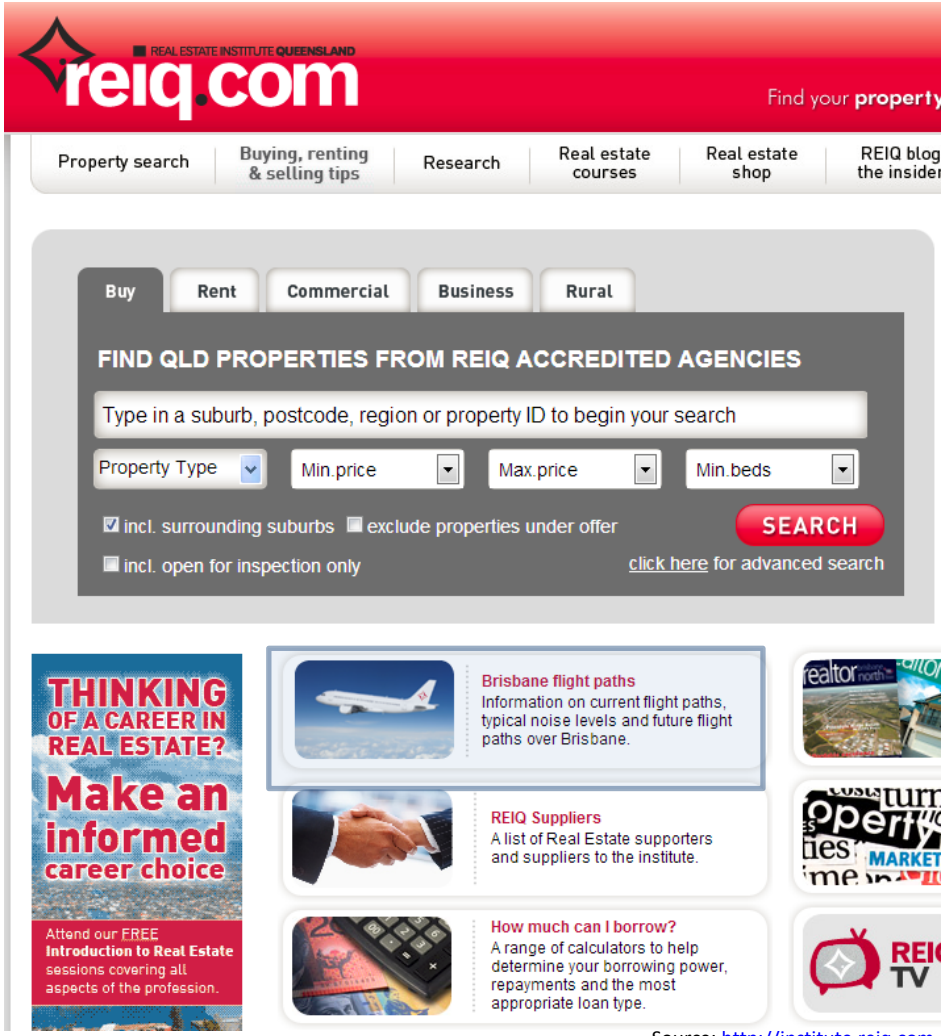
WebTrak

One tool is WebTrak, an online software used (including Vancouver Airport) to track individual aircraft movements.

Current and future flight paths

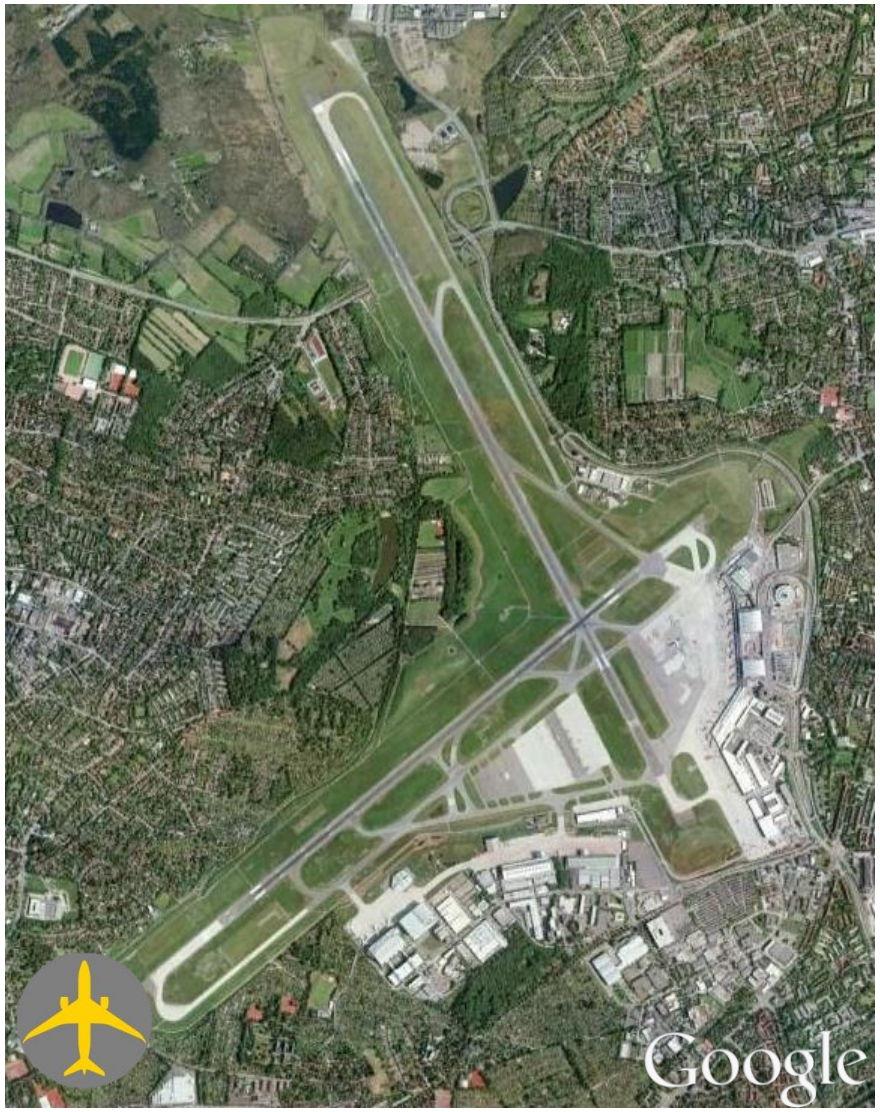
Brisbane Airport's online visitor centre includes new flight path information software, which provides comprehensive information about current and future flight paths into and out of the airport.

The site also details the expected number of flights into and out of Brisbane during typical busy days, evenings and nights.



Source: http://institute.reiq.com

HAMBURG, GERMANY



Originally opened in 1911, Hamburg Airport is the fifth busiest airport in Germany by passenger movements. Located in the country's north, its key markets include domestic markets in the country's south (Frankfurt, Munich and Stuttgart) and international markets in London and Zurich as well as point to point leisure markets.

Hamburg Airport is significantly constrained due to ongoing urban encroachment.

Population	5 million
Distance to city centre	8 km
Curfew	Yes
Noise Surcharge	Yes
Noise Contour Metric	Laeq / Lamax
National Standard	Act for Protection against Aircraft Noise
2012 Annual Passengers	13.5 million
Website	www.airport.de
Ownership Structure	Private Non-Listed Airport Company
Coordinates	53°37′49″N 009°59′28″E

HAMBURG, GERMANY

Key Airport Noise Management Measures

Noise Management	
Airport Curfew	0600-2300 Normal operating hours 2300-2400 Only delayed scheduled and regular charter flights 2400-0600 Only for declared emergencies or medical flights
Noise Quota	There is a restriction to the size of the noise footprint surrounding the airport for the 62 dB (A) contour. The footprint cannot exceed the 1997 contour. Comparison of contours is made annually in the noise report.
Noise Surcharges	A noise surcharge applies for all take-offs and landings for aircraft exceeding 2,000kg (maximum take-off weight). The surcharge has seven (7) levels which range from €5.50 to €1,350.00. Aircraft are categorized as per their average noise emissions as measured in Hamburg.
Preferential Runways	Arrival aircraft over 200,000kg maximum landing weight shall use Runway 05 or 15. For take-offs Runway 33 shall be used. Between hours 2200-0700 Runway 15 shall be used. Exceptions are permitted only if required for traffic situation or air traffic safety.
Engine Run-up Restrictions	Engine test runs outside the noise abatement hanger are permitted only after prior consent
Land-Use Planning and Insulation Schemes	Law requires Hamburg Airport to provide financial support to people whose household lies within a certain noise boundary. People wishing to apply for financial support need to apply through the local government.
Other Noise Abatement	Engine run-up hanger – the airport has a fully enclosed engine run-up hanger that can accommodate aircraft up to a B747. The airport publishes detailed noise abatement procedures for arrivals with speed and altitude recommendations. Continuous descent arrival (CDA) procedures are also available for fuel and noise reduction.
Chapter 3 Aircraft Restrictions	Noise abatement procedures require certain departure procedures for Chapter 3 aircraft.
Noise Monitoring	Thirteen (13) noise monitoring stations surround Hamburg Airport. The airport website provides average noise levels at each monitoring station for each month of the previous two years.

HAMBURG, GERMANY

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Community Outreach Initiatives	
Noise Advisory Board Structure	Aircraft Noise Abatement Commission in accordance with § 32b of the German Aviation Act. Members are appointed by the Government.
Noise Complaints Management	Noise Complaints are handled by the air traffic services provider. http://www.dfs.de/dfs_homepage/en/Services/Customer%20Relations/Complaints/Aircraft%20noise%20complaints/
Other Community Outreach Initiatives	Experience the Airport - Hamburg Airport has a model exhibition that simulates operations at the airport. It is the feature attraction of various airport experiences that include an outdoor viewing terrace and airside tours of aprons and the fire brigade facility.

HAMBURG, GERMANY

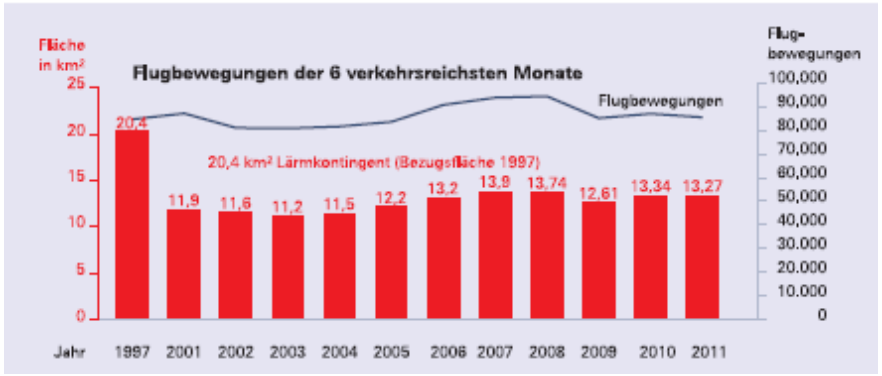
Noise Reports

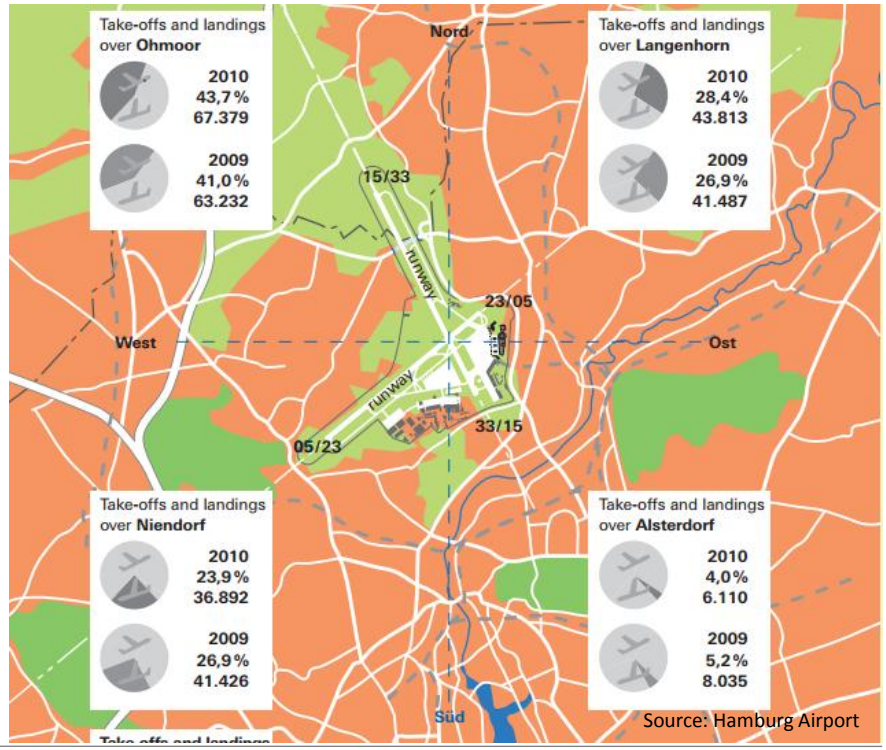
The annual noise report is used by Hamburg Airport as a general environmental communication tool. A main focus of the report is to update the community on the noise footprint of the previous years' operations. Graphics are a key feature of the report and are used to illustrate:

- Noise footprint and aircraft movement comparison over the previous 10 years
- Movements by quadrants

The use of a noise footprint comparison helps illustrate an improvement over time due to quieter aircraft operations as well as the regulations imposed on flight movements with any yearly change is explained in detail in the report. One such regulation is to not exceed the base year (1997) noise footprint.

The report includes information on various environmental projects that are current at the airport, which help highlight the airport in conducting initiatives in the area of environmental impact.





Source: Hamburg Airport

HAMBURG, GERMANY

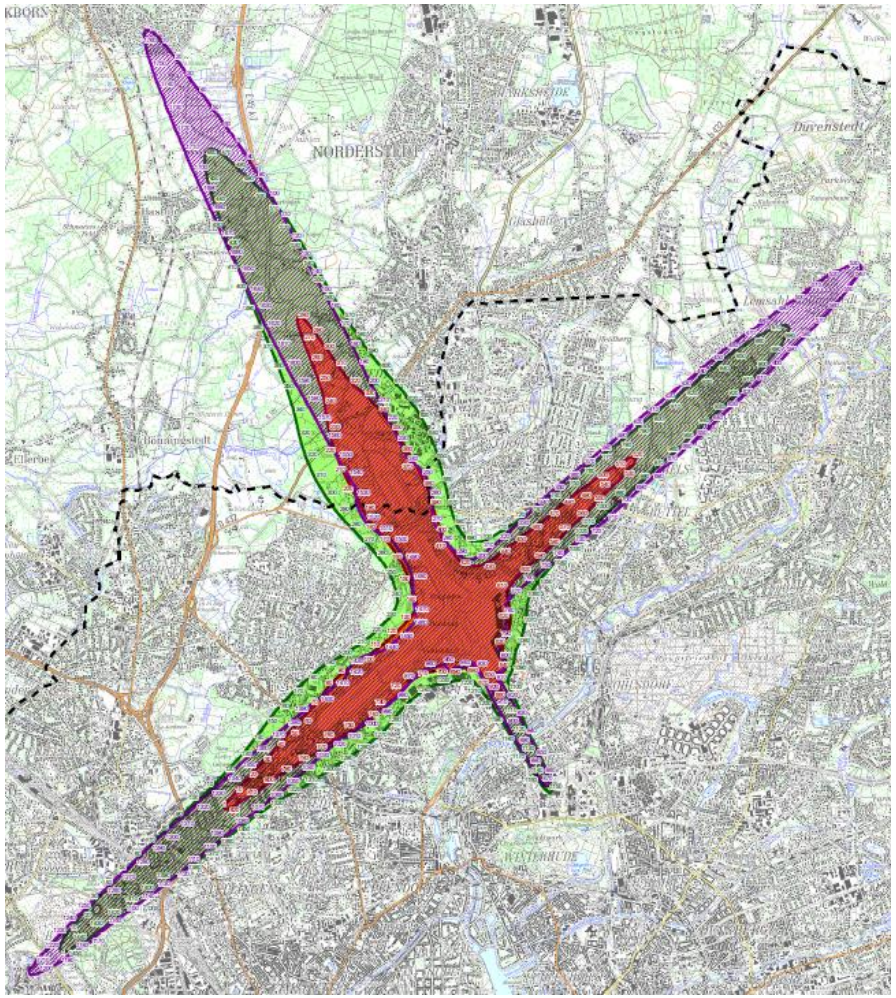
Noise Protection Area

Hamburg Airport is required under Federal Law to provide financial support to people whose household lies within a certain noise boundary. This law was amended in 2007 based on new research into the impact of noise on people. There are two distinct protection zones that are eligible for financial support for noise insulation expenses:

- Protection Zone 1 – households can apply for support up to 150€ per m² for all rooms
- Night Protection Zone – households can apply for support up to 150€ per m² for bedrooms

People wishing to access financial support need to apply through the local government. Once approval is given that the household in question is within a protection zone the applicant will then provide confirmation to the airport for financial support.

Information on the noise protection area is also found on the Hamburg Airport and the state government website.



Source: Hamburg Airport

HAMBURG, GERMANY

Adventure Airport

Hamburg Airport actively engages the local community through many ways, not only from an environmental perspective. The airport has taken the approach that raising understanding of airport operations will result in better community acceptance. This is apparent in how they deliver their environmental information (in a newsletter type format) and through the way they open the airport to the community to experience it even when they are not travelling.

Hamburg Airport has an impressive 1:87 scale 150 m^2 model exhibition that simulates operations at the airport, and is a major tourist attraction in Hamburg. It is the feature attraction of the Adventure Airport programme that also includes other various airport experiences such as an outdoor viewing terrace and airside tours of aprons and the fire brigade facility.

A recent addition to Hamburg Airport's tools for communication with the public is the "Infomobil". The Infomobil is part of their Good Neighbour Policy and is present at various city events and provides information about the airport, including construction projects, noise protection programs and security.

Source: Hamburg Airport

Source: Hamburg Airport

HAMBURG, GERMANY

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Noise Surcharge

Hamburg Airport imposes a noise surcharge as per the following specification:

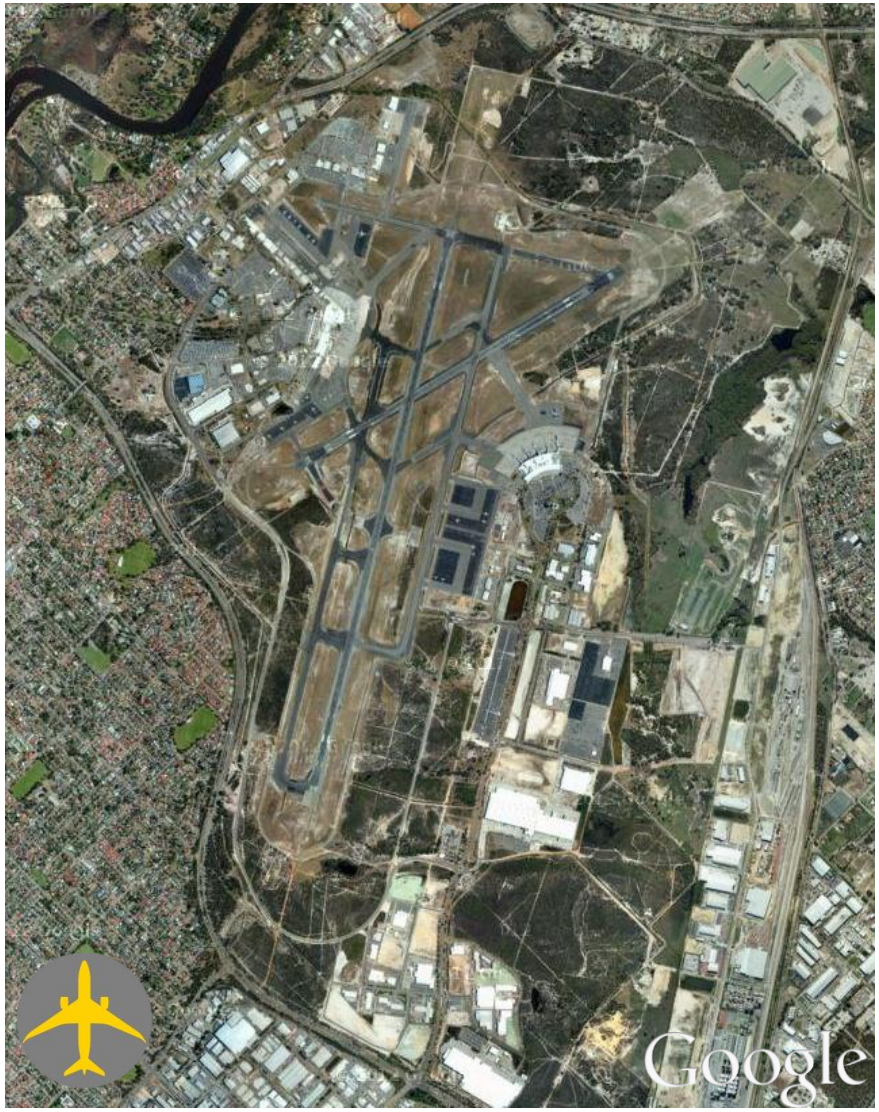
"A noise surcharge will be levied on all landing s and take-offs of aircraft exceeding 2,000 kg Maximum Take-Off Mass (MTOM). The noise surcharge is graduated according to the noise emission classes. The noise emission classes are based on average noise emission levels per aircraft type and series, as measured in Hamburg."

Hamburg Airport, *Airport Charges*, January 1st, 2011

Noise Emission Classes						
1	**2**	**3**	**4**	**5**	**6**	**7**
up to 71,9 dB(A)	72,0 to 74,9 dB(A)	75,0 to 77,9 dB(A)	78,0 to 80,9 dB(A)	81,0 to 83,9 dB(A)	84,0 to 86,9 dB(A)	up 87,0 dB(A)
5,50 €	**13,00 €**	**27,00 €**	**55,00 €**	**160,00 €**	**421,00 €**	**1.350,00 €**
AC68	ACJ	A3181	A300F	A3002	A3004	AN12
AC69	AT72	A3191	A300S	A3006	B7272	AN4R
AC6T	AT722	AJ25	A3201	A3102	FK28	B7471
AN2	AT725	B7376	A3202	A3103	IL96	B7472
AT42	BD70	BA461	A3211	A3302	MD11	B7473
AT423	BE39	BA462	A3212	A3402	MD81	B747S
AT424	BE55	BA463	A3303	A3403	MD82	C141
AT425	BE60	BE40	A3406	A3405	MD83	DC103
ATP	BN2	BJ40	AN74	AN26	MD88	DC93
BA31	C414	C337	B7373	B7372	TU54	G2

Source: Hamburg Airport

PERTH, AUSTRALIA



Perth Airport is located on the West Coast of Australia and is the 4th busiest airport in country. The existing airport site has been in use for civilian operations since 1944 and was privatized in 1997.

Population	1.8 million
Distance to city centre	12 km
Curfew	No
Noise Surcharge	No
Noise Contour Metric	ANEF
National Standard	AS2021-2000: Aircraft noise intrusion - building siting and construction
2012 Annual Passengers	12.6 million
Website	www.perthairport.com.au
Ownership Structure	Private Non-Listed Airport Company 50-year long-term lease from the Federal Government, with an option for 49 years
Coordinates	31°56′25″S 115°58′01″E

PERTH, AUSTRALIA

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Noise Management	
Airport Curfew	None
Noise Quota	None
Noise Surcharges	None
Preferential Runways	Runway 21 is the preferred take-off runway while Runways 21 and 24 are preferred for landings.
Engine Run-up Restrictions	From 0530 to 2100 local time, there are no restrictions other than on locations. From 2100 to 2300 local time, there is no time limitation at ground idle power; however at above ground idle power each aircraft is limited to 15 minutes. From 2300 to 0530 local time turbo-jet, turbo-prop and piston powered aircraft are restricted to ground idle power only with no time limits, however piston engine aircraft may exceed ground idle power for essential maintenance for a single maximum period of 5 minutes per aircraft.
Land-Use Planning and Insulation Schemes	Local planning agencies use the ANEF contours to determine the compatibility of different land uses per AS2021-2000. No insulation program is in place. The State Government of Western Australia has the responsibility for land use planning outside the airport boundary. The Statement of Planning Policy No. 5.1 (SPP No. 5.1) - Land Use Planning in the Vicinity of Perth Airport describes the manner in which the State Government will develop land surrounding Perth Airport to be compatible with the future development of the airport.
Other Noise Abatement	Ongoing trial of additional use of Royal Australian Air Force (RAAF) airspace when the area is not in use by Defence.
Chapter 3 Aircraft Restrictions	Large, marginally noise compliant Chapter 3 aircraft are restricted from operating new services from 1 September 2010.
Noise Monitoring	The Perth component of the NFPMS has 6 permanently installed Noise Monitoring Terminals (NMTs) which are strategically located around Perth Airport. In addition to the permanent NMTs, there are portable NMTs which may be connected to the system from time to time.

PERTH, AUSTRALIA

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Community Outreach Initiatives	
Noise Advisory Board Structure	The Aircraft Noise Management Consultative Committee (ANMCC) membership is determined by Perth Airport PTY LTD and comprise Federal Members of Parliament representing electorates impacted by aircraft noise, representative of municipalities affected by aircraft noise and community representatives from high noise affected areas. Also representatives from relevant Federal and State Government agencies participate together with representatives of the aviation industry.
Noise Complaints Management	Airservices Australia (Air Navigation Services Provider) manages noise complaints and enquiries about aircraft noise and operations at Perth Airport through its dedicated Noise Complaints and Information Service (NCIS). The service is the Australian aviation industry's main interface for the community on aircraft noise and related issues. Complaints can be lodged using an online complaint form, the WebTrak system, a complaint Hotline (9am to 5pm), fax or post.
Other Community Outreach Initiatives	Webtrack monitoring system is in place and publication of alternative noise metrics.

PERTH, AUSTRALIA

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

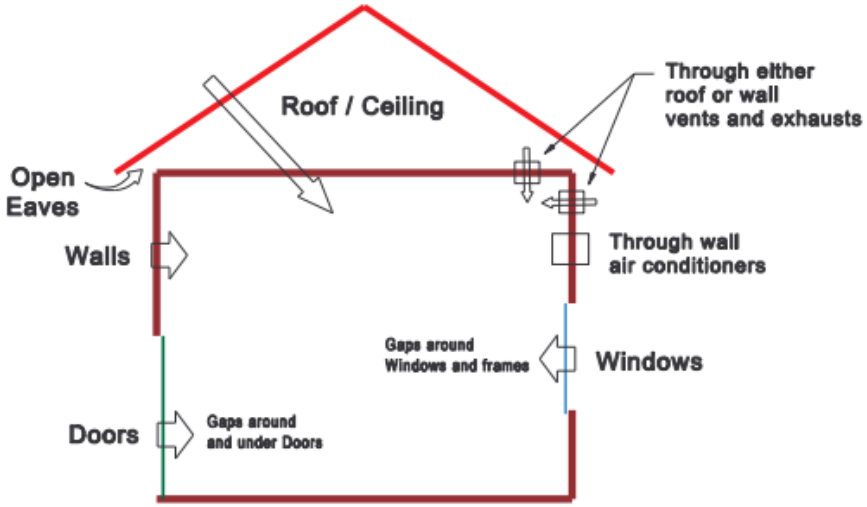
Reducing Noise inside Existing Homes

Perth Airport has developed an information booklet to provide assistance to existing home owners adversely affected by aircraft noise and wish to reduce noise intrusion into their homes.

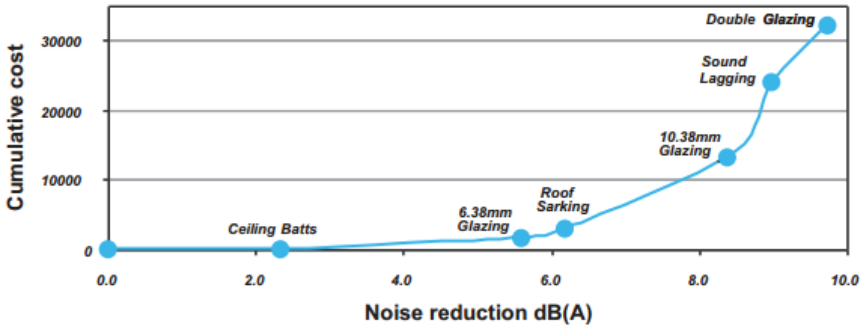
The booklet provides insightful tips, likely benefits and costs for several components of an existing house such as:

- Roof / Ceiling
- Walls
- External Doors
- Windows
- Vents / Exhausts
- Open Eaves
- Air Conditioning / Ventilation Systems
- Fire places

The Western Australia Planning Commission issued a similar document that goes into additional technical details.



Source: Perth Airport



Source: Western Australia Planning Commission

MELBOURNE, AUSTRALIA

Melbourne-Tullamarine Airport is the second busiest airport in Australia after Sydney. It was opened North of the city in 1970 as a replacement to Essendon Airport, located closer to downtown, which is still opened for general aviation operations.

In 2012, Melbourne airport announced that it was expecting a third runway to be required in 2018-22 with a preference for a East-West orientation parallel to the existing runway.

Population	4.2 million
Distance to city centre	23 km
Curfew	No
Noise Surcharge	No
Noise Contour Metric	ANEF
National Standard	AS2021-2000: Aircraft noise intrusion - building siting and construction
2012 Annual Passengers	28 million
Website	www.melbourneairport.com.au
Ownership Structure	Private Non-Listed Airport Company 50-year long-term lease from the Federal Government, with an option for 49 years
Coordinates	37°40'24"S 144°50'36"E

MELBOURNE, AUSTRALIA

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Noise Management	
Airport Curfew	None
Noise Quota	None
Noise Surcharges	None
Preferential Runways	Runways 16 and 27 are preferred for landings and Runways 27 and 34 are preferred for takeoffs between 0600 and 2300 except under high capacity landing modes where LAHSO (Landing and Hold Short) is used off Runway 27 and 34, or 34 and 09. For nighttime operations, Runway 16 is preferred for landings and Runway 27 is preferred for takeoff.
Engine Run-up Restrictions	Yes. Approval and special conditions apply.
Land-Use Planning and Insulation Schemes	Local planning agencies use the ANEF contours to determine the compatibility of different land uses per AS2021-2000. No insulation program is in place.
Other Noise Abatement	No intersection departures allowed at nighttime
Chapter 3 Aircraft Restrictions	Large, marginally noise compliant Chapter 3 aircraft are restricted from operating new services from 1 September 2010.
Noise Monitoring	The Melbourne component of the NFPMS has seven permanently installed NMTs which are strategically located around Melbourne Airport but also nearby Essendon Airport.

MELBOURNE, AUSTRALIA

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Community Outreach Initiatives	
Noise Advisory Board Structure	Melbourne Airport has two consultative committees with input on aircraft noise related issues. The Community Aviation Consultation Group (CACG) is an independent forum where community members and organisations can raise opinions and issues regarding the airport. The CACG has 10 members consisting of local community representatives, Australian Mayoral Aviation Council, Trades Hall Council, Department of Planning and Community Development and an independent chair. In addition to the members noted above, meetings are attended by representatives from the Department of Infrastructure and Transport, Air Services Australia and Melbourne Airport management. The Noise Abatement Committee is chaired by Melbourne Airport and consists of representatives from Airservices Australia, the major airlines, State EPA, Australian Government Department of Infrastructure, Victorian Department of Planning and Community Development, local councils around Melbourne Airport and the operator of Melbourne Airport. The Committee's role is to review the impact of aircraft noise exposure on the surrounding community and, in a consultative manner, make recommendations to minimize the effect of aircraft noise.
Noise Complaints Management	Airservices Australia (Air Navigation Services Provider) manages noise complaints and enquiries about aircraft noise and operations at Melbourne Airport through its dedicated Noise Complaints and Information Service (NCIS). The service is the Australian aviation industry's main interface for the community on aircraft noise and related issues. Complaints can be lodged using an online complaint form, the WebTrak system, a complaint Hotline (9am to 5pm), fax or post.
Other Community Outreach Initiatives	Webtrak Monitoring is in place

MELBOURNE, AUSTRALIA

Third Runway

Forecasts show that Melbourne Airport's existing two runways will reach capacity somewhere between 2018-2022. Melbourne Airport has undertaken extensive studies and research, in order to determine the preferred orientation of its third runway using a range of criteria including noise considerations.

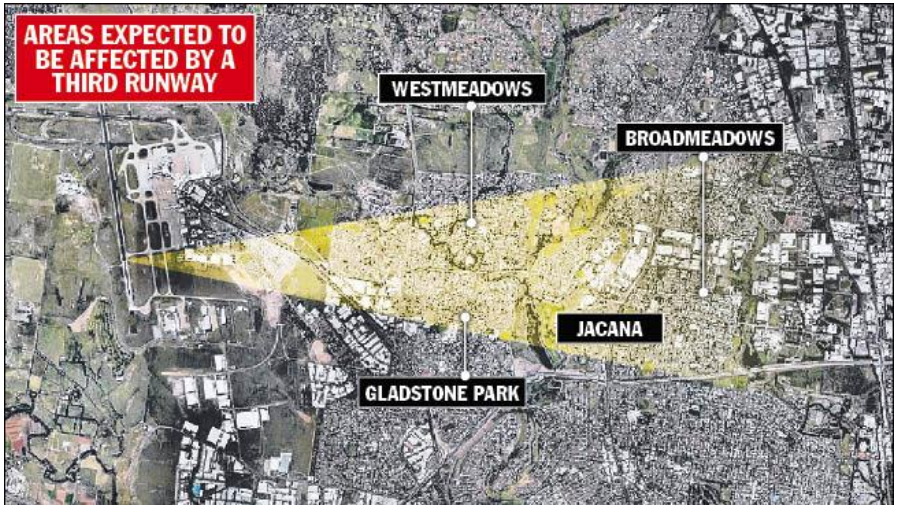
Public consultation on the plan will be sought in the second quarter of 2013, with the necessary planning, consultation and approval process expected to be carried out by 2015-2016.

The new runway would have a construction timeframe of two to four years, which will see it ready for operation around 2018-2022.

Alternative Noise Metrics

Land use planning controls for areas around the airport have been in place since 1992. Melbourne Airport acknowledges the shortcomings of the ANEF system to assess the full impact of aircraft noise and is moving towards the use of supplementary noise metrics such as N60/N65/N70 contours, in accordance with the National Airports Safeguarding Framework (Guideline A).

Source: heraldsun.com.au



Source: heraldsun.com.au

SCHIPHOL, NETHERLANDS

Located south of Amsterdam, Schiphol Airport is the Netherlands main international hub and one of the busiest airports in the World with over 50 million passengers processed in 2012.

The airport has 6 runways, the most recent one commissioned in 2003. At 3,800m long, Runway 18R/36L is the airport's longest and positioned to reduce noise impacts on surrounding communities

Population	2.2 million
Distance to city centre	9 km
Curfew	No. Night Noise Quota
Noise Surcharge	Yes
Noise Contour Metric	Lden (Lnight,Lday) and N60/70
National Standard	Netherlands Aviation Act, Building Act and Schiphol Airport Zoning Decision
2012 Annual Passengers	51 million
Website	www.schiphol.com
Ownership Structure	Private Non-Listed Airport Company
Coordinates	52°18'29"N 004°45'51"E

SCHIPHOL, NETHERLANDS

VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Key Airport Noise Management Measures

Noise Management	
Airport Curfew	No. Some restrictions on marginally compliant Chapter 3 aircraft during nighttime.
Noise Quota	In 2003 aircraft movements operating quota for Amsterdam Airport Schiphol were replaced by another system with no specific limit on the annual number of movements . However, a total noise volume (TVG) limit is now enforced for Lden and Lnight, and maximum noise levels in 35 enforcement points Lden and 25 points Lnight.
Noise Surcharges	There are two noise charges in effect at the airport - one charged by the airport and the other by the government.
Preferential Runways	Preferential runway use sequence with wind criteria.
Engine Run-up Restrictions	From 2200 – 0600 (2100 – 0500 summer) reverse thrust above idle not be used safety permitting
Land-Use Planning and Insulation Schemes	Demolition: buildings within the 65 Ke (Pre-2003 contours) and 71 dB(A) Lden contours Insulation: buildings within the 40, 50 and 60 Ke noise contour (Pre-2003 contours) for the 24 hour period and Laeq = 26 dB(a) for the night.
Other Noise Abatement	During daytime 0600-2200 (0500-2100): After landing, the use of idle reverse thrust is advised on all runways except RWY 04/22, safety permitting. During nighttime 2200-0600 (2100-0500): After landing, reverse thrust above idle shall not be used on any runway, safety permitting.
Chapter 3 Aircraft Restrictions	Aircraft certified with a margin less than 5 EPNdB below Chapter 3 standards are not allowed to operate as follows: 1. Engines with bypass ratio <= 3, all new operations. 2. Engines with bypass ratio <= 3, all operations between 1700-0700 (1600-0600 summer). 3. Engines with bypass ratio > 3, take-off between 2200-0500 (2100-0400 summer).
Noise Monitoring	Amsterdam Airport Schiphol has a noise monitoring system installed called NOMOS. The manufacturer is B&K. Currently 24 fixed unit's and 1 mobile unit are operational.

SCHIPHOL, NETHERLANDS

Key Airport Noise Management Measures	
Community Outreach Initiatives	
Noise Advisory Board Structure	Schiphol has two important bodies which consult with municipalities and local resident representatives: the Schiphol Regional Consultative Committee (CROS) and the Alders Platform. Schiphol participates in plenary meetings and various working groups of the CROS. Through consultation between the parties involved, the CROS aims to foster airport use that recognizes the diverse range of interests. In the CROS, local residents, administrators and sector partners cooperate in project and working groups on issues concerning the airport. The Alders Platform is a consultative body that advises the government on the balance between aviation expansion at Amsterdam Airport Schiphol, disturbance restriction and the quality of the residential environment.
Noise Complaints Management	Local Community Contact Centre Schiphol (Bas) is the local contact centre for information and complaints about air traffic at and around Schiphol. Bas is a joint initiative by Air Navigation Service Provider of the Netherlands (LVNL) and Schiphol Group.
Other Community Outreach Initiatives	FANOMOS online, an interactive tool illustrating noise in the vicinity of Schiphol Airport.

SCHIPHOL, NETHERLANDS

Noise Mitigation Design Competition

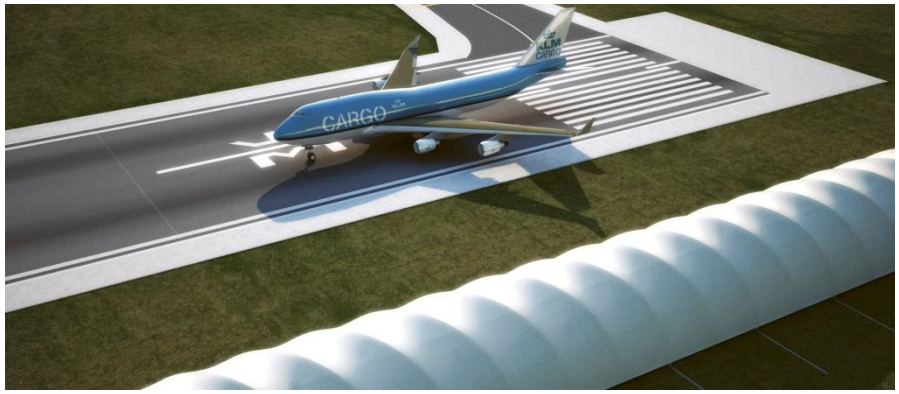
Following the commissioning of the new runway 18R-36L, noise complaints increased significantly following an Environmental Impact Study issued in 2003 that had underestimated the level of annoyance. Additional research found that the primary cause of annoyance was low frequencies typical of aircraft ground noise.

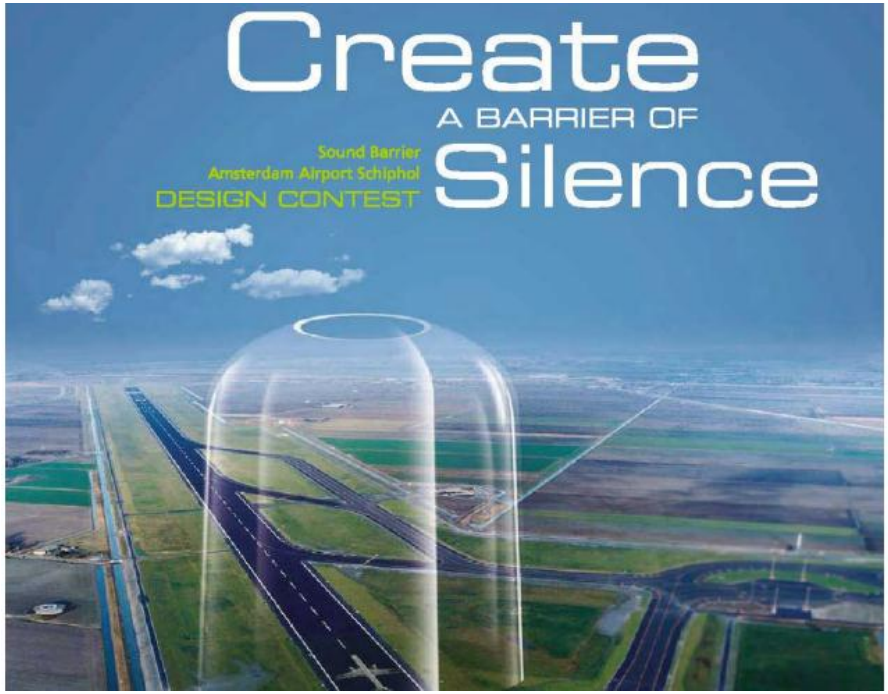
In April 2008 Amsterdam Airport Schiphol launched an international design competition for a new noise-reduction facility at Runway 18L-36R (the Polder runway) to offset the issues that had been observed.

Schiphol invited educational institutions, private individuals, design agencies and businesses to present an innovative solution for the complex problem of ground noise in Hoofddorp-Noord, produced by aircraft taking off from the Polder runway. The winning project earned its designer a cash prize of €750,000 (€250,000 as category winner and €500,000 for the overall winning design). The two other category winners received €250,000 each.

Urban designer Toine van Goethem won the contest for the ecobarrier, which not only reduces sound levels but also makes money by converting Schiphol sewage and de-icing fluids into electricity and algae paste.

The concept as designed has since been questioned for operational safety reasons but an alternative was completed in 2011 involving the development of ground ridges.





Source: Schiphol Airport

LONDON-HEATHROW, UK

London Heathrow International Airport is the busiest airport in the United Kingdom and Europe. With over 70 million passengers, it is the third busiest in the world.

Built in 1929, it has since expanded to a dual parallel runway system that is significantly constrained by urban encroachment. Because of this, Heathrow has been a case study on noise management and mitigation since the 1960s and has been identified as a trend setter by many airports that were interviewed through this review of Best Practices process.

Population	15 million
Distance to city centre	22 km
Curfew	No. Night Noise Quota
Noise Surcharge	Yes
Noise Contour Metric	Leq Noise Contours
National Standard	National Planning Policy Framework and Draft Aviation Policy Framework
2012 Annual Passengers	70 million
Website	www.heathrowairport.com/
Ownership Structure	Private Non-Listed Airport Company
Coordinates	51°28′39″N 000°27′41″W

LONDON-HEATHROW, UK

Key Airport Noise Management Measures

Noise Management	
Airport Curfew	The 'Night Period' is 23:00 to 07:00 during which period the noisiest types of aircraft (classified QC/8 and QC/16) may not be scheduled to land or take-off.
Noise Quota	The 'Night Quota Period' is from 23.30 to 06.00 hours, during which period aircraft movements are restricted by a limit on the number of movements, with noise quotas as an additional measure. This means that points are allocated to different aircraft types according to how noisy they are. The noisier the aircraft type, the higher the points allocated. This provides an incentive for airlines to use quieter aircraft types.
Noise Surcharges	Landing charges uses noise compliance (i.e. dB below Chapter 3) as a core component to establish landing charges for aircraft weighting more than 16 tonnes.
Preferential Runways	In weather conditions when the tail wind component is no greater than 5 knots on the main runways 27R and 27L. These runways will normally be used in preference to runways 09R and 09L, provided the runway surface is dry.
Engine Run-up Restrictions	Subject to approval and location.
Land-Use Planning and Insulation Schemes	Heathrow's Day Noise Insulation Scheme commenced in 1996. It is restricted to the 18-hour 1994 69dB LAeq noise contour, enhanced to take account of early morning arrivals noise. Furthermore, any resident of a property within the scheme boundary based on the noise 'footprint' of the noisiest aircraft regularly operating between 11.30pm–6.00am can also get acoustic treatment.
Other Noise Abatement	-
Chapter 3 Aircraft Restrictions	Noise surcharge on marginally compliant Chapter 3 aircraft (i.e. less than 5 dB below Chapter 3)
Noise Monitoring	Routine noise and flight path monitoring is carried out continuously by the airports' Noise and Track Keeping (NTK) systems using twelve (12) permanent monitoring stations as well as a range of mobile stations as required.

LONDON-HEATHROW, UK

Key Airport Noise Management Measures

Community Outreach Initiatives	
Noise Advisory Board Structure	**Air Noise Monitoring Advisory Committee (ANMAC)** Initially setup by the Government in the early 1990s to advise on the operation of the noise monitoring equipment, it has been used as an advisory body on various noise issues. Members include representatives from National Air Traffic Services (NATS), the Environmental Research and Consultancy Division (ERCD) of the CAA, the Scheduling Committees and their technical advice, Heathrow, Stansted and Gatwick airports, and a representative and technical adviser from the Consultative Committees of the three airports. The committee is chaired by the head of the Environment Division at the Department for Transport. **Heathrow Airport Consultative Committee (HACC)** The HACC is an independent committee, which includes representatives of airport users, local authorities and other bodies concerned with the locality. Heathrow meets a statutory obligation by consulting with the committee. The HACC meets six times a year and is a public forum. **Noise and Track Keeping Working Group (NTKWG)** The NTKWG is a group set up by Heathrow comprising local community representatives, air traffic control and airport personnel. It is active on noise and track-keeping and other environmental issues and reports on these to the HACC. **Local Focus Forum (LFF)** Initially set up to keep residents up to date with progress with Terminal 5, the forum is now an opportunity to share information about pending developments and operational impacts that might affect the local area.
Noise Complaints Management	Through an online form or Webtrak's inquiry module. http://www.heathrowairport.com/noise/help/make-an-enquiry
Other Community Outreach Initiatives	Comprehensive Set of Operational Data available to the public http://heathrowoperationaldata.com
Online Noise Monitoring System	http://webtrak.bksv.com/lhr

LONDON-HEATHROW, UK

Quota Count System

The QC classification is intended to reflect the contribution made by an aircraft to the total noise impact around an airport, the latter being expressed by the total Quota Count – the sum of the QC classifications of all arrivals and departures. Classifications are assigned separately for arrivals and departures.

In 1993, a new Quota Count (QC) system was introduced at Heathrow Airport based on aircraft noise certification data as follows:

- Take-off quota count values are based on the average of the certificated flyover and sideline noise levels at maximum take-off weight.
- Landing quota count values are based on the certificated approach noise level at maximum landing weight minus 9.0 EPNdB.

Aircraft are then given quota QC classifications as follows:

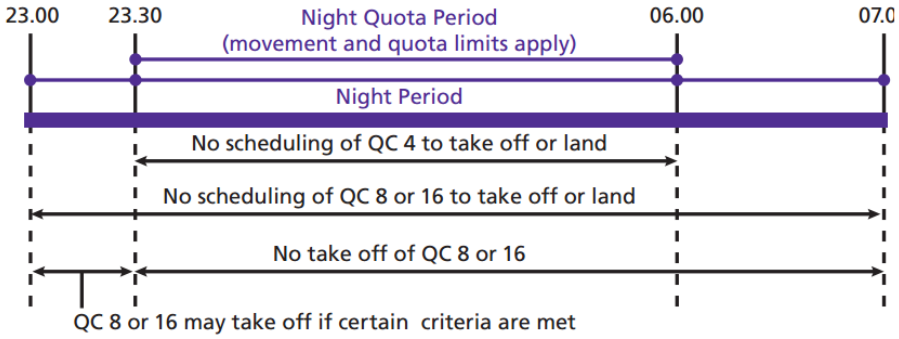
Certified noise level (EPNdB)	Quota count
More than 101.9	QC / 16
99 – 101.9	QC / 08
96 – 98.9	QC / 04
93 – 95.9	QC / 02
90 – 92.9	QC / 01
87 – 89.9	QC / 0.5
84 – 86.9	QC / 0.25

Aircraft are exempt from the movements limits and noise quotas if their noise certification data are less than 84 EPNdB when calculations above are applied.

Noise Quotas and Movement Limits

Summer							
	2006	2007	2008	2009	2010	2011	2012
Movement Limit	3250	3250	3250	3250	3250	3250	3250
Noise Quota	5610	5610	5460	5460	5340	5220	5100

In addition, the following restrictions are also in place:



Source: Heathrow Airport

VANCOUVER AIRPORT AUTHORITY

Beyond, Every Day.

PART III

COMMUNITY OUTREACH

REPORT OUTLINE

This section reviews community outreach strategies.

It includes a review of communication and consultation principles as well as key outreach initiatives such noise advisory boards and multimedia tools.

It also addresses considerations surrounding the narrative on the trade-offs between noise and emissions.

NOISE DIALOGUE

When engaging in a dialogue relating to noise, it is recommended to keep in mind the fundamental driver of complaints. Most people will put up with aircraft sounds if there is a belief that it is necessary (i.e. sound does not become noise). However, people will be annoyed at sound, even when it is objectively quiet, if it can't be justified as being necessary.

Therefore, for a dialogue to occur it is considered important to show the community that all the alternatives to generating the sound/noise have been explored and that, in the case of aircraft noise, there are good reasons for the aircraft operating in the way they do (i.e. where and when they fly). Unfortunately, when the aviation industry puts a gloss on things (i.e. things will get better) it often leads to unfulfilled expectations and accusations of misleading behaviour.

Building trust is an imperative and must include community involvement, transparency and an open dialogue.

Infrastructure Australia has developed the following recommendations which encapsulate key lessons learnt from responding to requests for aircraft noise information from members of the public in recent years.

These suggested approaches evolved in circumstances where there was widespread community mistrust of 'official' aircraft noise information and where there was a critical need to re-build bridges between aviation authorities and the public.

Recommendations
• Provide facts – let the individual make up their own mind.
• Describe noise in terms of exposure – let people work out effect for themselves.
• Try to provide the information the enquirer wants.
• Be aware of the limitations of your data.
• Provide information that describes the noise in a way the enquirer can relate to.
• Use multiple metrics.
• Give the enquirer the type of information which relates to the question.
• Attempt to provide information in a form that the enquirer can independently verify.
• Don't provide noise contours without also giving out information on the flight paths underlying the contours.
• Be prepared to provide detailed technical advice on aircraft operations or on aircraft noise if this is what the enquirer is seeking.
• Don't be afraid to point out the facts to the enquirer if their perception does not accord with what has actually happened.
• Avoid comparing aircraft noise with other noise sources such as road traffic.
• Clearly differentiate between current and future noise.

Source: Guidance Material for Selecting and Providing Aircraft Noise Information (DOTARS) and David Southgate

TRANSPARENCY

Using transparent aircraft noise information presents the opportunity for a win/win situation. In the past there has often been a disconnect between the different parties when discussing aircraft noise. Airports have stated that the noise situation is improving, while members of the public have expressed an opposite view.

In fact, both sides have been correct when viewing the issue from their own perspective. Conventional noise contours have been shrinking over the past decade as the noisy 'old generation' aircraft, for example B727 and F28, have been replaced by much quieter 'new generation' aircraft, for example B737-400 and B717.

However, on the other side of the coin, at most major airports aircraft movement numbers, and hence the numbers of noise events, have been increasing and the gaps, or periods of respite, between periods of aircraft overflight activity have been decreasing.

Ideally, the focus now needs to move from a debate on whether things are getting 'better' or 'worse' to one where both sides recognize that the nature of aircraft noise exposure patterns is changing and adopt noise descriptors which establish a common understanding on what is actually happening. Experience in recent years has shown that the transparent aircraft noise descriptors, as discussed in this document, provide the opportunity to establish this common understanding. Some form of agreed language needs to be in place before a meaningful dialogue can take place between the parties on strategies for managing aircraft noise.

Airport	Community
• Noise situation is improving • Conventional noise contours have been shrinking • Aircraft are becoming quieter.	• Noise situation is getting worse • Aircraft movement numbers (noise events) have been increasing • Periods of respite between periods of over-flight activity have been decreasing.

COMMUNICATION, CONSULTATION & ENGAGEMENT

Engagement values the right of communities to have an informed say in the decisions that affect their lives. It is based on the ideas of public participation, which is distinguished from public communication and consultation as illustrated below.

Both public participation and engagement are different from traditional forms of interaction between sponsors and the community because they are based on a two way interaction. The engagement process emphasizes the sharing of power, information, and a mutual respect between the sponsor and the community.

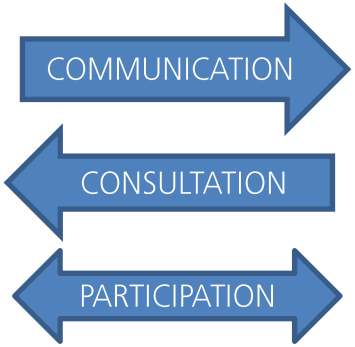
For airports, communication means telling the community what it is doing or what it intends to do while consultation means receiving and collecting feedbacks from public representatives.

Under a broader engagement scheme involving active community participation, the airport and the community work together to identify problems, explore options and arrive at solutions.

In practice, some airports may have adopted the new wording (e.g. engagement, participation) but have not adopted the new process.

Level of Involvement	Flow of Information
Communication	One way – sponsor to public representative
Consultation	One way – public representative to sponsor
Participation	Two way - between sponsor and public representative

Source: Handbook on Citizen Engagement: Beyond Consultation, CPRN(2008)



ROLE OF INFORMATION

In order to meaningfully engage the community, there is a need to use transparent, comprehensive and comprehensible information on aircraft noise exposure patterns which can be understood and trusted by all parties.

The following table illustrates some of the key differences between a deliverable or response that is deemed transparent versus another that is not.

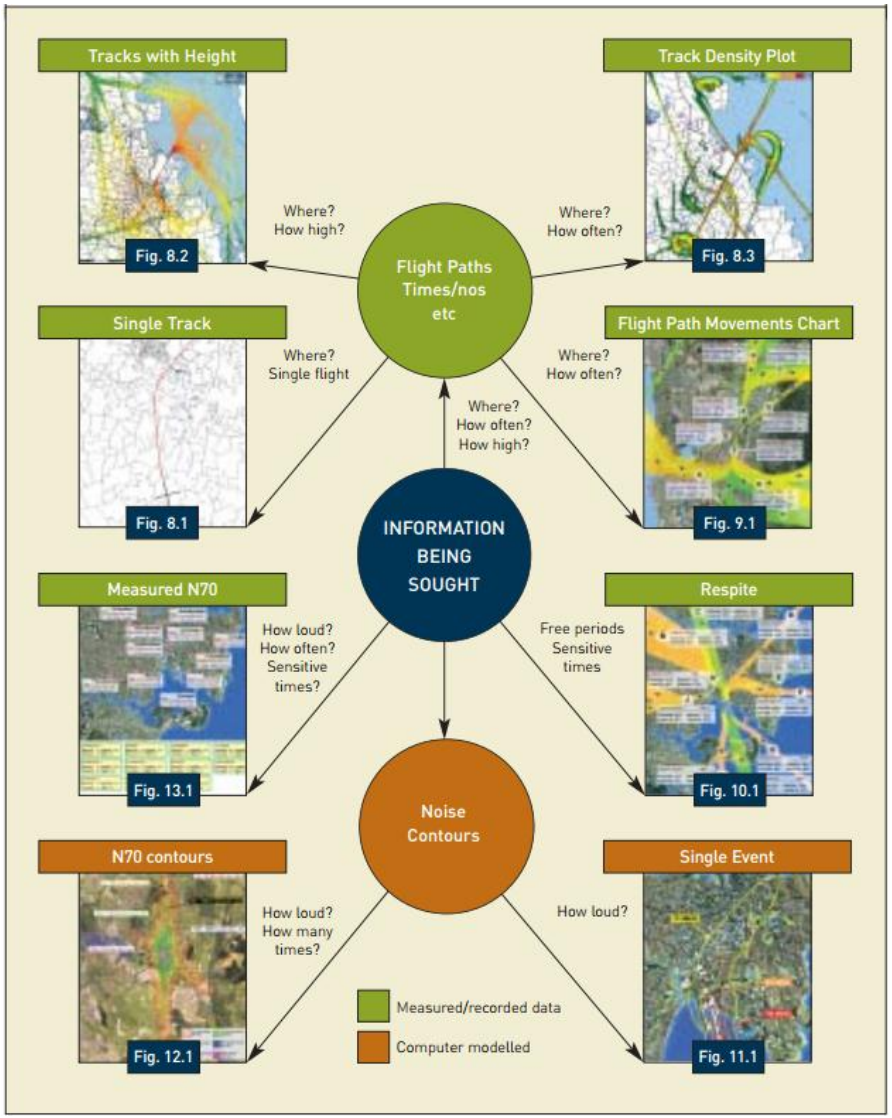
This does not mean that conventional ways to illustrate aircraft noise are wrong, but it highlights the need to complement conventional ways to describe noise with alternative means that will allow members of the community to have an informed say.

Transparent	Conventional
Customized noise metrics	Standard noise metrics
Flight Paths	Noise Contours
Area wide	Noise Boundaries
Interactive	Static
Number of events	Total Noise Load
Extremes/Ranges/Variability/Time	Average

PRODUCING INFORMATION

Aircraft noise information can be produced in several different forms and, due to the fact that it describes aircraft noise in non-technical terms, can be used in a wide range of circumstances. In broad terms the information can be delivered in two distinct modes – reactively or proactively.

While it is important that good quality information is available to respond to requests or to assist in resolving complaints, it is equally important that proactive efforts be made to ensure that transparent information is readily available to any member of the community.



Source: Infrastructure Australia

PRODUCING INFORMATION

As previously highlighted, a key consideration of community engagement on noise issues is the need for the proactive use of communication tools.

Depending on the topics of concerns expressed by the community, the ongoing production of information associated with the impact of noise may be sufficient to highlight incremental changes associated with growth or patterns of operations at the airport.

If a proposed change to operations or infrastructure is likely to create sudden shifts in growth and patterns of operations, then a more comprehensive outreach plan should be established.

Infrastructure Change	
• New runway • Extended runway	Perception is immediate due to the physical nature of the change.
Operational Change	
• New flight tracks • New modes of operation	Perception will be immediate or gradual based on implementation.
Demand Growth	
• Additional aircraft movements • Upgauge of existing aircraft operations	Perception will be gradual.

OPERATIONAL CHANGES

While significant infrastructure changes to airports often trigger a comprehensive consultation process, the progressive growth of aircraft movements is often barely perceptible for the general public.

However, changes to operational procedures can have significant impacts on the community, especially if changes are implemented suddenly.

Such changes include the implementation of RNP (Required Navigation Performance) tracks. Such procedures have been found to be very efficient from an aeronautical perspective, leading to significant reduction in fuel burn as well as CO_2 emissions and costs.

Although some benefits are associated with noise because of the use of continuous descent approaches, RNP also leads to a concentration of movements over tight approach paths compared to historic procedures. It is therefore also important to consider noise impacts when designing such procedures.

Finally, considering that a key benefit of RNP operations is the ability to reduce gas emissions (and fuel costs), engaging in a discussion with the community about the trade-offs between noise and emissions is part of a healthy engagement process.

Recommendations
• Engage with the whole community - not just 'the noise committee' .
• Examine and discuss noise changes using 'single event' not 'average day' metrics.
• Don't assume a noise cut-off.
• The reason for the proposed changes must be clear; if the change is simply about saving money for the airlines say so.
• Be prepared for debate about noise sharing - concentration vs spreading of flight tracks; respite, etc.
• Match promises with reality - be realistic about the impacts.
• Apply the same rules for all operators.
• Examine the option of rotating RNPs.
• Can the issue be handled by optimising both noise and emissions through the use of carbon offsets?

NOISE CONSULTATIVE COMMITTEES

Models

There are various formats for noise management committees, but they will generally fall under two categories:

- Committees chaired by airports
- Committees with an independent chair

The adjacent table describes the general benefits and weaknesses of each model.

Chaired by Airports	Chaired by Independent Chair
Benefit Committee provides a real incentive for the airport to understand and take responsibility for noise issues.	**Benefit** Independence is an important component of building trust with the community.
Weakness Committees are not independent.	**Weaknesses** Chair may be lacking in expertise and knowledge. If the Chair is funded by the airport then the committee is not perceived as independent.

Membership

Each committee has varying rules on membership and representation. Although some individuals report to a formal entity (e.g. city council, industry associations, etc.), others often only represent themselves and will often get 'captured' if they stand on the committee for too long (i.e. risk of losing independence over time).

Some committees have residency rules in regards to proximity of members from the airport. Committees need to be very careful about rejecting potential members because they live a long way from the airport.

Ultimately, it is imperative that the formal noise committee is treated as just one channel of communication/involvement with the community. Many problems have been created by airports saying they consulted the community when in fact they only consulted the formal noise committee.

The skill of the chair in running the committee is often a key to the success of the committee as a whole.

NOISE CONSULTATIVE COMMITTEES

VANCOUVER AIRPORT AUTHORITY
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The following table summarizes the consultative committees that the airports we have studied have put in place. Note that some airports have more than one committee dealing with noise issues (e.g. one is 'technical' and one deals with general airport related issues, including noise).

Airport	Country	Committee	Chair
Sydney	Australia	Sydney Airport Community Forum	Independent Chairperson Appointed by Federal Minister
Melbourne	Australia	Melbourne Airport Community Aviation Consultation Group	Independent Chairperson
		Melbourne Airport Noise Abatement Committee	Chaired by Airport
Brisbane	Australia	Brisbane Airport Community Aviation Consultation Group	Independent Chairperson Named by Airport
Perth	Australia	Perth Airport Community Aviation Consultation Group	Independent Chairperson
		Aircraft Noise Management Consultative Committee	Chaired by Airport
Auckland	New Zealand	Aircraft Noise Community Consultative Group	Independent Chairperson Named by Auckland Airport and Auckland Council
Schiphol	Netherlands	Schiphol Regional Consultative Committee	Independent Chairperson Appointed by Minister
London Heathrow	United Kingdom	Heathrow Airport Consultative Committee	Independent Chairperson

GUIDING PRINCIPLES – MULTIMEDIA TOOLS

There are a range of ways to disclose noise as part of a broader community outreach initiative. The single-most important consideration when responding proactively or reactively to request for information is to ensure that the response delivered answers the question that was implicitly asked.

Multimedia tools are very useful in illustrating the impact of noise on communities. However, such tools can quickly become a "gadget" providing information overload without specifically tackling the information initially sought by the community or public representative. As such, it is important to understand the benefits and constraints associated with a range of noise and alternative metrics before formalizing a response for public disclosure.

The following pages review a range of multimedia tools currently in use.

TRANSPARENT NOISE INFORMATION PACKAGE (TNIP)

VANCOUVER AIRPORT AUTHORITY
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TNIP is a suite of software applications to enable aircraft noise disclosure information to be rapidly produced for individual airports. Developed by the Australian Department of Infrastructure, this software was a key response to the community backlash associated with the commissioning of the third runway at Sydney Airport.

TNIP Expert

TNIP Expert is a tool which takes data either from Noise and Flight Path Monitoring systems, or from noise modelling studies carried out using the US Federal Aviation Administration's Integrated Noise Model (INM), and produces **'real'** information about aircraft noise.

TNIP Expert enables the user to 'look inside' noise contours. A user can easily see the number and types of aircraft that have been allocated to the flight tracks which underpin the contours and create what-if scenarios.

Alternative Metrics

The charts illustrated on the following pages are derived from the TNIP software suite but could in practice be developed from other similar software packages or online noise monitoring packages such as Vancouver's WebTrack system.

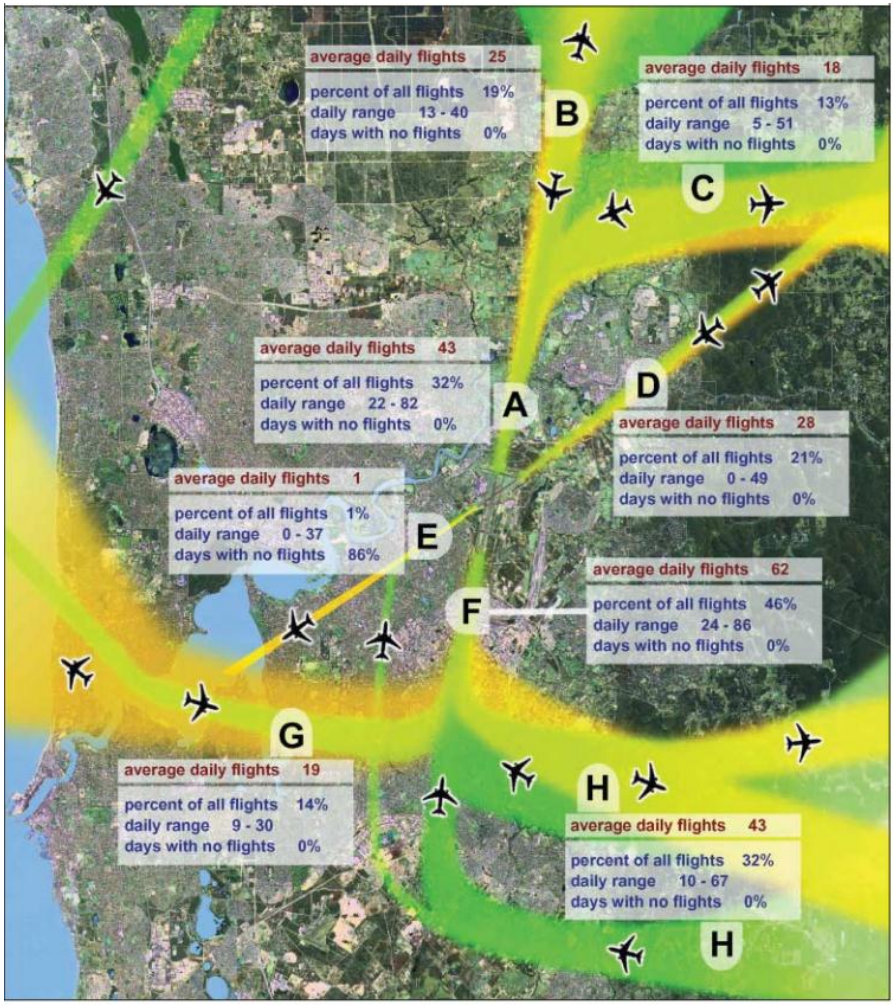
FLIGHT PATH MOVEMENT CHARTS

Flight path movements chart were developed in consultation with the public to overcome some of the perceived weaknesses of flight path maps. They show a 'macro' picture of aircraft noise distribution around an airport.

In particular, the charts show that aircraft do not all follow the same track but tend to spread to generate distinct flight path zones. For many suburbs, aircraft overflight activity varies widely from day to day according to which runways are being used at the airport—runway use is primarily dictated by wind conditions. A flight path movement chart therefore contains, in addition to average day information, data on the busiest and quietest days during the period covered by the chart to give an indication of how noise varied over that period.

Suggested Uses:

- providing information to prospective house purchasers about typical aircraft noise exposure patterns around an airport
- responding to queries about trends in aircraft noise exposure
- giving a picture of how noise is distributed between suburbs around an airport
- input into environment and noise assessment reports, or for airport consultative committees
- providing advice to supplement noise contours, for example for land use planners and decision-makers
- environmental monitoring and reporting, both regular reporting and 'State of the Environment'.



Source: Infrastructure Australia

FLIGHT PATH MOVEMENT CHARTS

VANCOUVER AIRPORT AUTHORITY
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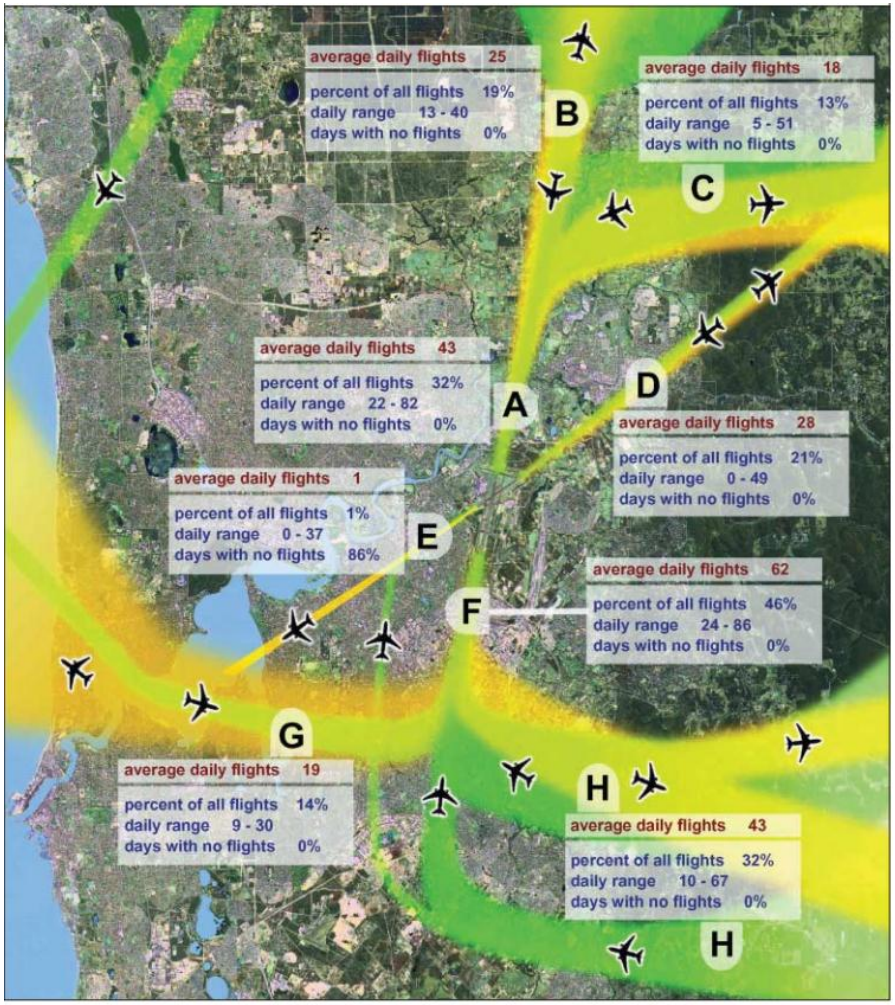
Strengths

- Information on flight path location and aircraft movement numbers is combined in a way that is understandable to the non-expert
- Information is taken beyond the 'average day' by giving data on day-to-day variations
- The charts are based on 'real' data and not on computer modelling
- The information on the chart can be verified without special expertise or equipment
- The charts enable a rapid assessment to be made of the extent to which noise is shared between suburbs.

Weaknesses

- The charts can give the impression that there are more movements in the wider flight path zones (visual impression can override the information provided)
- Aircraft will still be heard outside the flight path zones.
- 'One-off' flight paths are not shown on the charts for reasons of clarity – the charts are designed to only show a 'macro' picture for the main jet flight path routes
- The charts provide information on aircraft movements not aircraft noise
- Flight path movements charts are two dimensional and therefore they can give the impression that the altitude of an aircraft does not vary along the length of the flight path zone.



Source: Infrastructure Australia

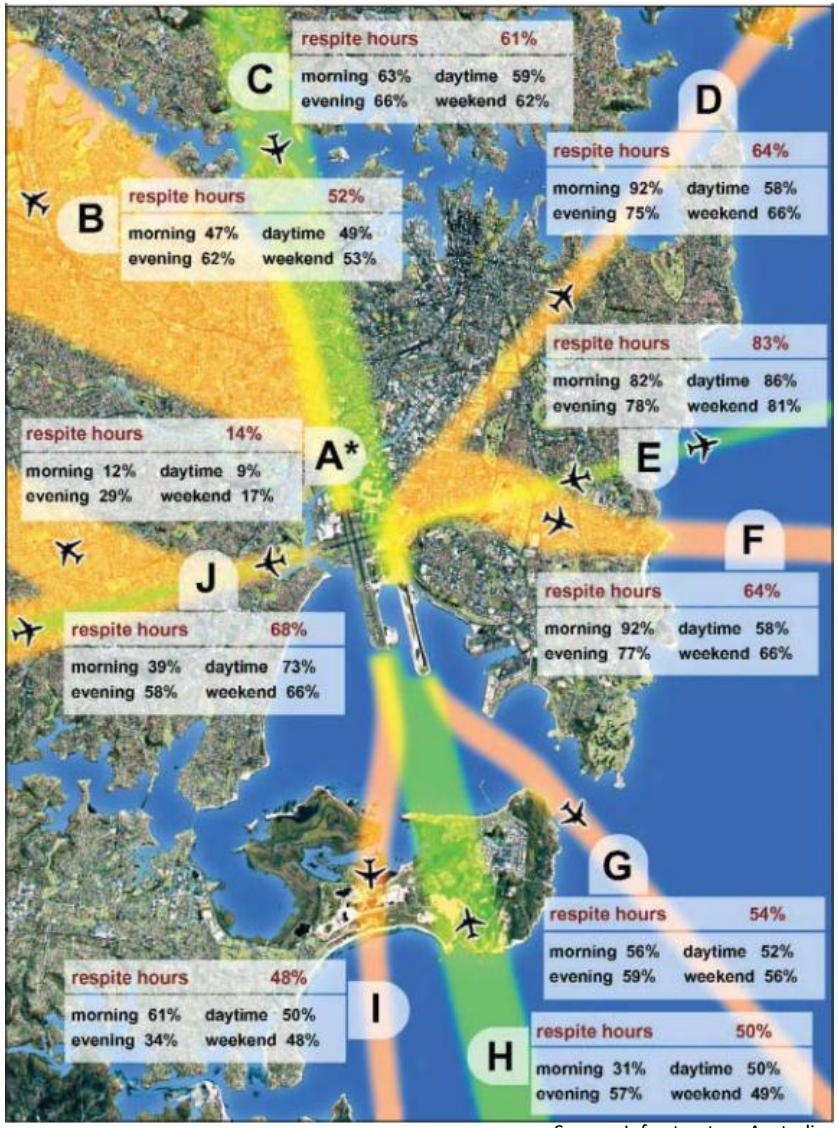
RESPITE CHARTS

The respite chart gives an indication of the extent to which different areas around an airport get 'breaks' from aircraft noise. The monitoring and reporting of these 'breaks' or 'respite' was a special priority for Sydney residents following the opening of the new runway at Sydney Airport in 1994.

The charts report respite by showing the proportion of hours during which there were no jet aircraft movements on each of the flight paths. For example, if the respite on a particular flight path is reported as '50%' it means that for 50 per cent of the clock hours during the period covered by the chart there were no movements on that flight path. A 'clock hour' means, for example, 8:00am to 9:00am.

Suggested Uses:

- providing information to prospective house purchasers about typical aircraft noise exposure patterns around an airport
- responding to queries about trends in aircraft noise exposure
- giving a picture of how noise is distributed between suburbs around an airport
- providing information on what happens at sensitive times
- input into EISs and noise assessment reports, for example for airport consultative committees
- environmental monitoring and reporting, both regular reporting and 'State of the Environment'.



Source: Infrastructure Australia

RESPITE CHARTS

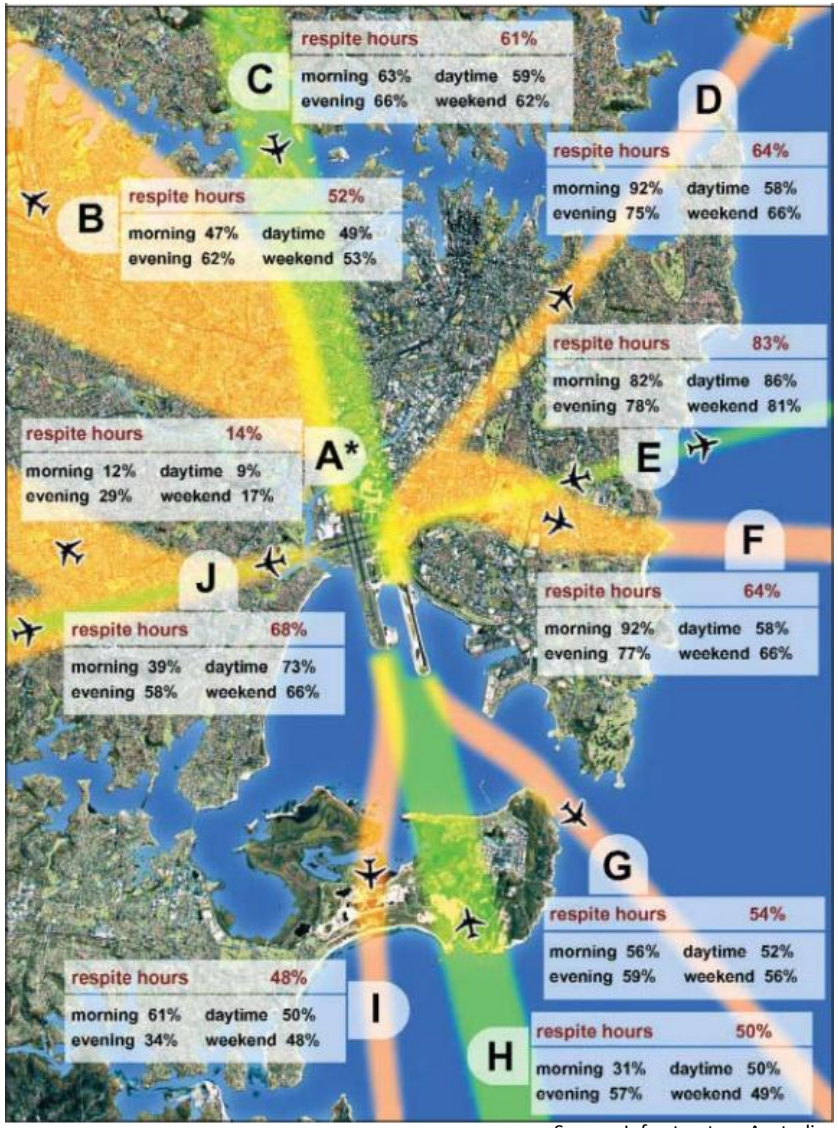
VANCOUVER AIRPORT AUTHORITY
Beyond, Every Day.

Strengths

- The charts give information on what happens at 'sensitive times'
- The information on the chart can be verified without special expertise or equipment, for example, by keeping a log of aircraft times
- The charts are based on 'real' information and not on computer modelling.

Weaknesses

- The information on the charts describes respite for each individual flight path zone – in some cases respite on one track can be disturbed by movements on another track and therefore in these circumstances respite will be less than that reported
- On the other hand, the charts show respite based on one hour breaks - this is a very blunt instrument and means that an area can have zero respite yet get only 24 overflights a day.



Source: Infrastructure Australia

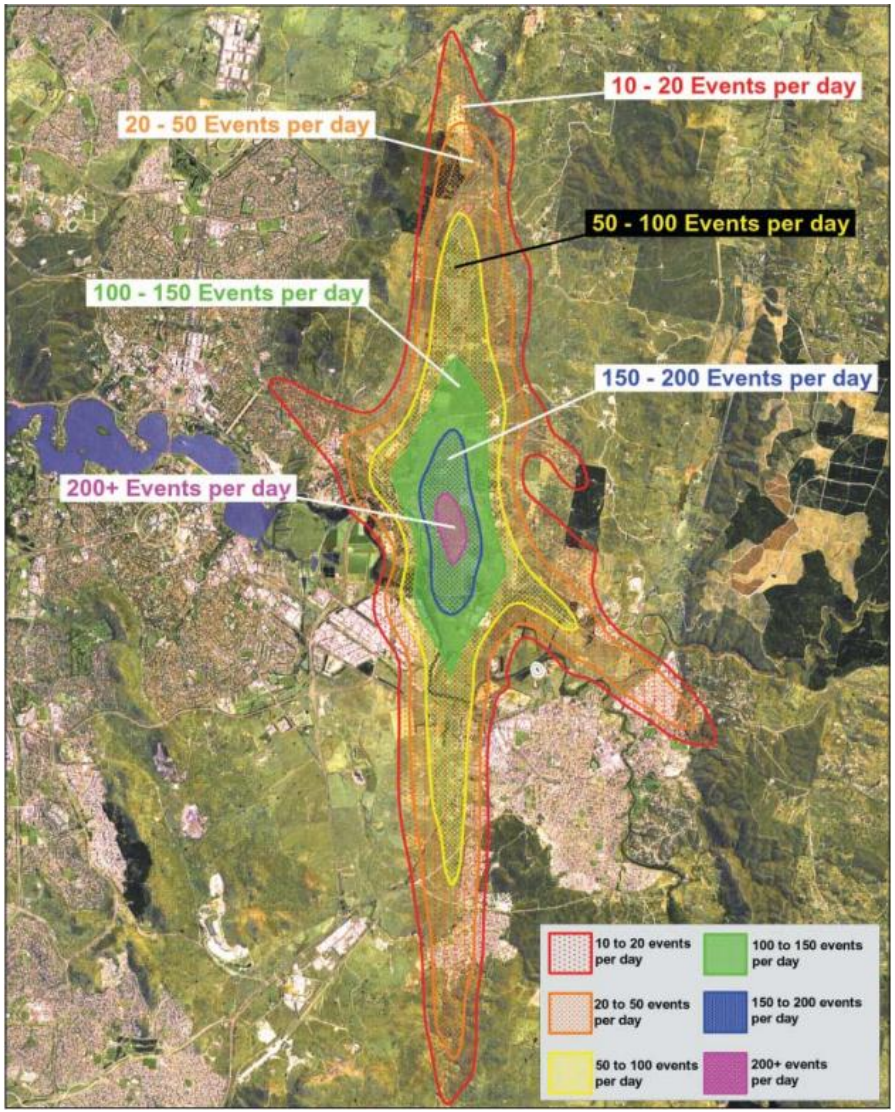
EVENTS ABOVE CHARTS (N60/N70 CONTOURS)

The noise contours on an N70 chart indicate the number of aircraft noise events louder than 70 dB(A) which occurred on the average day during the period covered by the chart. An aircraft noise event of 70 dB(A) is one that is likely to disturb conversation inside a house with open windows. This event therefore may interfere with activities like watching television or using the telephone. For nighttime events, N60 contours (events above 60 db(A)) are found to be likely disturbing to sleeping patterns.

The N60/N70 contours are generated using computer models, such as the FAA INM.

Suggested uses

- giving a 'macro' picture of noise around an airport to complement and put into perspective information based on flight paths and movement numbers and times, etc
- input into EISs and noise assessment reports, for example for airport consultative committees
- providing advice to supplement noise contours, for example for land use planners and decision-makers
- environmental monitoring and reporting, both regular reporting and 'State of the Environment'.



Source: Infrastructure Australia

EVENTS ABOVE CHARTS (N60/N70 CONTOURS)

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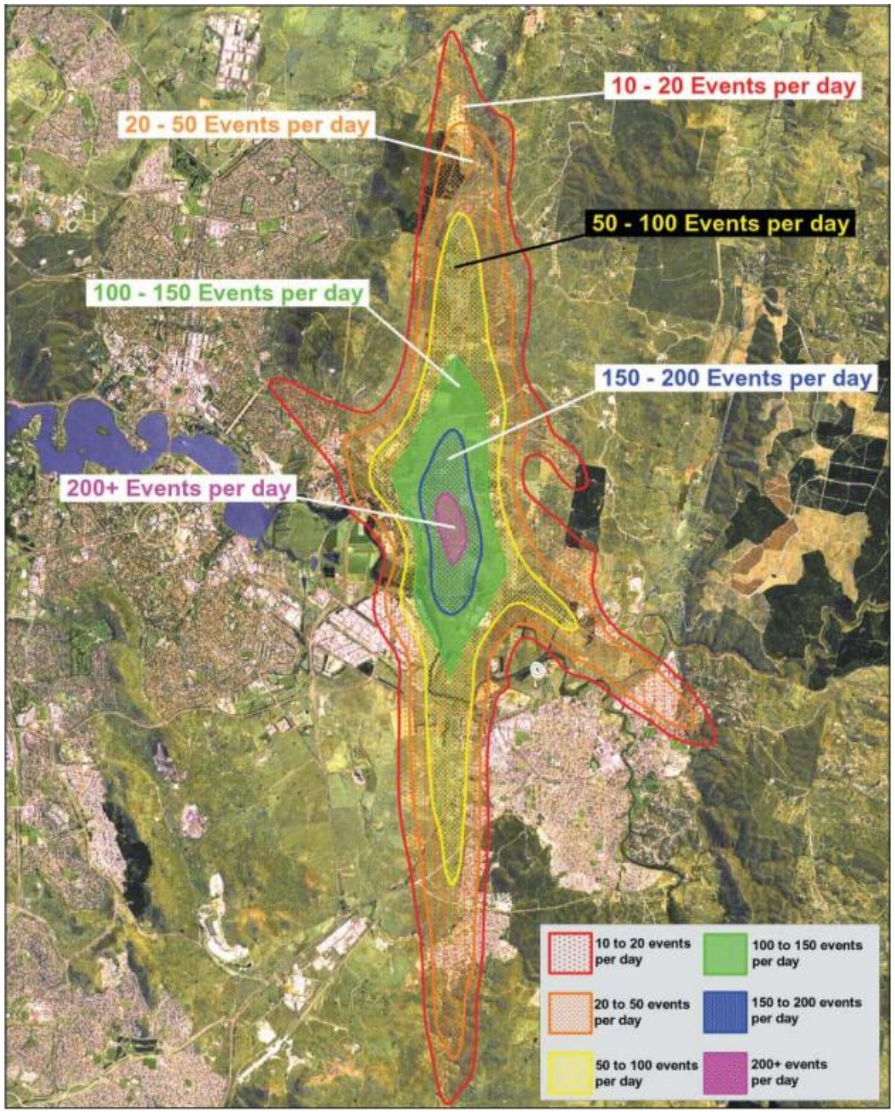
Strengths

- N70s report noise by the number of single events which is the way a person generally experiences and perceives aircraft noise
- The contours are arithmetic – for example, all other things being equal, if the number of flights on a flight path doubles, the N70 doubles
- The information can be relatively easily verified, for example, by cross-comparing with a measured N70 chart
- N70s are useful for showing noise exposure in a meaningful way for short time periods, for example evening periods, as it takes information beyond the 'average day'.

Weaknesses

- Like any noise contour an N70 contour can give the impression that there is no noise beyond the outer contour
- Some people distrust the contours as they are produced using computer models and not by measurement
- It is not readily apparent what a sound pressure level of 70 dB(A) will be like in practice.



Source: Infrastructure Australia

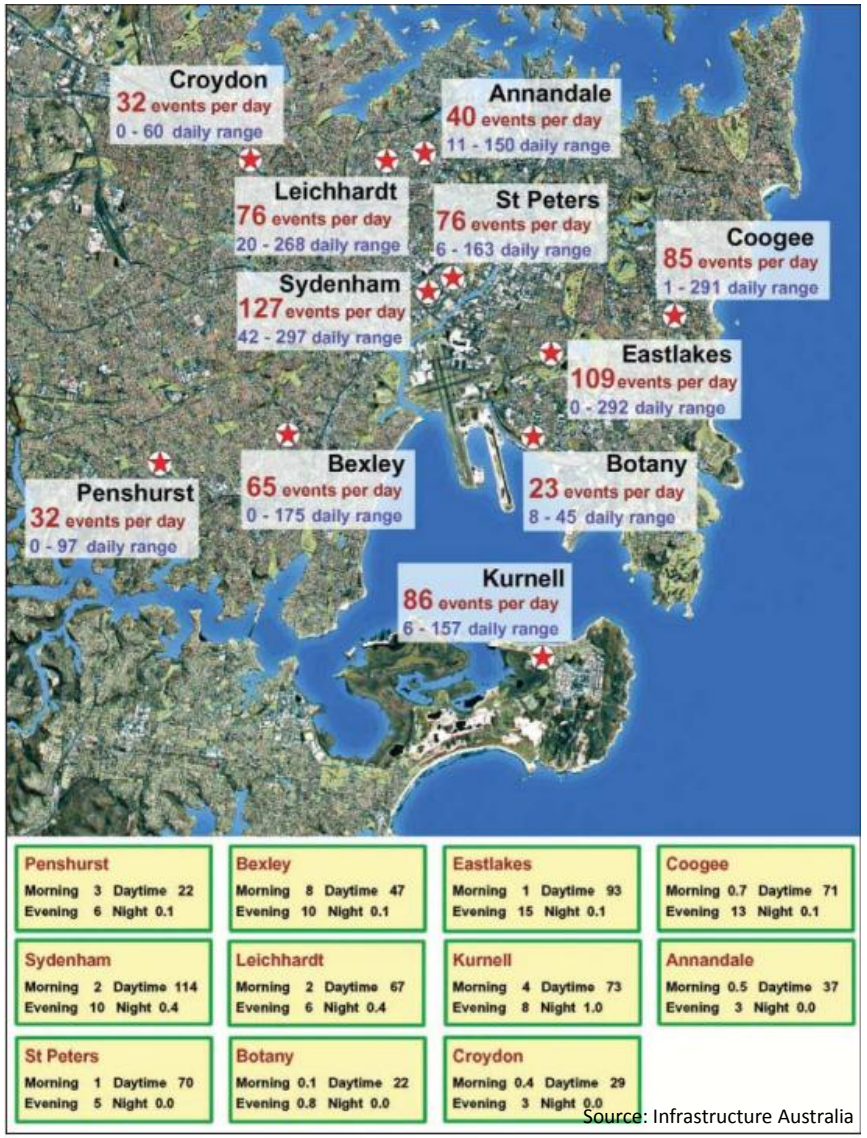
MEASURED N70 CHARTS

Despite the enormous efforts that have gone into verifying the output of computer models such as FAA's INM, members of the public tend to be very wary of computer modelled data and often have much more faith in data which has been recorded by an NFPMS. The measured N70 chart reports actual noise measurements made around an airport. This contrasts with N70 contours which are generated by computer modelling. The measured N70 not only provides information from a source that is more trusted by some people, it also provides a good tool for checking the accuracy of N70 contours.

At most major Australian airports, aircraft operations are monitored using a Noise and Flight Path Monitoring System (NFPMS). These systems gather large amounts of data and experience has shown that it is difficult to synthesise the results of the noise monitoring in a way that is meaningful. It has been found that a useful overview picture of aircraft noise monitoring data can be obtained by using the N70.

Suggested uses

- summarising the results of a period of noise monitoring
- cross-checking N70 contours
- input into EISs and noise assessment reports, for example, for airport consultative committees
- environmental monitoring and reporting.



Source: Infrastructure Australia

MEASURED N70 CHARTS

VANCOUVER AIRPORT AUTHORITY
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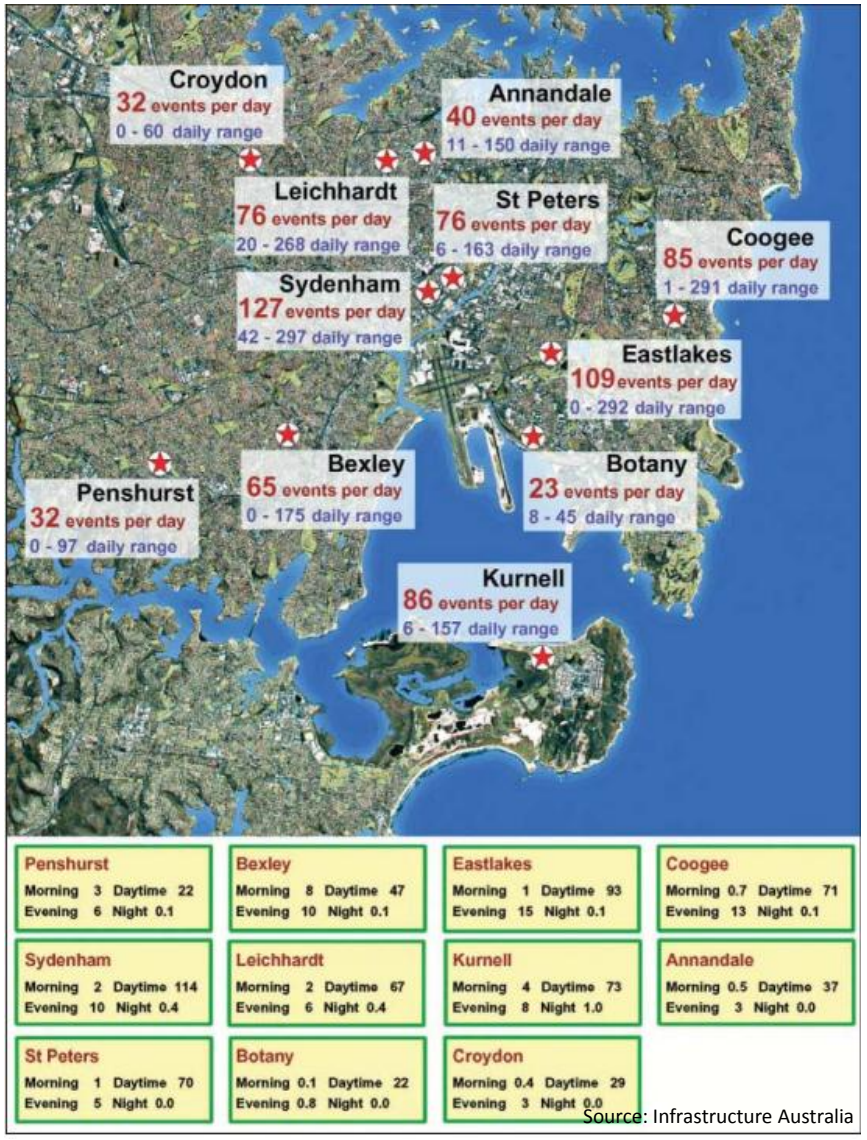
Strengths

- The charts summarise a great deal of information in a way that is easy to comprehend
- The information is derived from noise monitoring not computer modelling
- The charts provide information on daily ranges in the N70 and also on noise exposure at sensitive times
- This form of representation allows a comparison to be made between computer generated N70 contours and measured N70 data
- Measured N70s allow a rapid overview examination to be made of the noise generated by particular operations or aircraft types, for example, departures by B747s.

Weaknesses

- The charts only provide information for those locations at or very near to the noise monitoring terminals
- The information needs to be treated with caution since sound pressure levels can change rapidly even at a short distance from a noise-monitoring terminal – particularly for landings
- It is not readily apparent what a sound pressure level of 70 dB(A) will be like in practice.



Source: Infrastructure Australia

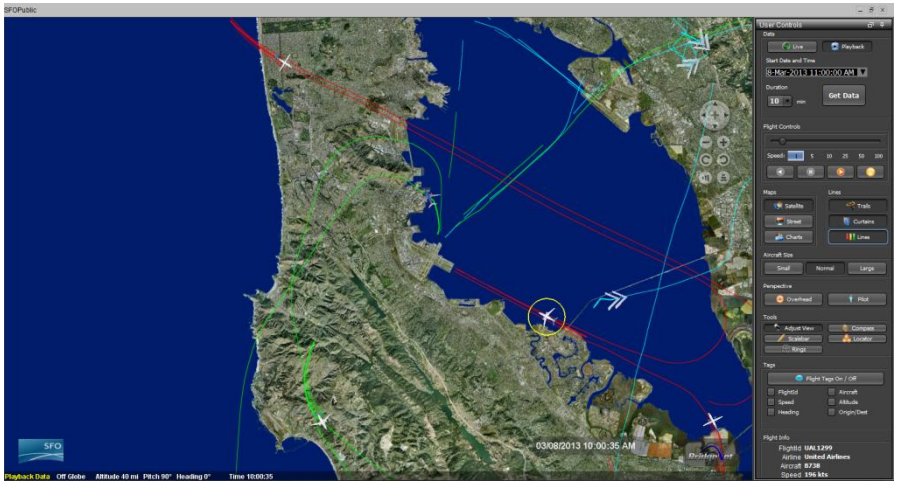
INTERACTIVE MULTIMEDIA TOOLS

Interactive multimedia tools allow information to be presented in an easy to understand format. The main objective of using these tools is to provide a better understanding of aircraft operations and to assist with dialogue with the community. Each tool provides and presents information in unique ways, and the level of sophistication varies greatly. As such, it is important for the airport to determine what information it wishes to present and then determine what tool is best used.

The following section contains some examples of multimedia tools available for airports.

VOLANS – BRIDGENET (USA)

VOLANS is a web-based application designed to create, evaluate and display flight operations in 3D. This software tool evaluates the acoustic and environmental impacts from new Performance Based Navigation Procedures as well as new runways and airfield configurations, providing a display of noise impacts using various acoustic parameters including A-weighted noise levels and audibility detection.



Source: Bridgenet and SFO

TRAVIS (Germany)

"TraVis (Topsonic TRAck VISualisation) is a web-based module which displays flight tracks together with measured noise data in the vicinity of an airport, which is clearly displayed on a map.

TraVis extends the airport's public relations and improves the dialogue between residents, complainants and the airport environmental department." (http://topsonic.aero)

Source: Hannover Airport

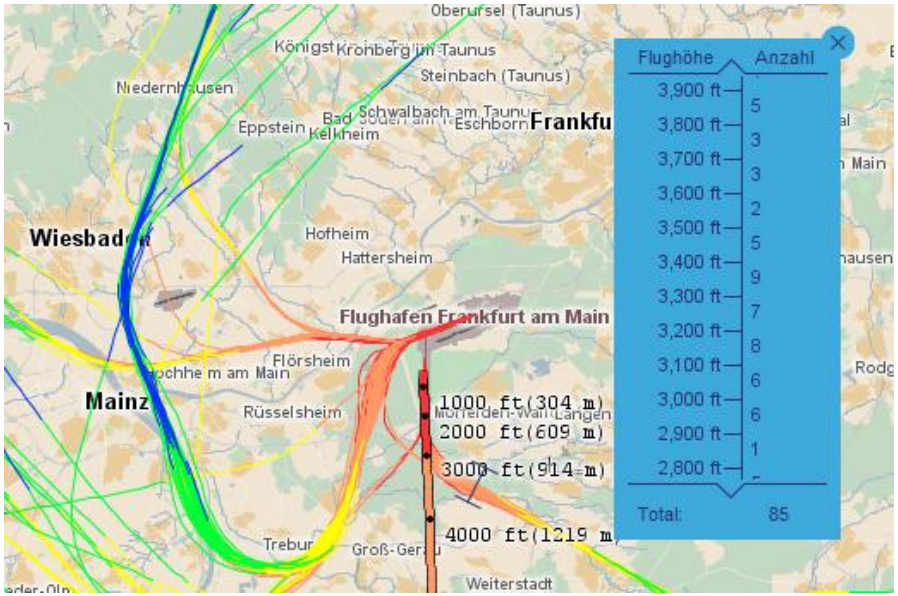
INTERACTIVE MULTIMEDIA TOOLS

STANLY (Germany)

The German air navigation service provider (ANSP) – Deutsche Flugsicherung (DFS) – is the developer of STANLY_Track. This tool displays flight tracks and altitude of aircraft in the vicinity of 14 major German airports as well as for 3 foreign airports located in close proximity to German airspace (Zurich, Basel, Salzburg).

It can show aircraft from a time lag of 15 minutes to 14 days. The main display highlights aircraft tracks as a line that changes colour depending on the altitude of the aircraft. The analysis feature of the tool allows users to look at flights over the previous 14 days and identify specific aircraft by selecting an individual flight track.

The DFS outlines that the intent of STANLY_Track is to provide transparent information on aircraft movements to the public.



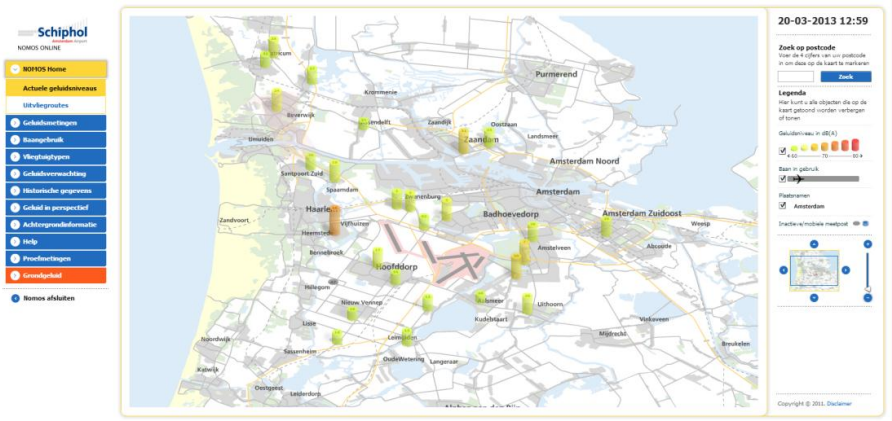
Source: DFS.de

NOMOS (Netherlands)

MediaCatalyst built an application in Flash Flex that visualizes real-time XML data drawn from 22 measurement points around Schiphol Airport. Historical records of aircraft noise levels are also accessible, their flight paths and the runway they use.

Since its launch, the number of noise complaints from people living in the vicinity of Schiphol Airport has decreased significantly.

The tool can be used in forensics – investigating non-compliance by individual flights.

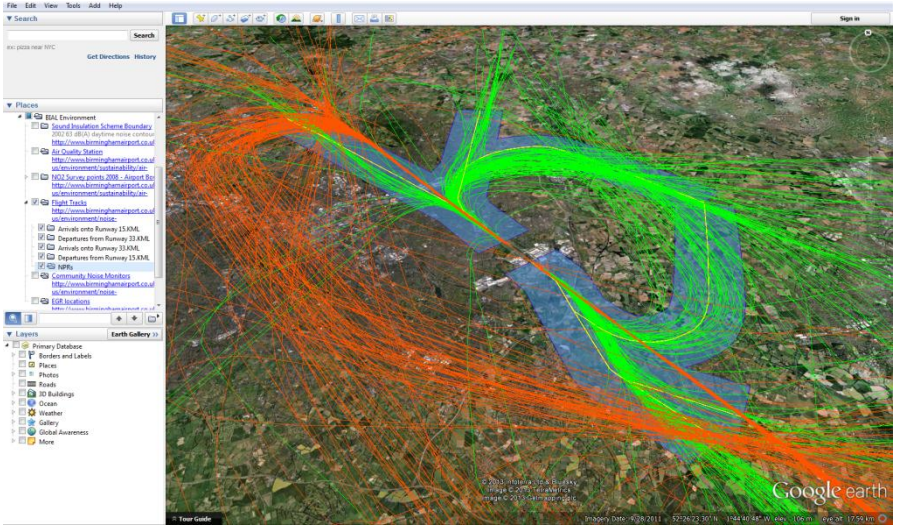


Source: Schiphol Airport

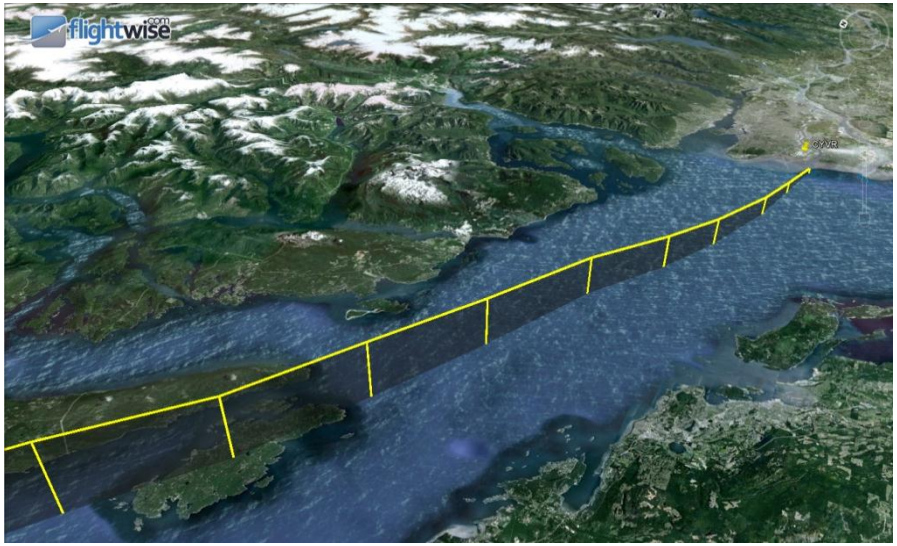
INTERACTIVE MULTIMEDIA TOOLS

The following represents an additional means of illustrating actual aircraft movement data with a software (Google Earth) that is increasingly being used by the general public.

It involves the development of an overlay that positions the location of aircraft and flight tracks in relation to the earth surface.



Source: Birmingham Airport



Source: Flightwise.com

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PART IV

SUMMARY OF BEST PRACTICES

INTRODUCTION

This section summarizes the practices outlined throughout this document and identifies those deemed "Best Practices" and most likely to be applicable to YVR.

A "Best Practice" is defined as one that will either practically enhance the noise environment in the vicinity of the airport, build stronger ties with the community, or enable an open and transparent dialogue with the community about noise exposure and how solutions are explored to provide an optimal experience for all residents in the vicinity of YVR.

This review includes a high-level assessment of implementation requirements for the identified best practices, the potential effectiveness of these practices, as well as the associated qualitative costs to stakeholders.

An "overview" summary table is provided on the next page, followed by expanded discussion of each item.

OVERVIEW

	Description
Marginally compliant Chapter 3 Restrictions	Implementation of restrictions on Chapter 3 aircraft originally certified as Chapter 2 (Hush-Kitted).
Advertisement of Fleet Upgrades	Advertisement of fleet upgrades associated with reduction in noise emissions.
Balanced Approach to RNP Operations	Inclusion of noise considerations in the assessment of proposed or existing RNP flight tracks.
Experience Centre	Development of a physical venue for residents to discover how airports operate and to enquire about the impacts associated to the operations such as noise.
Multilingual Communication Strategy	Development of a communication strategy targeted towards communities where languages other than English or French are primarily spoken.
Alternative Noise Metrics	Development of interactive tools to communicate the impact of noise using alternative noise metrics.
Noise Mitigation Design Competition	Organization of a design contest associated with a selected noise mitigation measure.
Adventure Airport	Development of a physical venue aimed at providing a fun and entertaining experience to the visitor while giving a broad overview of the complexity of airport operations.
Existing Home Noise Insulation Brochure	Participation to the development or refinement of a home noise insulation brochure for residents in the vicinity of the airport.
Noise-based Landing Charges	Development of a scheme to raise funds associated with the noisiest operations.
Community Trust Fund	From the funds raised through the proposed noise-based landing charges scheme, development of a community Trust Fund aimed at reinvesting in the communities affected adversely by noise.
Acoustic Treatment Program	From the funds raised through the proposed noise-based landing charges scheme and in partnership with the City, development of an acoustic treatment program for existing houses located in noise affected areas.
Real Estate Disclosure	Ensure the transparent accessibility of flight path movements and noise contours to real estate buyers.
Total Noise Volume	Development of a monitoring system quantifying noise based on the sound profile of individual movements.

MARGINALLY COMPLIANT CHAPTER 3 RESTRICTIONS

Marginally compliant Chapter 3 aircraft contribute disproportionately to the total noise impact for neighbouring communities.

A growing practice involves restricting marginally complaint Chapter 3 aircraft. In Canada, these aircraft consist mainly of hush-kitted aircraft such as the Boeing 727 and 737-200.

In many cases, restrictions apply only to new services, hence, grandfathering the rights of airlines to fly as they do currently but putting pressure on them to modify their fleet in order to connect to new markets.

Implementation Requirements / Considerations
The implementation of an airport restriction on marginally complaint Chapter 3 aircraft would be subject to the Transport Canada 'check list' process for adding a new noise control procedure[1]. This process requires that the proponent conduct an economic analysis of the proposed restriction and consult extensively with all industry stakeholders. This restriction would likely face significant opposition by the air carriers, and Transport Canada would need to ensure compliance of the format of the proposed restriction with Federal rules (e.g. Northern exemptions on Chapter 2 aircraft operations).
Effectiveness
This practice would lead to a reduction in noisier aircraft movements which will vary based on its actual implementation. However, this doesn't guarantee that the affected aircraft operator will replace their fleet with quieter aircraft and may instead decide to relocate operations at airports that do not have such constraints in place.
Cost to Stakeholders
The costs to airlines operating these aircraft could be significant since it would impose constraints on their ability to operate a national route network across Canada However, a change in fleet would be offset by cost reductions with the use of more modern aircraft technology (e.g. fuel costs and maintenance).

1. Transport Canada Advisory Circular No. 302-002 – Implementation of New or Amended Noise Abatement Procedures

ADVERTISEMENT OF FLEET UPGRADES

This practice is a proactive way to communicate actual noise reductions associated with fleet upgrades by airlines operating at YVR.

In the simplest form, a new quieter aircraft could be advertised in the various communication methods currently used by the Airport Authority (e.g. through internet or noise reports). Providing aircraft information and published noise impacts in comparison to other aircraft would assist in communicating the information.

More detail on the actual changes realized at YVR could be a secondary step that would help identify the 'real' implications to the areas surrounding the airport.

Conversely, the Airport Authority could consider also informing the public on new operations by louder aircraft types, whether these are single events (e.g. Antonov 124 operating a charter cargo flight) or scheduled events (e.g. Chapter 2 operations associated with Northern exemptions). Explaining the nature and benefits of these operations to the broader community would help provide better understanding.

Implementation Requirements / Considerations

This initiative involves a passive role where the Airport Authority periodically identifies changes to the fleet operated by airlines. It may involve a single passenger airline flight or a gradual transition where a quieter aircraft usage increases in comparison to noisier aircraft where an airline operate more than aircraft type to YVR.
This can be implemented through the Airport Authority's existing aircraft of the month in its YVR Air Mail newsletter or through a more comprehensive multimedia experience.

Effectiveness

The actual noise reduction benefit maybe limited due to the fact that the operations identified maybe a small contribution to the overall operations at YVR; however, highlighting the specifications of operations before and after the transition between aircraft types would still provide a better appreciation of the improvements to the community.

Cost to Stakeholders

This initiative is in line with existing communication strategies implemented by the Airport Authority. Additional costs may be incurred for tailored multimedia experiences.

BALANCED APPROACH TO RNP OPERATIONS

A significant consideration to the introduction of RNP procedures at YVR is the diversity of the fleet mix. Almost 50% of the operations at the airport are with propeller aircraft, and many of these do not have the capabilities to use RNP. Until a significant portion of the fleet has transitioned to RNP capabilities, introducing these procedures will continue to be a challenge. However, as these procedures begin to be developed and as aircraft fleet transition, the Airport Authority should keep the following under consideration.

Arrival

RNP flight tracks have been found to provide significant operational benefits to operators by reducing track miles, fuel consumption and therefore emissions.

However, the benefits associated with operating performance often take priority over the associated noise impacts. Although the use of RNP can lead to a reduction of noise on arrivals due to the use of CDA (Constant Descent Approach), it can also lead to a concentration of noise over areas located under the flight paths or lead to new approach paths altogether.

Departure

RNP departure procedures could be used to define 'low noise impact' noise corridors over the community; however, implementation of these should be measured against criteria that includes: objectively measured noise reduction; additional fuel and emissions caused by flying extra track miles; and, moving flights paths away from one community to reduce noise should not come at the expense of increasing noise in another community. Only those solutions that provide a win-win situation for all these criteria should be considered.

Implementation Requirements / Considerations
Transport Canada should be encouraged to set national policy on how RNP procedures are to be evaluated during development, including how to address 'true' and 'perceived' noise impacts, as many of the changes associated with RNP will create impacts outside the mandated area of noise management assigned to local airport authorities. All aviation stakeholders should be engaged directly to ensure that noise assessments are undertaken as part of the design of future RNP procedures and that the community be engaged in the process as well. For existing procedures, complaints associated to RNP operations should be identified and, where required, reviewed with NAV Canada to determine whether refinements could be introduced to mitigate the impact of noise on surrounding communities while preserving most of the RNP track benefits. The consultation process should also include local planning authorities and airlines.
Effectiveness
The ability of the aviation industry to justify the layout of the flight tracks on the basis of the extent of noise and emissions as well as operational savings to airlines will assist in getting community commitment and will assist the deployment of these new procedures.
Cost to Stakeholders
While the review process associated with airspace redesign is primarily a responsibility of NAV Canada, as a key stakeholder, the Airport Authority and local authorities may be required to dedicate some resources to this process.

EXPERIENCE/INFORMATION CENTRE

An Experience/Information Centre can take many shapes and forms. Its purpose is to provide a physical venue for residents to discover how airports operate and to enquire about the impacts associated with operations such as noise.

YVR currently has an exhibit located in the public observation area (Domestic Terminal Level 3) that includes some interactive tools for providing information about the airport and aircraft operations. Visitors to this area include the travelling public as well as meeters/greeters.

The specifications of an Experience/Information Centre should facilitate access to the general public and residents. It could be a permanent exhibit located adjacent to Airport Authority offices or be an expansion of the existing public observation area. Another method could be to use a mobile display as done in Hamburg. A mobile display provides the flexibility to go to the public and community events.

Brisbane Airport in Australia and Hamburg Airport in Germany provide two examples of Experience Centres (both permanent locations and mobile displays). Although noise impact is not the only focus of Experience/Information Centres, in both cases the airport uses these centres to educate, inform and build a fascination in the airport in order to achieve a better relationship with the community.

Implementation Requirements / Considerations
An Experience/Information Centre could be developed as a component of a broader community outreach strategy. As such, it may take different shapes or forms, and a clear understanding of the centre's objectives and how these fit within the context of the Airport Authority's existing community stewardship program would need to be defined.
Effectiveness
The effectiveness of this initiative on its own can be limited but can greatly enhance a broader strategy by providing a one-stop location for all enquiries relating to the operations and developments at YVR.
Cost to Stakeholders
Costs will vary based on the type of development initiated (e.g. real estate, staffing, display).

MULTILINGUAL COMMUNICATION STRATEGY

Vancouver is a thriving multicultural hub. Although English is broadly spoken, communicating in the native language of the largest ethnic communities in Vancouver can reach additional residents and provide a better opportunity for dialogue about the airport's development and its associated impacts on surrounding communities.

Implementation Requirements / Considerations
A multilingual communication strategy would start with an assessment of the predominant ethnic communities that are affected by noise in the vicinity of YVR. Beyond the translation and distribution of existing material to these communities, the outreach initiative can involve face-to-face meetings with the assistance of translators.
Effectiveness
This initiative will be more effective in communities where English is not as broadly used and therefore where existing communication and consultations tools are not as accessible.
Cost to Stakeholders
The proposed initiatives are within the realm of existing public relations activities. Additional costs will be incurred through the translation of relevant material and support of translators for live meetings.

ALTERNATIVE NOISE METRICS

The Airport Authority has used alternative noise metrics to a limited extent. The annual aeronautical noise management reports do include a range of charts and graphs that assist the reader in understanding the noise impacts associated with airport operations.

A notable exclusion from the 2011 report was the exclusion of NEF contours as well as the inclusion of operational charts highlighting the range and average number of operations on each runway.

An increased use of alternative metrics could include increased use of "events above" charts as well as flight path movement charts either based on modelling or, ideally, from actual data collected from the noise monitoring system.

In addition, the aeronautical noise management report could be complemented with an online application allowing for the customization of charts and tables to suit the needs of the individual readers. This could involve limiting the data to the area of concern or to the time of day of concern so that the data can be narrowed down to the needs of individual residents.

Implementation Requirements / Considerations

The Airport Authority could work with the community or members of the YVR Noise Management Committee to determine the charts and information that is most likely to contribute to enhanced communication of the impacts of actual and projected operations. Some charts may be selected as a means to compare operations annually while others can be produced to address a specific query from the community.

Effectiveness

The use of alternative noise metrics has proven successful in providing information to residents. However, there is a need to ensure that the metrics produced indeed address the concerns raised by the community and that any limitation in the modelling is clearly outlined.

Cost to Stakeholders

The production of alternative metrics uses information that is already available to create appropriate outputs. Some current programs may allow the seamless production of these metrics using minimal interface. Under this scenario, the costs will be limited. In other cases, there may be a need to create a chart or output that is unique and that will require specific IT resources hence increasing costs.

NOISE MITIGATION DESIGN COMPETITION

As highlighted in the case study for Schiphol Airport, a design competition can be an innovative way to find a novel solution to a problem identified while demonstrating to the community the airport's commitment to finding solutions.

Implementation Requirements / Considerations
The implementation of this practice will involve the selection of an issue suitable for a design competition.
Effectiveness
Effectiveness will vary based on complexity of the issue that is targeted.
Cost to Stakeholders
Costs will vary based on the extent and scope of the application, including prize: administration of the process; money for a potential award; and, costs associated with implementing the winning idea or concept.

EXISTING HOME NOISE INSULATION BROCHURE

Transport Canada land use planning guidelines recommends that no new residential developments be built within the 30 to 35 NEF contours around airports. Since annoyance does not "magically" stop at a specific line, there will still be segments of the population annoyed by aircraft noise within and beyond the 25 NEF contours.

The City of Richmond, which is the local City most impacted by aircraft noise, has bylaws and policies to ensure new residential development in high noise areas are properly sound insulated and potential buyers are advised of exposure to aircraft noise and operations. While this might be successful for buyers of new developments, a brochure targeted at existing residents in older dwellings might help augment the current policies and bylaws.

The objective of the brochure would be to provide educational information about aircraft noise and operations, and provide advice on options to sound insulate the dwelling.

While not specific to aircraft noise, the City of Vancouver, as part of a program called SoundSmart, has published a noise control manual that includes recommendations on how to sound proof existing homes (http://vancouver.ca/files/cov/noise-control-manual.pdf). A similar type of manual that is specific to aircraft noise may provide an effective tool to provide information to residents, and provide advice on actions and projects to better sound insulate existing older dwellings.

Implementation Requirements / Considerations

The Airport Authority could work with local cities most impacted by aircraft noise (City of Richmond and City of Vancouver) to develop a sound proofing brochure.

Effectiveness

This initiative would ensure consistency between the messages communicated by the Airport Authority and local Cities in regards to aircraft noise and to guide residents to the same resources for the assessment of noise impacts and mitigation tools.
Beyond the impact on residents, this initiative would consolidate the collaboration between the City (land use planning authorities) and the Airport Authority.

Cost to Stakeholders

Costs would include brochure content development and layout, and consultation of technical aspects of building sound insulation. Future ongoing costs would likely include renewal of information to keep up-to-date on advancements in building materials as well as local and national building codes.
Costs to the local Cities would consist of staff time to review and participate in material development.

NOISE-BASED LANDING CHARGES

There are many airports that have some form of a surcharge to landing fees related to aircraft noise levels. ICAO permits the use of such charges as long as they are fair and part of a cost recovery exercise that involves the alleviation or mitigation of impacts associated to aircraft noise rather than to increase revenues for the airport.[1]

A noise-based landing charge system (e.g. surcharge on noisier aircraft or rebate for quieter aircraft) should, therefore, be used in parallel with other mitigation best practices, such as a formal acoustic treatment program or Community Trust Fund for reinvestment in the communities affected by noise.

Implementation Requirements / Considerations
The implementation of a noise-based charging system should be evaluated by the Airport Authority against its business objectives and its strategy to mitigate or alleviate the impacts of noise in the community. If a program is to be developed, community and stakeholder engagement could be sought to set objectives and benchmark applications worldwide to identify the most suitable models for YVR.
Effectiveness
The effectiveness of this strategy will be dependent on a balanced approach between the costs recovered from operators and the benefits to the community whether it is through an acoustic treatment package or general community trust fund.
Cost to Stakeholders
Costs would be targeted at noisier aircraft operators but should be limited to a cost recovery exercise focussed on noise mitigation or alleviation strategies.

1. Doc 9082 - ICAO's Policies on Charges for Airports and Air Navigation Services, 8th edition, 2009

ACOUSTIC TREATMENT PROGRAM

An acoustic treatment program could be initiated on its own (airport-funded) or as a mean to reinvest the funds collected through a specific noise-based landing charges system as highlighted under the previous practice.

The program could be targeted towards existing buildings, residential or other sensitive applications (e.g. healthcare, schools) for the application of acoustic treatment beyond building code requirements.

Implementation Requirements / Considerations

The implementation of a comprehensive acoustic treatment program could be funded by a noise-based charging system in order to generate the funds required to undertake the project. Community and stakeholder engagement could be sought, especially with planning authorities to coordinate the efforts and to clearly define the eligibility and extent of the program.

Effectiveness

The effectiveness of acoustic treatment packages will vary based on the baseline condition of each building. Effectiveness will also depend on the scope and scale of the program.

Cost to Stakeholders

Given the very few operations of noisier aircraft in the fleet at YVR (e.g. Boeing 727 and 737-200s), funding an acoustic treatment program would be a challenge using landing fees alone. Additional sources of funds would need to be sought to cover the costs and expense of the program.

In addition, significant Airport Authority and City resources would be required to administer the program (overall administration of program, consultations, noise monitoring to establish eligibility, project management of work, etc.).

COMMUNITY TRUST FUND

The Airport Authority already has a presence in the community, notably through sponsorships. The development of a Community Trust Fund may help augment and support current investments in the community.

A Community Trust Fund may not be a requirement under existing conditions. However, under the introduction of a noise-based landing charges system, there may be a need to transparently manage the funds levied from noisier aircraft operators. As such, the development of a Community Trust Fund could provide an appropriate structure to manage the reinvestment activities in the community.

Implementation Requirements / Considerations
The creation of a Community Trust Fund could be implemented as a mean to provide the transparent management of funds associated with alleviating the impact of noise in affected communities. The implementation of such a fund would require the development of Terms of Reference and the selection of Trustees to provide adequate oversight of the funds and of the selected initiatives for reinvestment in the community.
Effectiveness
The development of a trust fund could be an effective means of managing funds specifically to compensate communities impacted by aircraft noise. The development of a clear scope and selection of a representative Board of Trustees would support the effectiveness of this initiative.
Cost to Stakeholders
Under this concept, the costs are suggested to be levied from equitable noisier aircraft movements as described under the Noise-based landing charges system.

REAL ESTATE DISCLOSURE

Buying a property for residential or investment purposes is one of the most intensive and stressful things a person can do. Considering the long term impact of such decisions, it is important to provide transparent advice on current and future flight paths.

Considering that real estate agents are the key interface during most real estate transactions, the airport could seek partnership with main real estate associations operating in Vancouver to ensure that prospective buyers get access to key tools to assess the location of properties in relation to the airport and flight paths.

Implementation Requirements / Considerations
This initiative would require reaching out to real estate associations such as the British Columbia Real Estate Association to agree on ways to communicate tools to assist real estate agents and buyers in finding information about the location of properties in relation to flight tracks.
Effectiveness
This disclosure to prospective buyers will create an expectation and awareness that will assist them with their decision.
Cost to Stakeholders
This practice involves the promotion of existing aircraft noise disclosure tools such as WebTrak on platforms hosted by real estate companies and associations. As such, cost will be insignificant to Vancouver Airport.

TOTAL NOISE LOAD

The concept of total noise load is used in Europe as a compliance measure that includes aircraft movements and a total noise load associated to individual aircraft characteristics.

In the context of YVR, this concept could be applied as a reporting mechanism rather than a compliance mechanism.

By tracking concurrently the quantity of movements as well as their relative noise "load", the airport would be able to communicate to the community comparative performances year over year. Note: This practice is meant to be used as a complement to transparent metrics and is used to quantity annoyance.

Implementation Requirements / Considerations
As data is readily available for aircraft movements, the key implementation requirement will be associated with the development of transparent total noise load metric, which could be based on the QC system (London Heathrow) or TVG system (Schiphol). A benchmarking exercise and consultation with the noise management committee could also be part of the process.
Effectiveness
The effectiveness of this tool would grow over time as more data is collected or if the airport decides to revisit past years to provide a more appropriate sample.
Cost to Stakeholders
The cost of this initiative is limited to the development of a comprehensive mechanism to assess total noise load which could be undertaken internally by YVR.

CONCLUSIONS

As part of its responsibility to manage noise impacts, the Airport Authority commissioned Airbiz to review Best Practices in regards to noise management at airports around the world to complement previous work undertaken.

This report reviewed operational and community outreach initiatives undertaken at other airports and how they could be implemented at YVR.

This document is structured to be easily shared with stakeholders, and complements a similar study commissioned by the Airport Authority and completed in 2009. Ideas identified in this document will assist with creating initiatives for the 2014-2018 YVR Noise Management Plan.

From this exercise, a dozen initiatives were specifically reviewed for consideration by the Airport Authority. It should be noted that practices adopted at one airport may be problematic to adopt at another airport due to differences in funding schemes, legislative requirements, business drivers, etc. Decisions on whether to adopt practices outlined in this document rests solely with the Airport Authority, and must fit within the context of their business strategy and objectives of supporting the economy and local communities by providing strong aviation links to the rest of the World.

VANCOUVER AIRPORT AUTHORITY

Beyond, Every Day.

APPENDIX

SUPPORT MATERIAL

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