City of Richmond

# Report to Committee

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| **To:** | Planning Committee | **Date:** | August 30, 2018 |
| **From:** | Victor Wei<br>Director, Transportation | **File:** | 01-0153-04-01/2018-Vol 01 |
| | Barry Konkin<br>Manager, Policy Planning | | |
| **Re:** | **2019-2023 YVR Noise Management Plan - City of Richmond Comments** | | |

## Staff Recommendation

1. That the staff comments contained in the report titled "2019-2023 YVR Noise Management Plan - City of Richmond Comments" form the basis of the City's response to the Vancouver Airport Authority regarding its preparation of the 2019-2023 YVR Noise Management Plan;

2. That a copy of this report be forwarded to Vancouver Airport Authority for its consideration in the preparation of the draft 2019-2023 YVR Noise Management Plan; and

3. That staff be directed to request a copy of the final YVR Noise Management Plan and provide the Plan to Council for information.

Victor Wei
Director, Transportation
(604-276-4131)

Barry Konkin,
Manager, Policy Planning
(604-276-4139)

Att. 3

| REPORT CONCURRENCE | |
|---|---|
| CONCURRENCE OF GENERAL MANAGER | |
| REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE | INITIALS: OJ |
| APPROVED BY CAO | |

## Staff Report

### Origin

The Vancouver Airport Authority (VAA) is responsible for noise management for up to ten nautical miles from the Vancouver International Airport (YVR), as per its ground lease with the federal government. The VAA Board must have an approved five-year noise management plan signed by the Federal Minister of Transport to guide its noise management practices. The current five-year YVR Noise Management Plan is now in its fifth and final year and a new five-year 2019-2023 YVR Noise Management Plan (the Plan) is being prepared by VAA staff.

This report presents staff's preliminary comments on noise-related issues and initiatives to be considered as part of the update. These comments, plus any additional ones identified by Council, would form the basis of the City's submission to VAA on the Plan, if supported by Council.

This report supports Council's 2014-2018 Term Goal #3 A Well-Planned Community:

> *Adhere to effective planning and growth management practices to maintain and enhance the livability, sustainability and desirability of our City and its neighbourhoods, and to ensure the results match the intentions of our policies and bylaws.*
>
> *3.1. Growth and development that reflects the OCP, and related policies and bylaws.*

This report supports Council's 2014-2018 Term Goal #5 Partnerships and Collaboration:

> *Continue development and utilization of collaborative approaches and partnerships with intergovernmental and other agencies to help meet the needs of the Richmond community.*

### Analysis

Preparation of the 2019-2023 YVR Noise Management Plan

VAA's three-stage process to update the Plan is outlined below. VAA expects to deliver the updated Plan to Transport Canada for approval by the end of 2018.

*Stage 1: Identify Community Issues (Fall 2017 to Spring 2018)*

Stage 1 activities included:

- Analysis of historical noise concerns;
- Launch of community web survey (March to mid-July 2018) to:
  - solicit input on concerns related to aircraft noise and canvass for potential initiatives to address them; and
  - get feedback on various aspects of VAA's current noise management program;
- Discussions with YVR Aeronautical Noise Management Committee (YVR ANMC); and
- Review of 2037 YVR Master Plan comments.

With respect to historical noise concerns, VAA undertook a trend analysis of noise concerns received between January 1, 2014 and December 31, 2017. During this period, a total of 6,458 concerns were received from 903 different individuals. Several individuals registered multiple concerns in the span of four years. Figure 1 provides the breakdown of concerns and individuals by community.

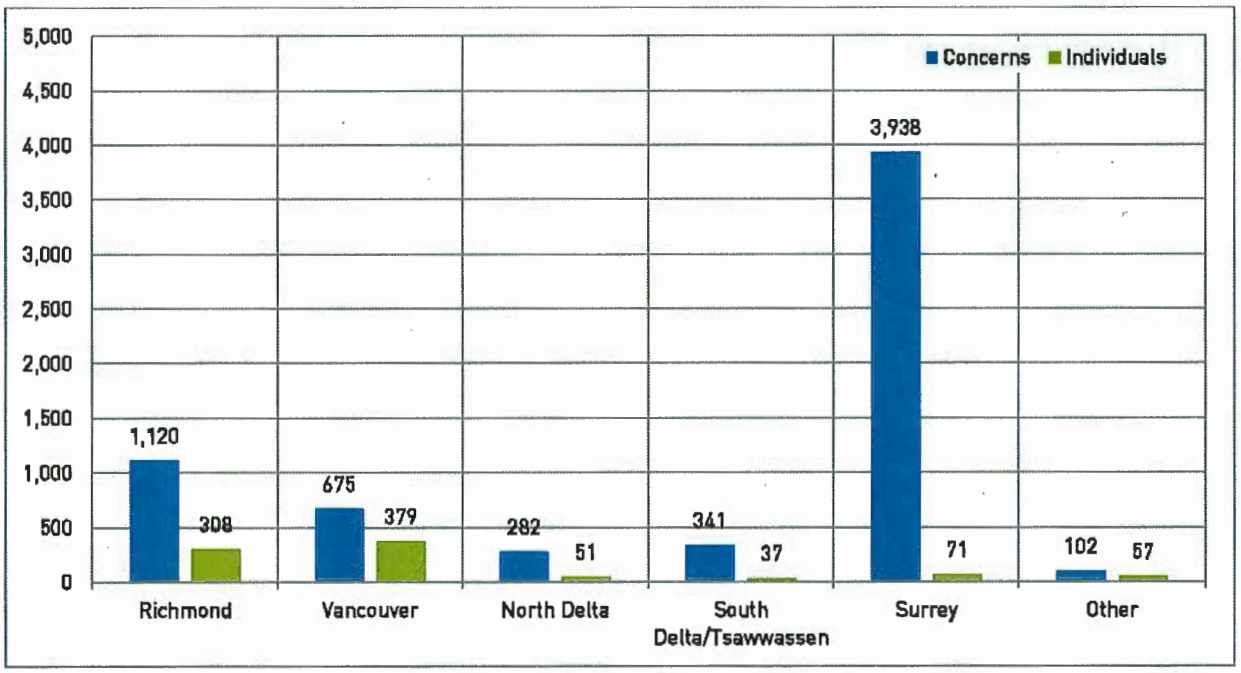


Figure 1: 2014-2017 Noise Concerns by Community

For Richmond, a total of 1,120 concerns were registered by 308 individuals over the four-year period. The annual breakdown of the number of concerns and individuals are shown in Table 1. Table 2 provides the rank ordering (from most commonly cited to least) of the top operational categories and issues associated with the concerns received.

Table 1: 2014-2017 Richmond Concerns and Individuals

| Year | Concerns | Individuals |
|---|---|---|
| 2014 | 303 | 94 |
| 2015 | 253 | 91 |
| 2016 | 255 | 84 |
| 2017 | 309 | 83 |

Table 2: Rank Ordering of Top Operational Categories and Issues

| Operational Category | Issue |
|---|---|
| 1. Float planes | 1. Low flying |
| 2. Jet departures | 2. Night operation |
| 3. Propeller departures | 3. Aircraft routing over populated areas |
| 4. Run-ups | 4. Frequency of air traffic |
| 5. Jet arrivals | 5. North runway use |

Regarding the 2037 YVR Master Plan, one of the comments provided by the City to VAA in June 2017 was to continue minimizing and mitigating noise and other impacts on Richmond

residents. VAA's latest 2037 Airport Noise Exposure Frequency (NEF) Study did not change its existing 2015 NEF contours or their noise impacts. These potential noise impacts are the foundation of the OCP's Aircraft Noise Sensitive Development (ANSD) land uses and policies.

*Stage 2: Identify Initiatives and Actions (Summer 2018)*

Stage 2 activities included:

- Review of noise management practices at other airports (Attachment 1);
- Reporting of interim results of the on-line community web survey (administered via web link on the VAA website that was open to the general public) and the on-line IPSOS survey panel (administered by a survey company via invitation to the closed membership of the panel) to YVR ANMC:
    - public comments to date were generally similar to those heard in the last update to the Plan (e.g. concerns related to night-time noise);
- Administering a separate questionnaire seeking input on issues and potential initiatives to the YVR ANMC (June 2018); and
- Meetings with key stakeholders and partners.

The community web survey and IPSOS survey panel closed on July 13, 2018. A total of 721 individual responses were received (218 through the open web link survey and 503 through the on-line IPSOS panel). Of these, 145 respondents were from Richmond residents:

- 108 individuals in Richmond completed the community web survey; and
- 37 individuals in Richmond participated through the IPSOS survey panel.

67% of Richmond residents who took part in the consultation stated that they have been annoyed by aircraft operations at some point during the past 12 months. Table 3 presents the top issues related to annoyance and the top suggested ideas to address the concerns for Richmond respondents.

Table 3: Top Issues and Suggested Ideas Related to Annoyance in Richmond

| Causes of Annoyance | Suggested Ideas |
|---|---|
| • Frequency of air traffic over populated areas<br>• Growth in air traffic<br>• Night-time operations | • Change flight paths<br>• Restrict night-time operations<br>• Further restrict engine run-ups<br>• Move traffic to other regional airports<br>• Reduce propeller aircraft traffic |

As the City is a key stakeholder in YVR-related issues, staff met with VAA representatives in April and June 2018 and provided preliminary comments to VAA on issues and potential initiatives in July 2018, which are described in more detail below.

*Stage 3: Evaluate Input, Create Action Plan, Draft Plan (Summer to Fall 2018)*

VAA will consider all input in Fall 2018 and has indicated that any additional comments provided by Council will be considered before the draft Plan is finalized.

Preliminary Staff Comments on Issues and Initiatives and VAA's Response

Richmond's appointed citizen members and City staff representatives on the YVR ANMC have been involved in meetings and workshops related to the update of the Plan since Fall 2017. Staff provided the comments below to VAA staff on issues and initiatives to consider in the new Plan by email on July 12, 2018.

On August 13, 2018, VAA staff provided a response to these items as noted in italics below. At that time, VAA staff also submitted a summary of completed actions from the 2014-2018 YVR Noise Management Plan (Attachment 2) and the draft 2019-2023 YVR Noise Management Plan Initiatives (Attachment 3).

*Future Close-In South Parallel Runway*

In 2017, a VAA 2037 Noise Exposure Frequency (NEF) Study found that, as a landing runway, there will be a negligible increase in aircraft noise with the potential future south runway and, as such, this would not warrant any change to the existing 2015 NEF contours. However, the 2037 NEF Study did not study the noise implications of the potential future south runway also being used as a take-off runway. Therefore, the projected noise impacts of the potential future south runway being used for departures are unknown at this time. As such, staff requested that VAA:

(a) Expressly state in the new five-year Plan that the use of the potential future south runway for departures may have significant noise impacts on the City of Richmond;

(b) Study the noise impacts arising due to departures from a potential future south runway on the affected larger area (i.e., as the future south runway is south of the existing south runway, aeronautical noise impacts in the City Centre may also extend further south), property owners, developers, and the community at large. This study should also include an assessment on how these changes may impact land use and development in Richmond; and

(c) Mutually agree with the City on how the negative impacts arising from departures on a potential future south runway would be mitigated.

*[VAA Response]*
*The approved YVR Master Plan identifies the locations for two future runway options.*

*If and when we determine that an additional runway is required to accommodate the community's demand for increased air services, a separate comprehensive multi-year consultation process with the community and our stakeholders will take place. Issues such as defining the modes of operating the runway, environmental impact, noise, possible effects on community and the process of construction will be explored.*

*Although premature now, at the appropriate time a detailed environmental impact assessment (EIA) would be undertaken to support plans for a new runway. To clarify, the noise management plan is not the start or substitute for an environmental impact assessment or project approval process for a new runway.*

*While the three topics raised by City staff would be addressed in the future EIA, under proposed initiative #10.3 in the 2019-2023 YVR Noise Management Plan, we will work to identify and ensure appropriate information and data required for future assessments are being collected.*

*Regional Airport Strategy*

Council resolved in June 2017 that: *the Vancouver International Airport Authority (YVR), in conjunction with other regional airports and stakeholders (e.g., NAV CANADA), be encouraged to prepare a Regional Airport Strategy.* A Regional Airport Strategy could help manage and distribute the social, economic, and environmental impacts (including noise) associated with airport operations. As this strategy has not yet been completed, staff requested that VAA:

(a) Prepare a Regional Airport Strategy that identifies the roles of VAA and other regional airports and includes a focus on noise and other social and environmental impacts.

*[VAA Response]*
*While YVR continues to work with and share information with our regional airport partners, Transport Canada is responsible for approving airport operations at these airports and NAV CANADA manages the shared airspace.*

*Creating a Regional Airport Strategy will not be included as an initiative in the 2019-2023 YVR Noise Management Plan; however, we meet regularly with regional airports and have referenced the various roles and responsibilities of regional airports in the YVR Master Plan and recognise that each airport in the Lower Mainland plays an integral role in serving the needs of local communities.*

*Community Awareness/Education*

Based on VAA's commissioned report on noise management practices at other airports, staff requested that VAA:

(a) Pursue new technology to better inform the public about aeronautical noise, which may include:
- an aircraft noise predictor app (identified in the report as being used in Amsterdam); and
- additional add-ons for WebTrak, which is a web-based tool that tracks "real-time" (with a 10 minute delay) and historical flight and noise data (e.g., decibel levels).

*[VAA Response]*
*Under proposed initiative #1.1 in 2019-2023 YVR Noise Management Plan* [Attachment 3], *we will look at incorporating tools to enhance community communication and information exchange.*

*Noise Reduction*

Based on VAA's commissioned report on noise management practices at other airports, staff requested that VAA:

(a) Expand VAA's existing Fly Quiet Awards to a Fly Quiet Program, which may include:

- establishing aircraft noise limits, particularly for night-time flights;
- applying noise charges for flights that exceed the aircraft noise limit (identified in the report as being in effect in Zurich and London Heathrow); and
- using the funds generated for measures that reduce noise impacts to community.

*[VAA Response]*
*Aircraft and engine manufacturers invest billions of dollars each year to research and develop new technologies to improve the noise performance of aircraft. As a result, the International Civil Aviation Organization (ICAO) states that aircraft produced today are approximately 75% quieter than they were 40 years ago. In addition, airlines invest billions in upgrading the fleet, resulting in improvements to noise and emissions reductions.*

*The ICAO establishes aircraft noise standards, which include meeting prescribed noise levels at three measurement locations: take-off; approach, and sideline. Depending on the measured noise levels, aircraft are categorized as either Chapter 2 (noisiest), Chapter 3, Chapter 4, or Chapter 14 (quietest).*

*The Federal Government, through Transport Canada, regulates all aircraft operating in Canada to ensure they meet airworthiness requirements, including meeting the ICAO noise standards. In addition, Transport Canada requires all jet aircraft over 34,000kg to meet Chapter 3 (or better) noise certification requirements in order to operate in Canada.*

*In 2017, 93% of the jet aircraft operating at YVR met Chapter 4 or better noise requirements. As all aircraft operating at YVR meet noise and emission standards set by Transport Canada, we do not think creating separate noise limits for aircraft operating at YVR would be appropriate. The YVR Fly Quiet Awards will remain a positive incentive to encourage and promote good noise management practices at the airport.*

(b) Examine the feasibility and potential effectiveness of the following noise mitigation techniques:
- landscaping to reduce ground noise produced by aircraft arriving and departing (identified in the report as an effective noise mitigation measure in Amsterdam as shown in Figure 2); and
- establishing an Aircraft Noise Ombudsman (identified in the report as being in effect in Sydney).

*[VAA Response]*
*Under proposed initiative #12.3 in the 2019-2023 YVR Noise Management Plan* [Attachment 3], *we commit to assess the use of berms, barriers, and landscaping as ways to minimize ground based airport noise from new developments; however, due to the limited space on Sea Island and height restrictions dictated by the Airport Zoning Regulations, it is unlikely that landscaping such as used in Amsterdam could be constructed at YVR.*

Figure 2: 80-acre green space adjacent to Amsterdam Schiphol Airport with landscaping to deflect noise

*Other Initiatives*

Staff also requested VAA to consider the following initiatives:

(a) That the new Plan indicate how the current 2014-2018 Plan has been implemented and identify any outstanding initiatives. Each Plan should not be an isolated stand-alone plan but should reference what progress has been made on past actions.

*[VAA Response]*
*Progress on Noise Management Plan initiatives is provided in our annual noise report, which is provided to YVR Noise Management Committee members and is available to the public on the YVR website. The attached table* [Attachment 2] *also provides a summary of completed actions against the 2014-2018 YVR Noise Management Plan initiatives.*

(b) That all incomplete and ongoing actions included in the current 2014-2018 Plan be carried over into the 2019-2023 Plan. For example:
- Was Action 4.2 (create summary report on nature of marginally compliant Chapter 3 aircraft operations) completed?
- There has been exploration of better methods to communicate with the public regarding aircraft noise (Action 2.2) but has anything been implemented?

*[VAA Response]*
*See summary of work initiatives* [Attachment 2] *for summary of completed actions from the 2014-2018 YVR Noise Management Plan.*

Staff Comments on Draft 2019-2023 YVR Noise Management Plan Initiatives

As indicated by VAA's responses above, the draft 2019-2023 YVR Noise Management Plan initiatives [Attachment 3] address most of the City's preliminary comments. Staff comments not addressed include:

- preparation of a Regional Airport Strategy;
- establishment, monitoring, and enforcement of aircraft noise limits; and
- establishment of an Aircraft Noise Ombudsman.

In addition, a number of the proposed initiatives are on-going actions that have been carried forward from the current 2014-2018 YVR Noise Management Plan. Staff suggest that the draft Plan be reformatted to more clearly delineate actions that are new from actions that are on-going (e.g., annual monitoring/reporting), which would improve understanding.

Next Steps

Should Council wish to include additional issues or initiatives that should be considered in the preparation of the 2019-2023 YVR Noise Management Plan, these would be forwarded to VAA. VAA has indicated that the staff feedback described above and any additional comments from the City will be considered in the finalisation of the draft Plan, which is expected to be completed by the end of 2018.

## Financial Impact

None.

## Conclusion

The Vancouver Airport Authority must update its Noise Management Plan every five years, as a requirement of its land lease agreement with the Government of Canada. As part of this current update, staff recommend that the comments contained in this report form the basis of the City's submission to VAA as it finalizes the 2019-2023 YVR Noise Management Plan.

for Tina Atva, MCIP
Senior Planning Coordinator
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For Joan Caravan
Transportation Planner
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TA:ta

Att. 1: YVR Noise Management Practice Review Final Draft Report (Airbiz), June 3, 2018
Att. 2: Summary of Work Against Initiatives in the 2014-2018 YVR Noise Management Plan
Att. 3: Draft 2019-2023 YVR Noise Management Plan Initiatives



# YVR NOISE MANAGEMENT PRACTICE REVIEW

## FINAL DRAFT REPORT

JUNE 1, 2018

# EXECUTIVE SUMMARY

The Vancouver Airport Authority (the Airport Authority) manages operations at Vancouver International Airport (YVR) under a long term ground lease with the Federal Government. The Vancouver Airport Authority is a community based not-for-profit corporation that receives no government funding and is governed by a Board of Directors appointed from the community whose focus is to ensure that YVR serves the best interests of the public. All profit generated at the airport is reinvested back into operations, maintenance and future projects. The Airport Authority is committed to creating an airport that British Columbia can be proud of: a premier global gateway, local economic generator and community contributor.

The Airport Authority is assigned the responsibility to manage noise from operations at YVR under a ground lease with the Federal Government. This is achieved through a comprehensive noise management program and establishing a Noise Management Plan (NMP) to guide work efforts. The NMP is also a requirement under the ground lease and must be reviewed and approved by Transport Canada. The Airport Authority structures the NMP over a five-year time period and outlines efforts to manage and reduce the impacts of operational noise at YVR.

The Airport Authority follows a multi-stage process to create a YVR Noise Management Plan.

For 2019-2023, the work includes gathering input from stakeholders, including the community, members of the YVR Aeronautical Noise Management Committee, and industry.

As part of the work to support the development of the Plan, the Airport Authority commissioned Airbiz to undertake a noise management practice review of other international airports. The purpose of this review was to objectively document practices at other airports and support discussions with the YVR Aeronautical Noise Management Committee, which plays an integral role in shaping noise management strategies at YVR.

As this review was meant to remain objective, no judgements are made on the benefits of the practices as this would be difficult to determine. Notably, the strategies to manage noise are often unique to each airport due to the specific nature of the airport's location and other variances (e.g. runway layout, fleet mix using the airport, rules and regulations, geographic layout). As such, strategies used at one airport may not necessarily work at other airports. Before any strategy is to be employed at an airport, the airport operator should undertake a comprehensive assessment to determine if the strategy will fit within the local context.

# EXECUTIVE SUMMARY

Contributing to a sustainable and prosperous future while caring about the well-being of its surroundings, its people, and its communities is fundamental to the Airport Authority's operating philosophy and central to its planning process and operations.

The Airport Authority's view is that there are four pillars to sustainability which includes: economic, environmental, social, and governance. As the Airport Authority continues to integrate sustainability into their planning and operations, a balanced approach is taken, and contribution to one pillar will not come at the expense of another. Therefore, to ensure all four pillars are taken into consideration in developing initiatives for the 2019-2023 YVR NMP, the following criteria will be used by the Airport Authority to evaluate proposed ideas:

- Impact on safety
- Impact on airport or aircraft operations
- Noise reduction benefit
- Effects on emissions or GHG
- Economic cost to industry
- Noise impact on other communities or areas
- Impact on current and future airport capacity
- Alignment with YVR's mandate to provide 24-hour air service for the region

Initial research on noise management practices at a selection of airports in the USA and Europe was undertaken by the Airport Authority. This research was expanded and supplemented by Airbiz through the inclusion of six additional airports in Canada, Europe and Australia.

A basket of notable practices and initiatives were compiled.

Fleet plan information was also collected from publicly available sources on a selection of airlines operating at YVR. The purpose of this work was to identify the fleet renewal activities of the main operators to give a sense of the transition and replacement of older, noisier aircraft with new, quieter, cleaner aircraft.

This report presents the results of this review.

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# 1 INTRODUCTION

# INTRODUCTION
# BACKGROUND

The management of noise from airport operations is a complex issue. As a responsible operator, the Airport Authority recognizes that some communities are affected by noise differently and they work in partnership with local residents, City staff, airlines, aviation associations, air traffic control, and Federal Government to reduce the impacts of noise disturbance where possible. Strong progress has been made in this area.

The Airport Authority is committed to minimizing noise disturbance while balancing the need for 24-hour airport access to serve the travel and business demands of the region.



Pursuant to a condition attached to the ground lease with the Federal Government, the Airport Authority is required to manage noise from airport operations, within a 10-nautical mile (nm) area around the airport. As such, the Airport Authority implements a comprehensive noise management program to achieve this requirement. As part of this program, the Airport Authority updates its Noise Management Plan (NMP) every five years. The NMP sets out how the Airport Authority will manage and reduce the impacts of operational noise at YVR and must be reviewed and approved by Transport Canada. The new NMP will span the years 2019-2023.

As part of the NMP update process, the Airport Authority commissioned Airbiz to undertake a review of noise management practices at other international airports. The key objectives of this study were to objectively document other practices at airports and support discussions with the YVR Aeronautical Noise Management Committee, which plays an integral role in how noise is managed at YVR. This report makes no recommendations or assessments of the practices, as practices are often unique to airports given the immense variation in local conditions. It will therefore be the decision of the Airport Authority, as the entity responsible for noise management, to determine whether or not such practices may be applicable to YVR.

The remainder of this report is structured as follows:

- Section 2: summary of key findings presented in the GTAA Noise Management Practice Review
- Section 3: summary of international airport noise management practices
- Section 4: Airline fleet plans
- Appendix A1: International airport profiles and practices
- Appendix A2: Selected case studies

# METHODOLOGY

The approach adopted for this study has involved a series of sequential steps. Broadly, these steps are illustrated opposite.

Airbiz reviewed initial research undertaken by the Airport Authority at the following five airports to validate findings and identify any further practices:

- Frankfurt (FRA)
- London Heathrow (LHR)
- Manchester (MAN)
- Portland (PDX)
- Seattle-Tacoma (SEA)



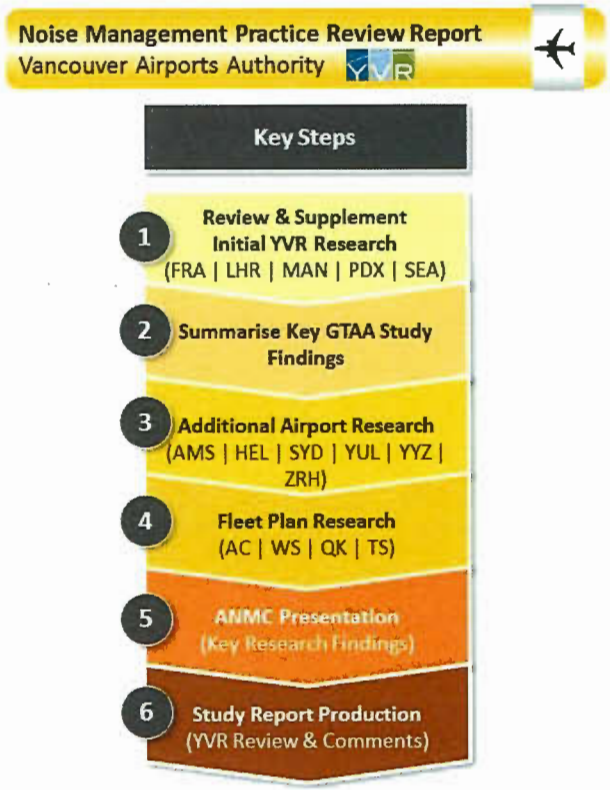
In 2017, a study focused on Noise Management Program Benchmarking and Best Practices at 26 airports worldwide was published by the Greater Toronto Airport Authority (GTAA). A review of this study was undertaken with the key findings summarized in Section 2.

To supplement the initial research undertaken by the Airport Authority, six additional international airports were examined, including two Canadian airports for local perspective – Toronto Pearson and Montreal Trudeau. The aim of including these additional airports was to strengthen the study's coverage and to capture a wider array of practices.

In March 2018, interim findings of the research were presented to the YVR Aeronautical Noise Management Committee.

A secondary wave of research focused on a review of 5-year airline fleet plans of selected carriers operating at YVR: Air Canada (AC), WestJet (WS), Jazz (QK), Air Transat (TS), as well as a selection of other international airlines.

All research conducted in this study was desktop based and relied on publicly available literature sources and data disclosures.



# STUDY AIRPORTS

Noise management programs and practices have been reviewed at 11 international airports across Canada, the USA, Europe and Australia.

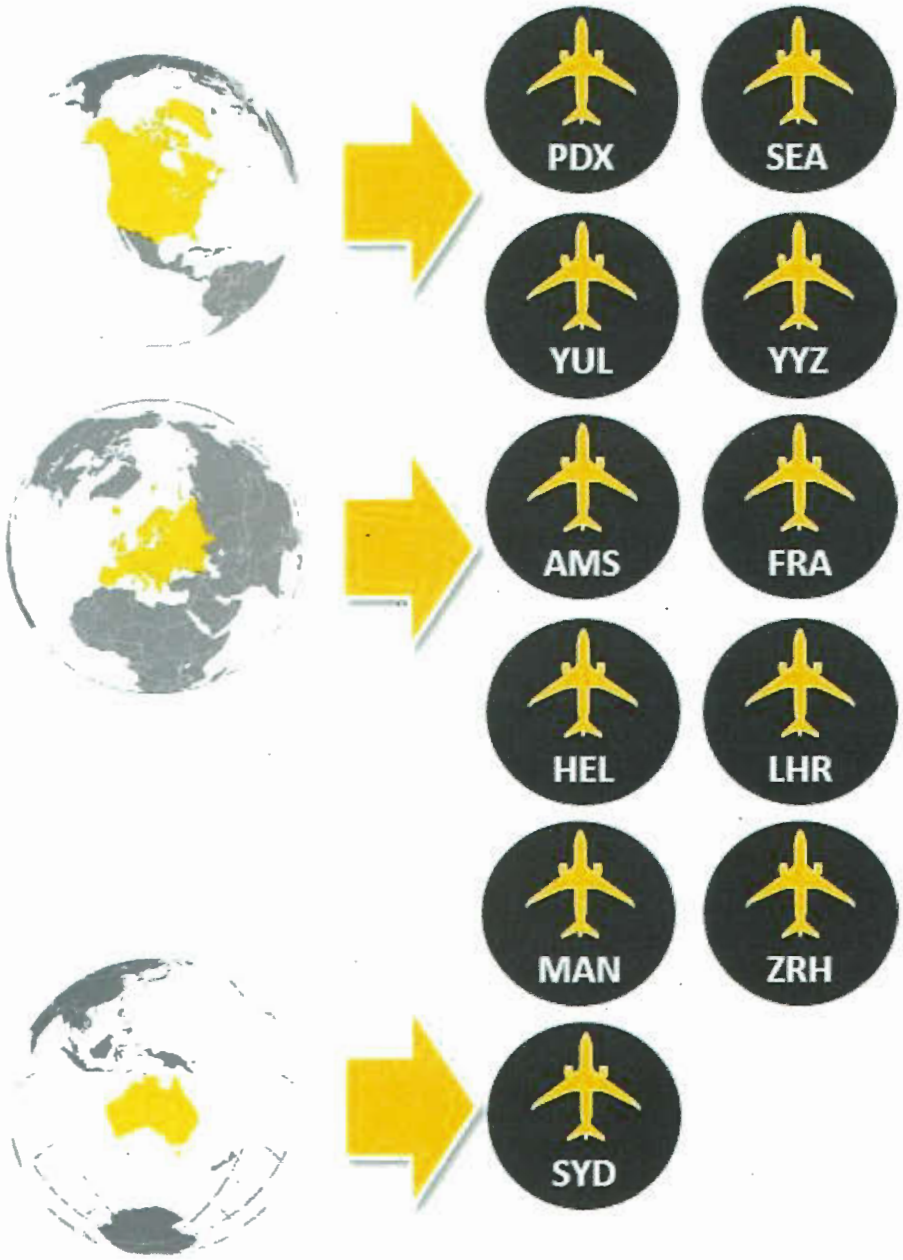
The airports shown opposite were chosen according to their relevance to YVR and the maturity of their noise management practices and programs. The basis of airport selection was underpinned by having a similar fleet mix (including significant jet movements), being located close to sensitive communities, having complex airspace and being subject to operational restrictions.

Specifically, the group of study airports includes:

- Two other major Canadian airports to provide further domestic insights on noise management under a common regulatory regime
- Six major European airports which operate under very stringent regulatory conditions (e.g. Finland and Switzerland)
- Australia's largest international airport which is constrained by a series of artificial operating restrictions, including a legislated hourly runway movement cap, a night curfew and a preferential runway system

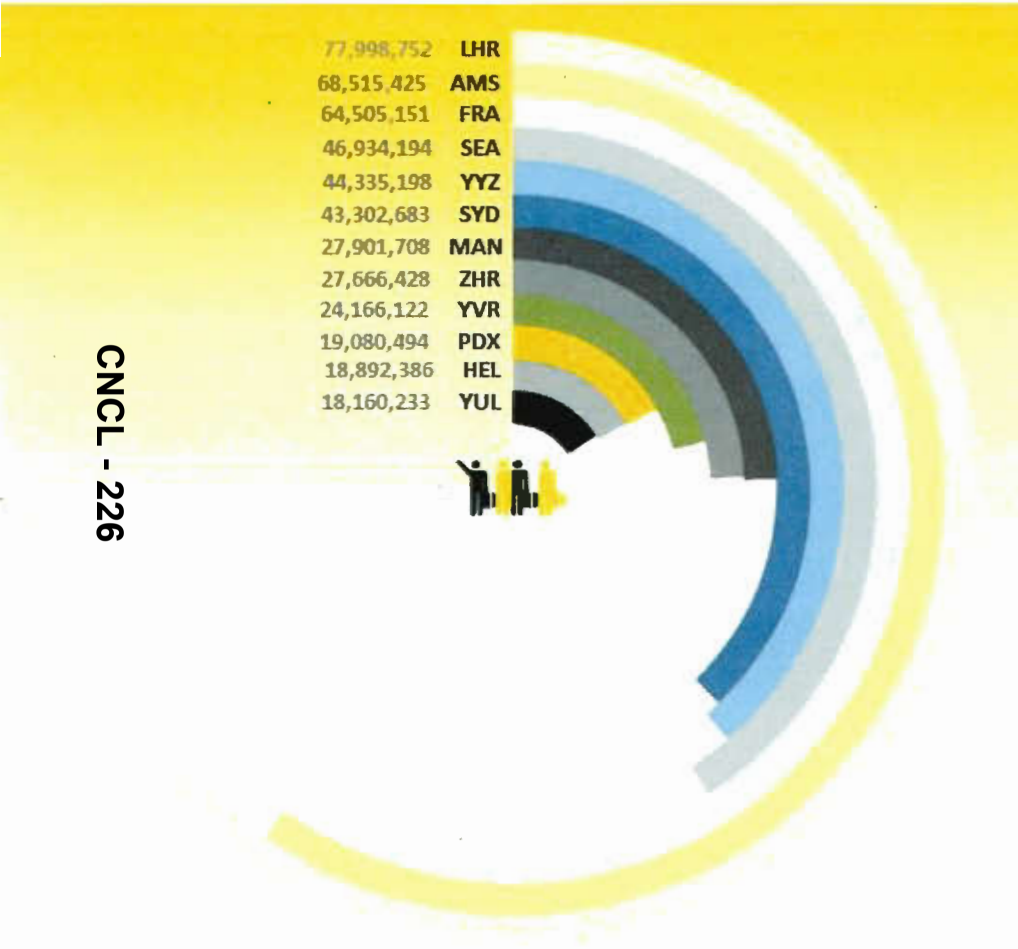
For information purposes, annual passenger throughput and air traffic movement figures are displayed on the next slide. The figures are based on a combination of 2016 and/or latest available operating statistics published by each of the airports featured in this study.

The annual passenger throughput and air traffic movement (ATM) numbers of all study airports including YVR are shown on the next slide. According to the statistics collected, YVR sits in the lower band of the third quartile of airports for passenger throughput and the upper band of the third quartile for ATMs.

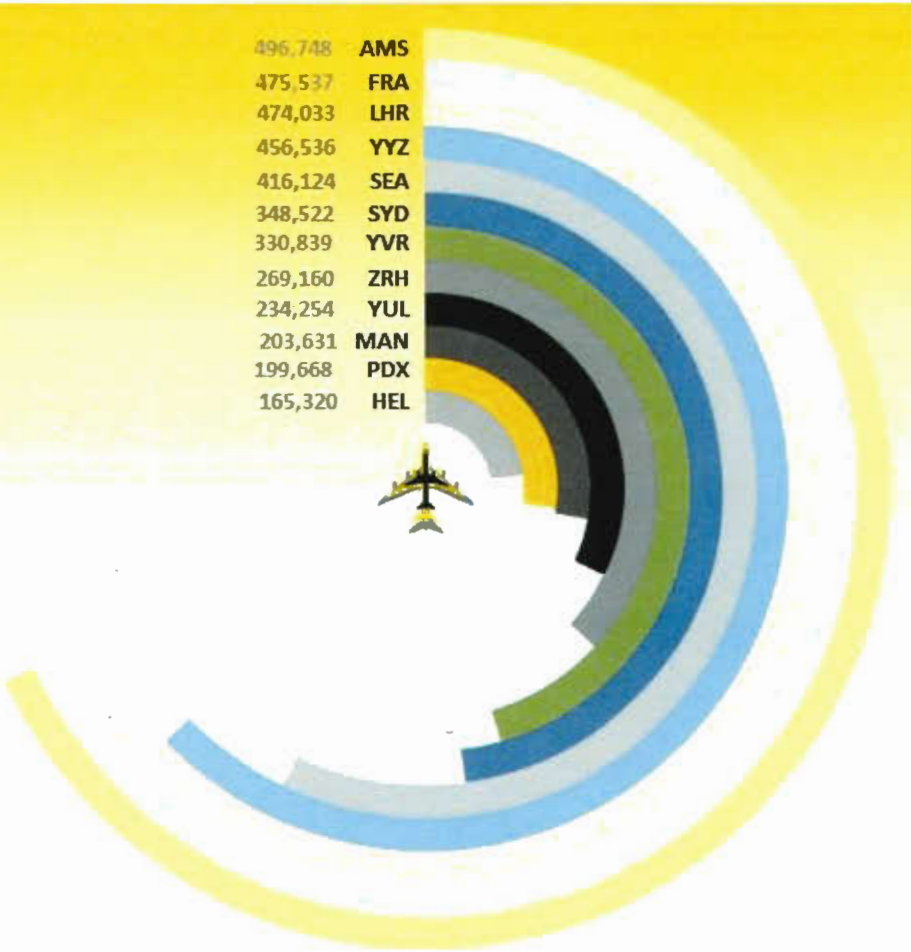


# STUDY AIRPORT PROFILES

## Annual Passenger Throughput




## Annual Air Transport Movements

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## NOISE MANAGEMENT PRACTICE REVIEW

# YYZ NOISE STUDY REVIEW

YYZ NOISE STUDY REVIEW

# TORONTO PEARSON INTERNATIONAL AIRPORT, CANADA

IATA: YYZ | ICAO: CYYZ

City: Toronto | Country: Canada

Airport Elevation

173m

Operating Hours

Preferential runways

2300 - 0700

City Centre Distance

22.5km

CNCL - 228

44.3 million

Passengers

456,536

Aircraft Movements

434,700

Tonnes

Cargo Throughput

**Large** Hub

STAR ALLIANCE

5

Runways

Runway Orientations

3 x NE/SW


2 x NW/SE


City-Airport Orientation

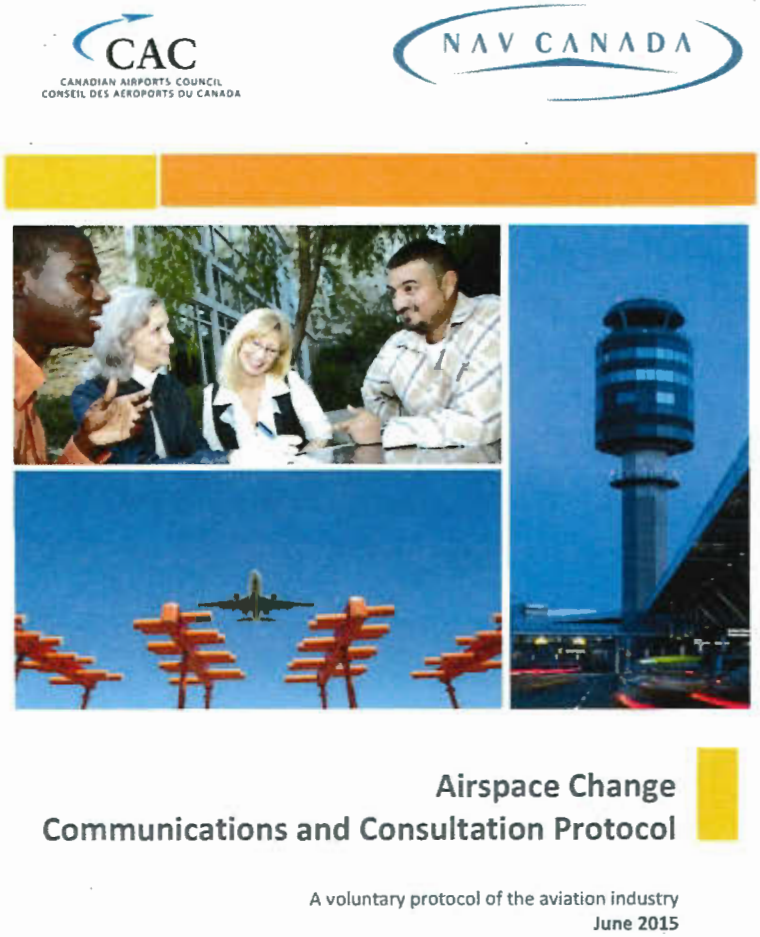
# CONTEXT IN TORONTO

Toronto Pearson International Airport (YYZ) provides an interesting case study given the significant interest in aircraft noise experienced by surrounding communities, and the fact that YYZ operates under the same regulatory regime as YVR, which includes a similar division of responsibility for airspace and airport management.

As high level background, in 2012, NAV CANADA implemented a redesign of the Windsor-Toronto-Montreal air routes resulting in the redistribution and concentration of air traffic over areas that had not been previously subjected to aircraft overflights.

While some consultation occurred prior to these changes, the new flight paths prompted action within affected communities. In turn, the government of Canada responded by reaching out to Canadian airports, NAV CANADA and Transport Canada to more clearly coordinate responsibilities to consult and communicate with communities during airspace changes. This led to the development of the Airspace Change Communication and Consultation Protocol (ACCCP) jointly by NAV CANADA and a number of Canadian airports through the Canadian Airports Council.

The Objective of the ACCCP is to set out requirements on how the aviation industry communicates and consults during airspace changes and defines roles and responsibilities of the parties involved. The ACCCP was approved by the Minister of Transport in 2015. The provisions of the ACCCP have been applied to airspace and procedural changes at approximately nine to ten airports since 2015, including on at YVR (related to the publication of a RNP approach for Runway 08L).




Source: NAV CANADA

YYZ NOISE STUDY REVIEW

# UNDERSTANDING WHAT HAPPENED

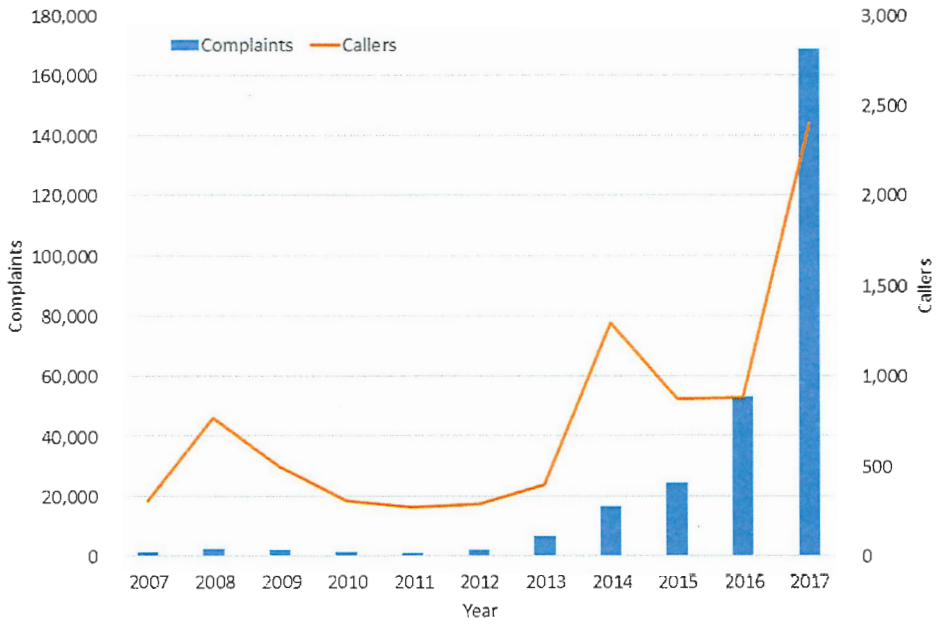
IATA: YYZ ICAO: CYYZ City: Toronto Country: Canada

As noted previously, NAV CANADA implemented redesigned Windsor-Toronto-Montreal air routes in February 2012. Among the changes, flights along the approach corridor for Runways 24L/R at Toronto Pearson were concentrated and relocated 1.8km south of the original flight path. As the chart indicates, complaints and callers began to rise significantly.

In June 2015, GTAA started a Noise Mitigation Initiatives Engagement Plan with NAV CANADA that included the commissioning of an independent review, Helios, to study noise management best practices at 26 international airports.

Then in April 2017, a Runway Rehabilitation Project commenced which led to operational changes and associated aircraft noise patterns and another considerable increase in complaints and callers. Toronto's subsequent response is clearly guided by the correlation of changes in airspace and runway use and the associated response by affected communities.






Source: CENAC (YYZ)

YYZ NOISE STUDY REVIEW

# MAIN OUTCOMES

IATA: YYZ ICAO: CYYZ City: Toronto Country: Canada

The output of the noise management best practices study is a set of potential new program and initiatives for GTAA:

| Area | Objective | |
|---|---|---|
| **Reducing impact of noise** | **Short-term:**<br>• Investigate summer time weekend runway alteration schemes<br>• Retrofit A320 family aircraft with vortex generators<br>• Investigate low power low drag (LPLD) operations<br>• Auxiliary power unit (APU) use restrictions | **Long-term:**<br>• Investigate opportunities to use runway to provide noise relief during off-peak periods<br>• Investigate continuous descent approaches<br>• Investigate departure procedures noise benefits |
| **Managing Night Noise** | **Short-term:**<br>• Investigate night-time preferential runway schemes<br>• Voluntary night-time ban on use of reverse thrust<br>• More stringent restrictions on the nosiest aircraft<br>• Earlier start for ground-run restrictions | **Long-term:**<br>• Extend the period during which night-time noise is managed<br>• No increase in total night-time noise |
| **Community and Industry Engagement** | **Community Forum:**<br>• Annual work programme aligned to community concerns<br>• Ensure wider community involvement<br>• Consider increasing the independence of Community Environment and Noise advisory Committee (CENAC) | **Long-term:**<br>• Industry forum with oversight of operational and policy activities related to noise<br>• Day-to-day complaint investigation supported by NAV Canada and airlines<br>• Voluntary industry code of practice<br>• Standard trials methodology |

YYZ NOISE STUDY REVIEW

# MAIN OUTCOMES

IATA: YYZ ICAO: CYYZ City: Toronto Country: Canada

The output of the noise management best practices study is a set of potential new program and initiatives for GTAA:

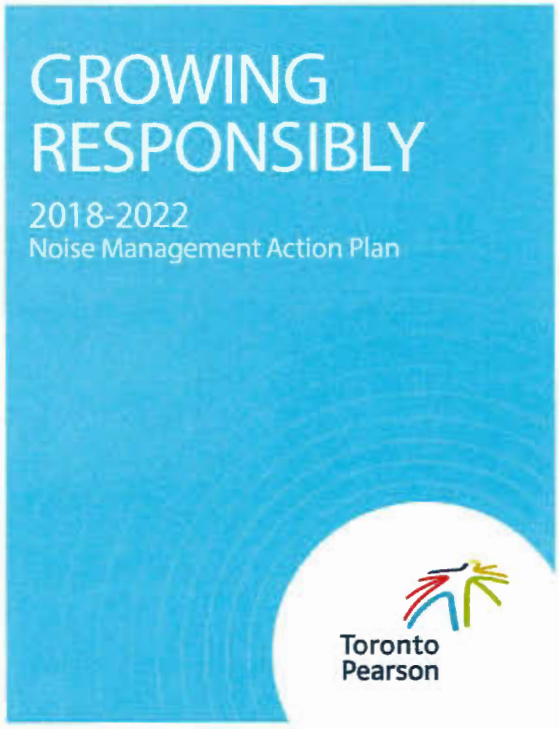
| Area | Objective |
|---|---|
| **Data and Reporting Initiatives** | Formal complaint policy |
| | Quarterly review of noise complaints |
| | Focus on aircraft noise on tangible actions |
| | Fly Quiet program |
| | Report compliance with preferential runway schemes |
| | Benchmark noise insulation schemes |
| **Examine Voluntary Initiatives** | Programme to determine how financial mechanisms could be use to incentivize quiet fleets |
| | Consider merits of voluntary land use compatibility plan |
| | Examine the condition under which a voluntary noise insulation scheme would be considered |
| | Consider the need for a designated third party to arbitrate where a noise issue has not been resolved satisfactorily |

# COMMUNITY COMMITMENTS AND TOOLS

IATA: YYZ | ICAO: CYYZ | City: Toronto | Country: Canada

The study, communication and consultation subsequently established a set of community commitments and practical tools:

| Area | Objective | |
|---|---|---|
| **10 Commitments to the Community** | 1. | We will collaborate better as an industry |
| | 2. | We will work smarter with our communities |
| | 3. | We will protect our neighbours |
| | 4. | We will help our neighbours sleep better |
| | 5. | We will have Canada's quietest fleet |
| | 6. | We will do more to understand our impacts |
| | 7. | We will limit surprises |
| | 8. | We will continue to take care of the environment |
| | 9. | We will lift up our communities |
| | 10. | We will always look for opportunities to improve |
| **9 Tools to manage noise and communicate effectively** | 1. | Quieter Fleet Incentive Program |
| | 2. | Night Flight Restrictions |
| | 3. | Runway Usage |
| | 4. | Noise Abatement Procedures |
| | 5. | Land Use Planning |
| | 6. | Noise Complaints |
| | 7. | Communications, Outreach and Noise Committees |
| | 8. | Noise Reporting and Metrics |
| | 9. | Fly Quiet Program |




Source: GTAA (YYZ)

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# 3 INTERNATIONAL PERSPECTIVES

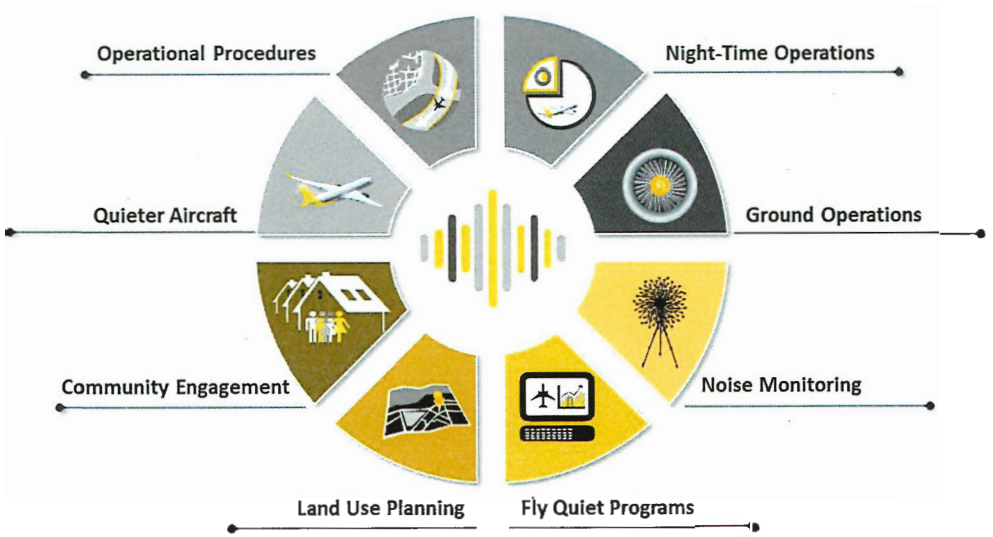
# INTRODUCTION

Airport noise remains a concern for some residents around airports in general, despite aircraft becoming progressively quieter over the last 30 years. While noise management practices help to reduce the impact of aircraft noise and provide relief to communities living near airports, especially at night, exposure to noise is inevitable given the close proximity of residential developments to the airport.

This review has identified eight common categories for noise management practices. These are listed below and illustrated opposite:

- Quieter aircraft
- Operational procedures
- Night-time operations
- Ground operations
- Noise monitoring systems
- Fly quiet programs
- Community engagement
- Land use planning



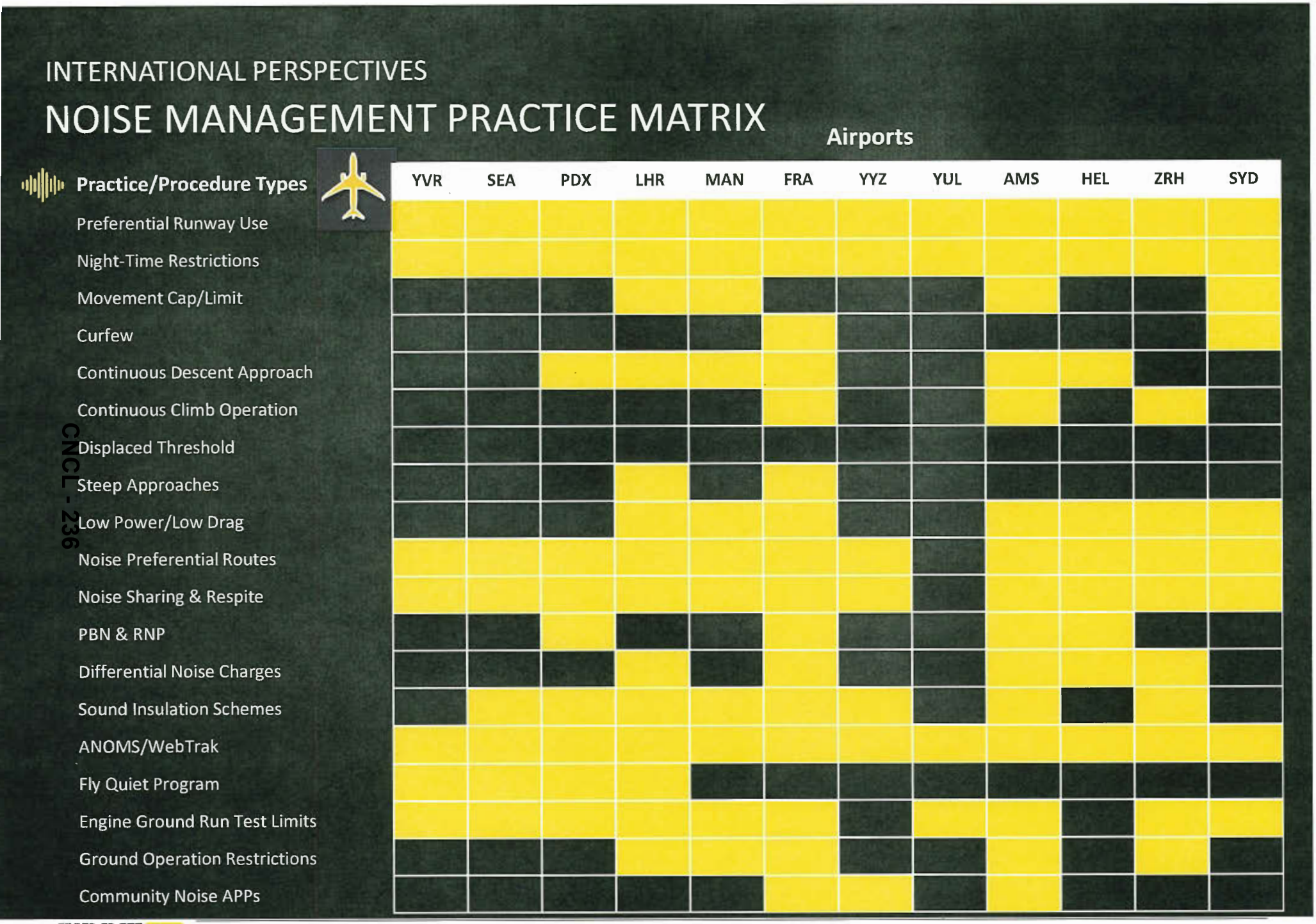



Airbiz reviewed noise management practices that fall under these categories at a selection of airports around the world. The highlights of this review are provided in this section, which were selected for their unique and/or creative ways of addressing noise. More detail on all airports studied can be found in the appendix.

As noted in the previous section, noise management strategies are often unique for each airport due to the local situation, and a practice that works at one airport may not necessarily work at others.

INTERNATIONAL PERSPECTIVES

# NOISE MANAGEMENT PRACTICE MATRIX



INTERNATIONAL PERSPECTIVES

# SUMMARY OF HIGHLIGHTS

| Category | Noise Management Practice Airport(s) | Detail |
|---|---|---|
| **Operational Procedure** | **Noise Sharing** Sydney Airport (SYD), Australia | The Long Term Operating Plan (LTOP) was developed in response to community pressure to share the noise generated by flight operations at SYD. LTOP provides 10 possible runway operating modes. A unique feature of LTOP is noise sharing targets. These targets aim to route as many flights as possible over water (55% to the south) and for the remaining flights to be shared between the other three directions as equitably as operationally feasible to do so. **Quantifiable noise benefits not available.** |
| **Night-time Operations**<br>**Operational Procedure** | **Night Curfew Flight Path Improvements + Noise Ombudsman** Sydney Airport (SYD), Australia | In Australia, the Aircraft Noise Ombudsman (ANO) was established in 2010 following a proposal outlined in the Australian Government's aviation policy paper. The ANO asked Airservices to consider if a better noise outcome could be achieved for coastal residents south of SYD affected by flights departing during the night curfew. Airservices reviewed and trialled changes to the Standard Instrument Departure (SID) track used during the curfew. Noise impact benefits were identified through flight tracking and formalizing the new SID is currently underway. **Quantifiable noise benefits not available.** |
| **Community Engagement**<br>**Noise Monitoring** | **Predictive Noise Disturbance App** Amsterdam-Schiphol Airport (AMS), The Netherlands | In response to community concerns about aircraft noise and to be as transparent as possible about its operation AMS, in collaboration with KDC Mainport, have been developing an aircraft noise predictor App. The aircraft noise predictor APP is designed to allow local residents living around AMS to know when and how much aircraft noise is to be expected, as well as the duration it will last. **Quantifiable noise benefits not available.** |
| **Community Engagement**<br>**Land Use Planning**<br>**Ground Operations** | **Ground Noise Solution** Amsterdam-Schiphol Airport (AMS), The Netherlands | A series of ground ridges were contoured into the local terrain on a 33ha site between a community and Runway 18R-36L. Each ridge was designed to deflect the sound waves upwards from their sloping surfaces. This is a clever example of best practice and innovation working in tandem, combining an airport noise solution with public art and recreational space. *The objective of the plan was to reduce ground noise by 10dB at 31.5Hz,* which were achieved through the trial testing period. (Source: https://www.schiphol.nl/en/you-and-schiphol/page/landscape-design-as-a-solution-to-ground-noise/). |

INTERNATIONAL PERSPECTIVES

# SUMMARY OF HIGHLIGHTS

| Category | Noise Management Practice Airport(s) | Detail |
|---|---|---|
| **Operational Procedure**<br>**Noise Monitoring** | **Steeper Approaches**<br>London-Heathrow Airport (LHR), United Kingdom | LHR trialled an RNAV $3.2^0$ approach procedure between September 2015 and March 2016. According to LHR the trial was successful and was found to have no adverse impact on daily operations. A noise reduction of up to 0.5-1 dB(A) were observed during trials (Source: https://www.heathrow.com/file_source/HeathrowNoise/Static/Heathrow_Slightly_Steeper_Approach_Trial_Report.pdf). |
| **Fly Quiet Program**<br>**Noise Monitoring** | **Departure Noise Limits**<br>London-Heathrow Airport (LHR), United Kingdom | All aircraft departing from LHR must adhere to noise limits set by the UK Government. The limits are (all times local): Day (07:00-23:00) 94dBA Lmax; Shoulder (23:00-23:30 and 06:00-07:00) 89dBA Lmax; Night (23:30-06:00) 87dBA Lmax. There are 12 permanent noise monitors located around Heathrow to monitor departure noise limits. Aircraft exceeding these noise limits must pay a fine, which is transferred to the Heathrow Community Fund. **Quantifiable noise benefits not available.** |
| **Fly Quiet Program**<br>**Noise Monitoring** | **Noise Management Priorities**<br>Helsinki Airport (HEL), Finland | Finavia, the operators of HEL, implement a comprehensive package of noise management both in the air and on the ground. Finavia has worked closely with its airlines, particularly Finnair on the late deployment of landing gear according to safety and operational criteria. **Quantifiable noise benefits not available.** |
| **Operational Procedure**<br>**Noise Monitoring** | **Noise Reduction Hangar**<br>Zurich Airport (ZRH), Switzerland | In 2014, Flughafen Zurich AG, the operators of ZRH, opened a new 'state-of-the-art', noise protection hangar to reduce the noise impacts on residents living in the surrounding municipalities from aircraft engine tests. The hangar's design lets air through while reducing noise (up to 30 dB(A)) through the use of high-performance sound insulation materials. It can accommodate aircraft up to Boeing B747-8 size. (Source: https://www.zurich-airport.com/the-company/zurich-airport-ag/completed-construction-projects/construction-of-new-noise-protection-hangar). |
| **Fly Quiet Program**<br>**Noise Monitoring** | **Noise Reduction Hangar**<br>Zurich Airport (ZRH), Switzerland | Differential noise charges are levied on all aircraft types operating at ZRH. Every aircraft is classified in one of five noise categories based on average peak noise values during take-off, as measured at the noise monitoring stations at and around the airport. All revenue from noise charges is credited to the Airport of Zurich Noise Fund (AZNF) and is used only for specific purposes, i.e. for costs relating to aircraft noise. **Quantifiable noise benefits not available.** |

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# 4

## NOISE MANAGEMENT PRACTICE REVIEW

# FLEET PLANS

AIRLINE FLEET PLANS

# QUIETER AIRCRAFT & NOISE CERTIFICATION

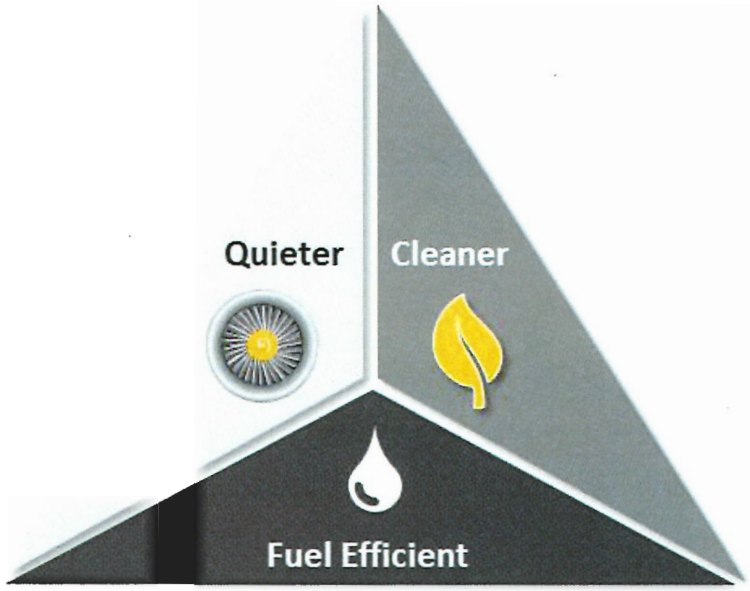
Jet aircraft entering service today are about 75% quieter than they were 40 years ago. The aircraft manufacturers continue to work to make aircraft even quieter while the airlines actively renew their fleets with the quietest aircraft.

Today, the aircraft in the skies above Vancouver are some of the most modern and quietest in the world. Through the ongoing replacement of older, noisier aircraft, as part of active fleet renewal programs, airlines are helping to reduce the noise impacts from individual aircraft using YVR.

Canadian airlines at YVR, including Air Canada, WestJet, Jazz and Air Transat are committed to being responsible members of the community, considering the environmental and social impacts of their operations in the air and on the ground. Continuing to reduce the impact of aircraft noise on communities is a high priority and forms a cornerstone of their respective corporate social responsibility programs, along with the reduction of greenhouse gas emissions, fuel optimisation and resource efficiency.

All of these airlines operate aircraft in ways that maximize noise reduction, without compromizing safety. This includes active renewal of their fleets with the quietest, cleanest and most efficient aircraft and the use of special take-off and landing procedures to minimize aircraft noise.

The first international noise certification standards for jet and large propeller driven aircraft were introduced by ICAO in 1972 to ensure that aircraft design was taking advantage of latest technological advancements and innovation. Progressively these noise certification standards have become more stringent in line with the level of noise reduction afforded by new technology (see next slide). The most recent standard, Chapter 14, applies to new aircraft types from December, 31 2017.

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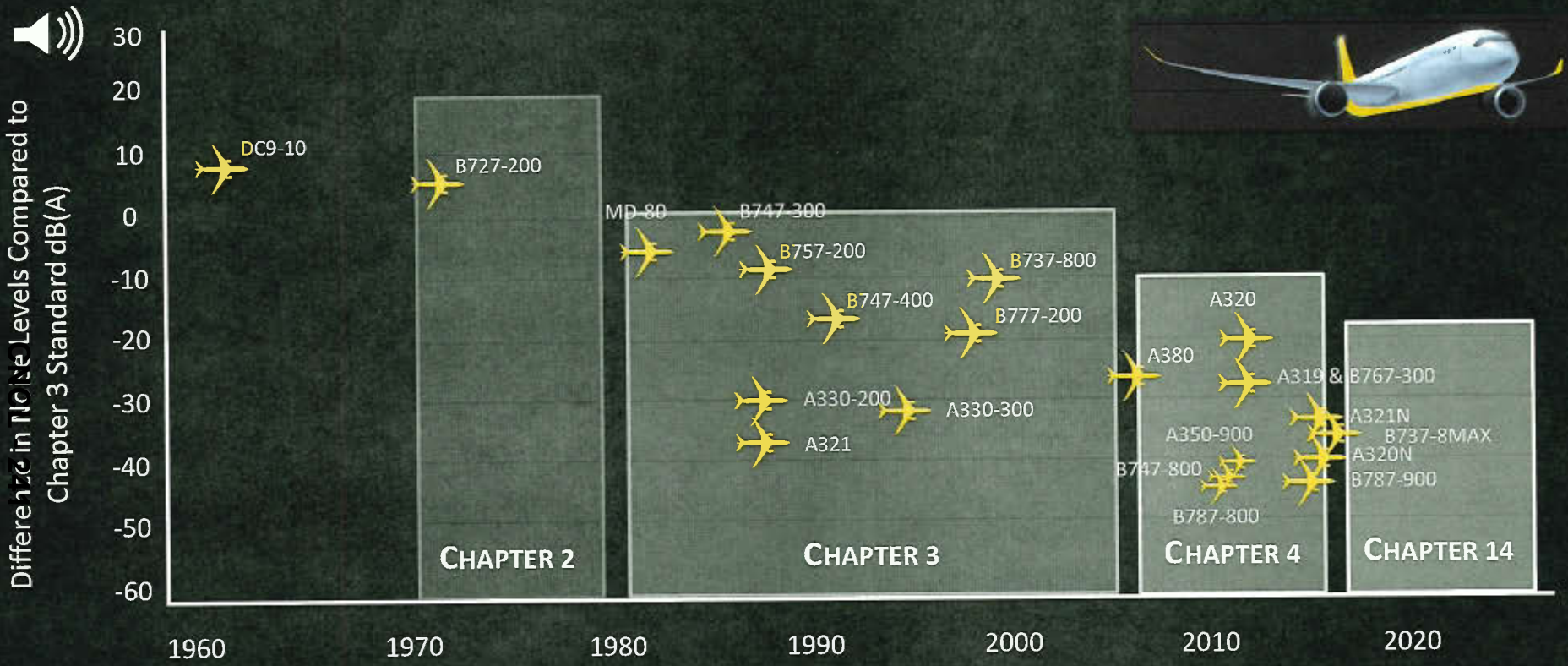
# QUIETER AIRCRAFT THROUGH MORE STRINGENT NOISE CERTIFICATION




ICAO NOISE CERTIFICATION STANDARDS (ANNEX 16, VOLUME I) FOR SUBSONIC & LARGE PROPELLER-DRIVEN AIRCRAFT

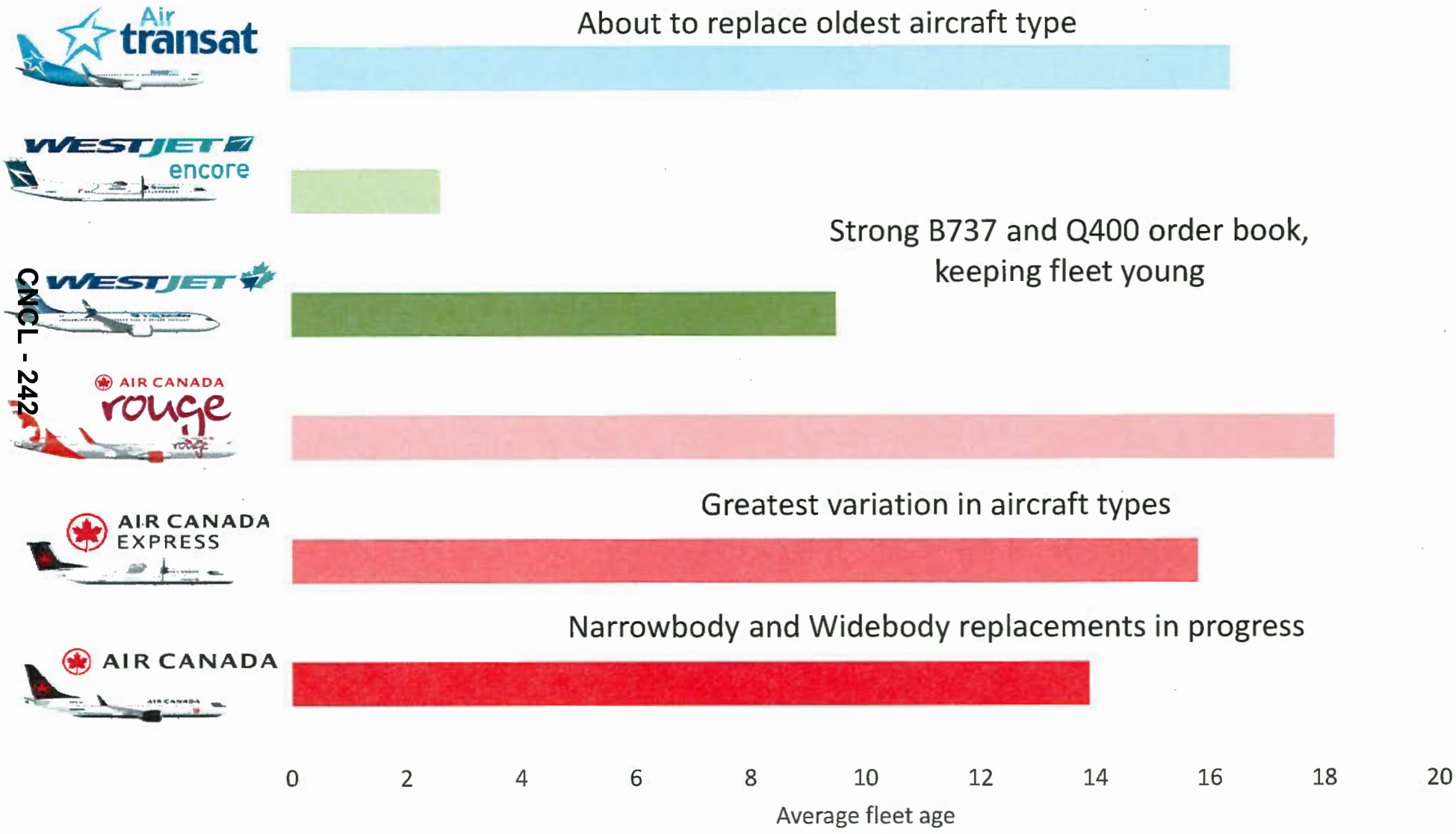
- Chapter 2: Type certificate required before 6 October 1977 for first generation turbofans & nacelles.
- Chapter 3: Type certificate required from 6 October 1977 for second generation turbofans & advanced nacelles.
- Chapter 4: Type certificate required from 1 January 2006 for new bypass ratio engines, nacelle technology & airframe design. Introduced a cumulative reduction of 10dB relative to Chapter 3 standard at all three noise measurement points.
- Chapter 14: Type certificate required from 31 December 2017 (31 December 2020 for aircraft <55t) for advanced high bypass ratio engines & nacelles. Introducing a cumulative reduction of 7dB relative to Chapter 4 cumulative levels at all three noise measurement points.

Notes

1) Chapter 2 aircraft were banned from operation in major countries around the world, including Canada starting from 1 April 2002.
2) The Effective Perceived Noise level (EPNdB) is calculated from the aggregation of individual measurements from three locations – approach (2km from runway threshold), sideline (450m laterally from runway centreline), flyover (6.5km from the brake release point).

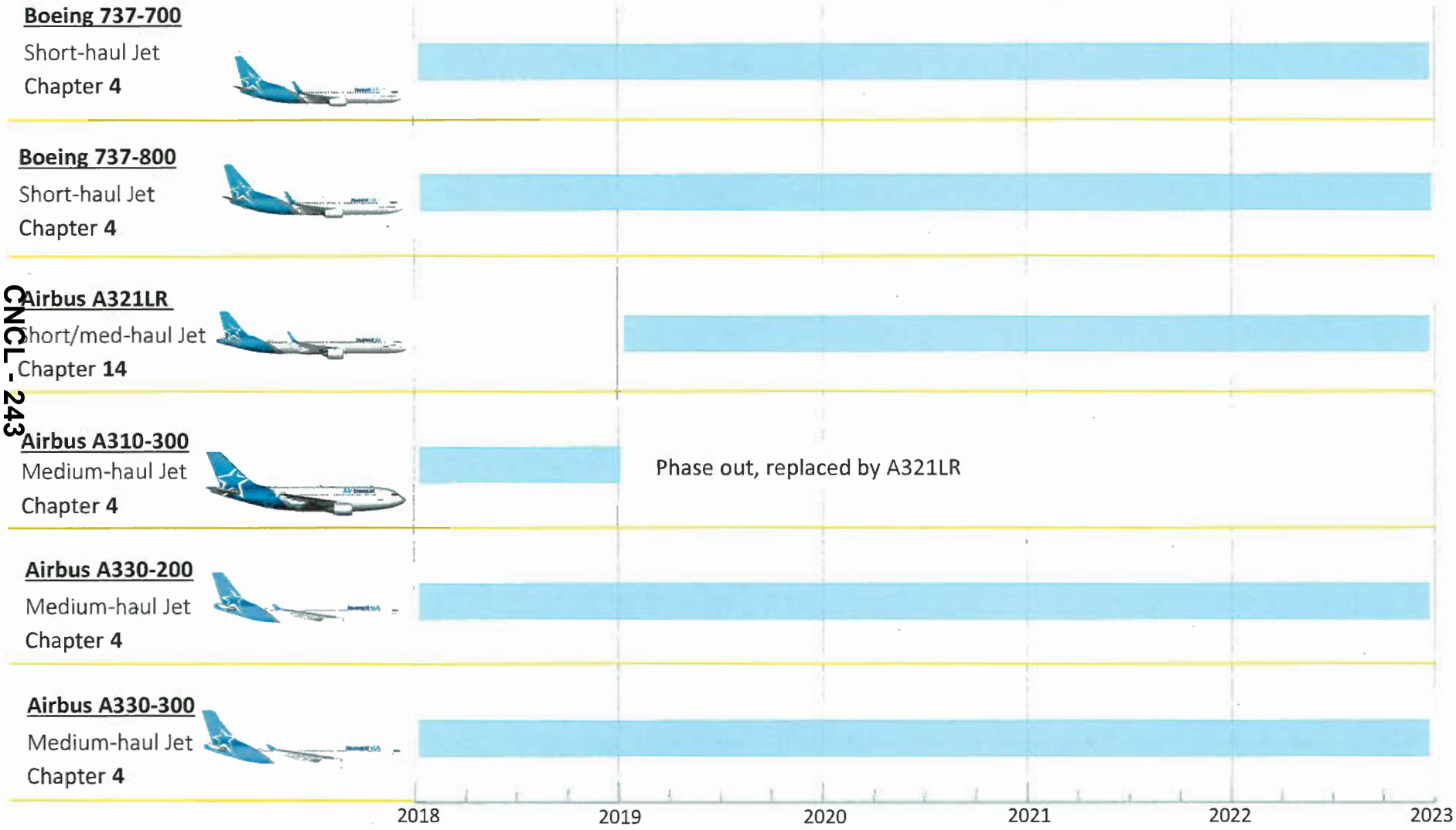
AIRLINE FLEET PLANS

# AVERAGE FLEET AGE



AIRLINE FLEET PLANS

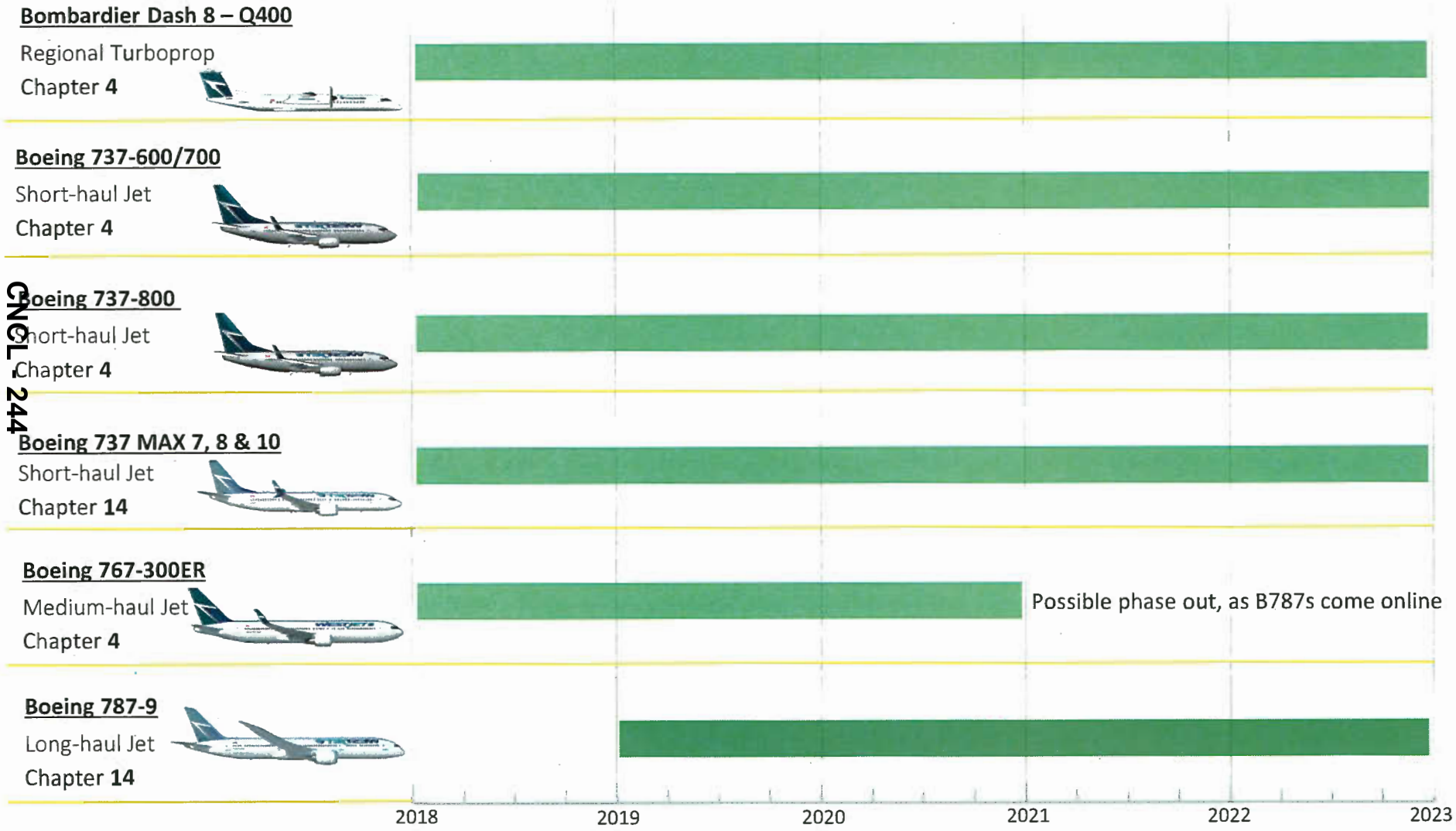
# AIR TRANSAT




Graphic displays known aircraft fleet for the next 5 years. Airline specific aircraft Chapter provided (may vary from certification Chapter).

AIRLINE FLEET PLANS

# WESTJET

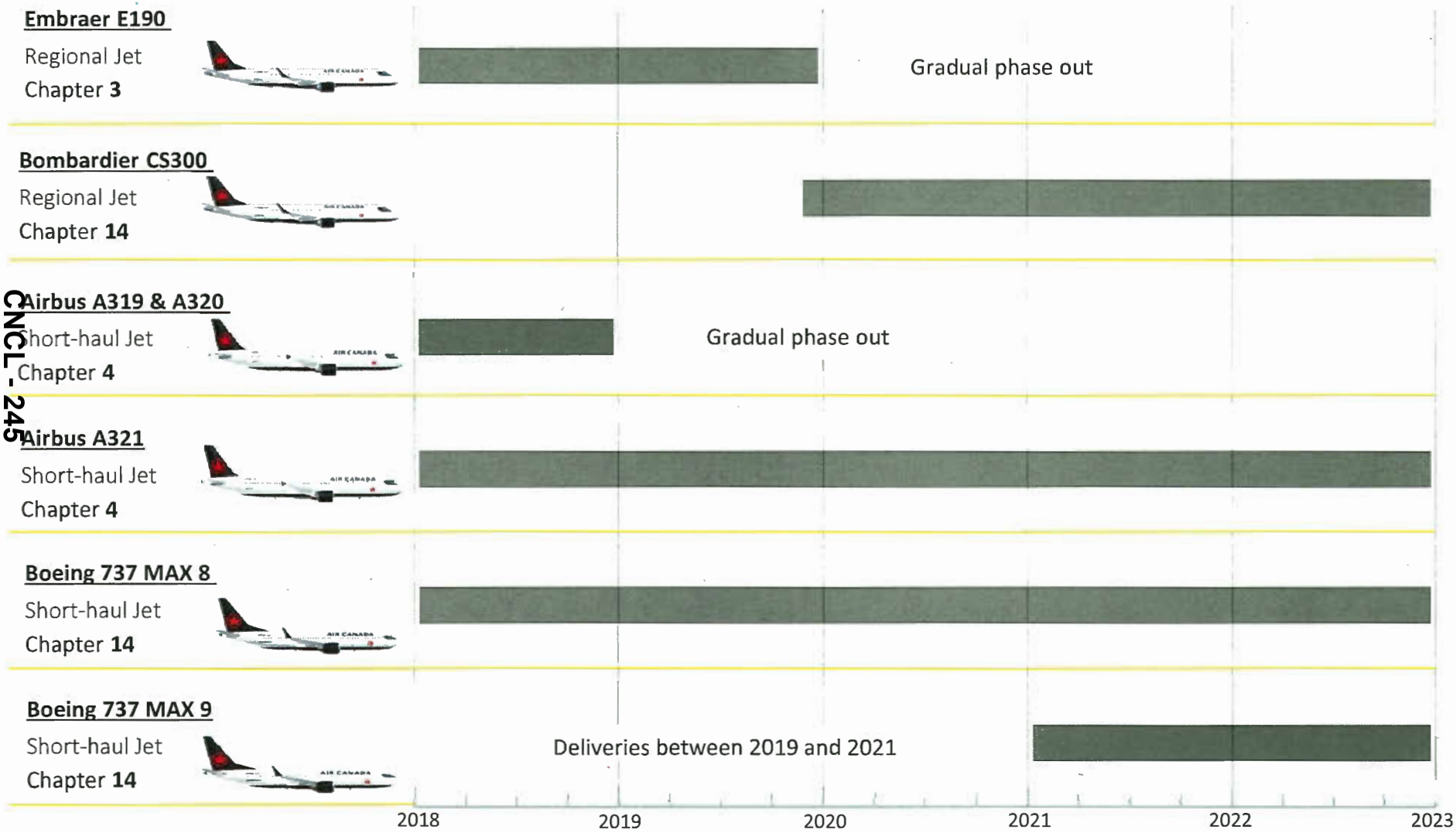



Graphic displays known aircraft fleet for the next 5 years. Airline specific aircraft Chapter provided (may vary from certification Chapter).

AIRLINE FLEET PLANS

# AIR CANADA: SHORT HAUL

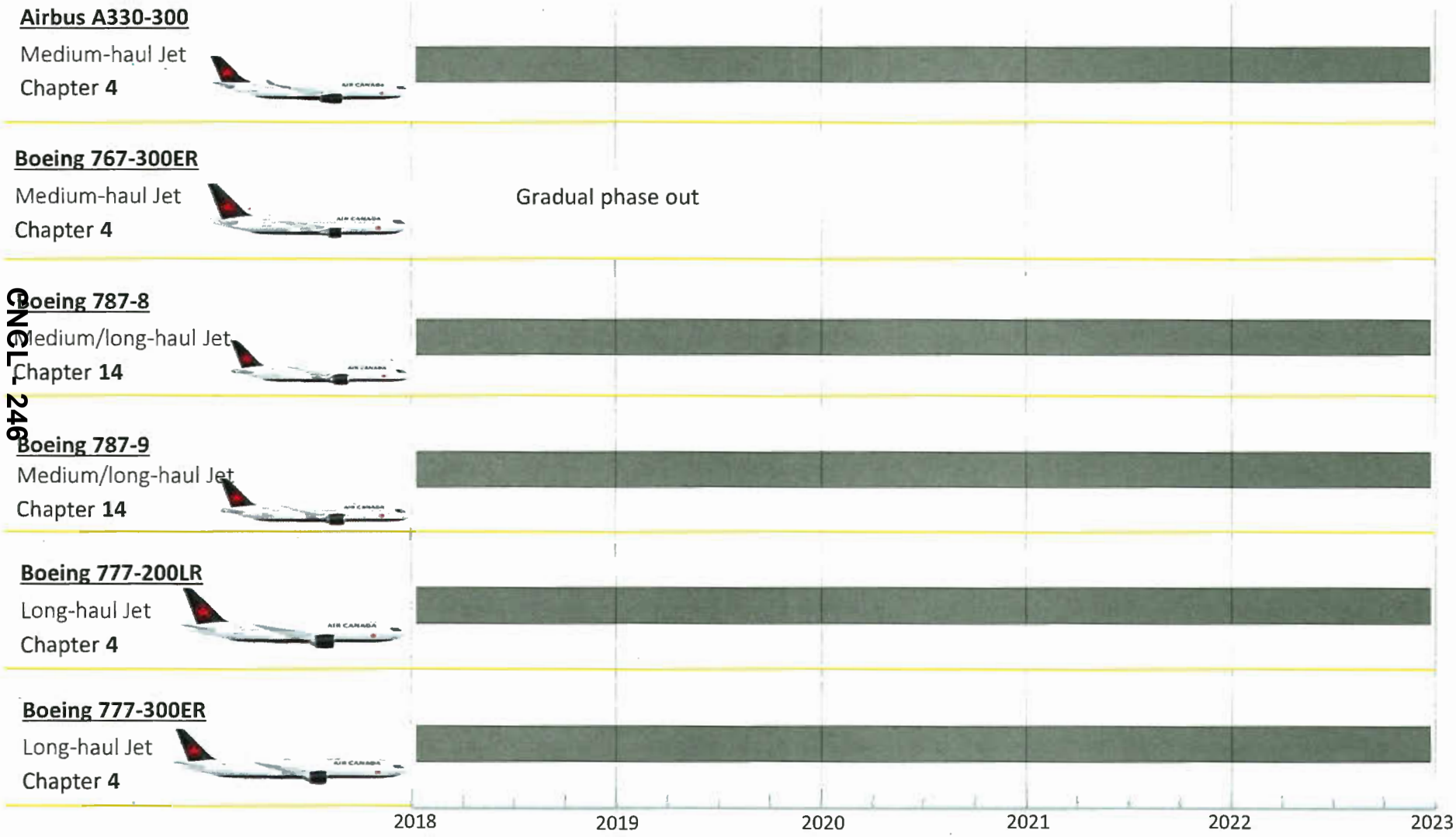
AIR CANADA






Graphic displays known aircraft fleet for the next 5 years. Airline specific aircraft Chapter provided (may vary from certification Chapter).

# AIR CANADA: MEDIUM/LONG HAUL

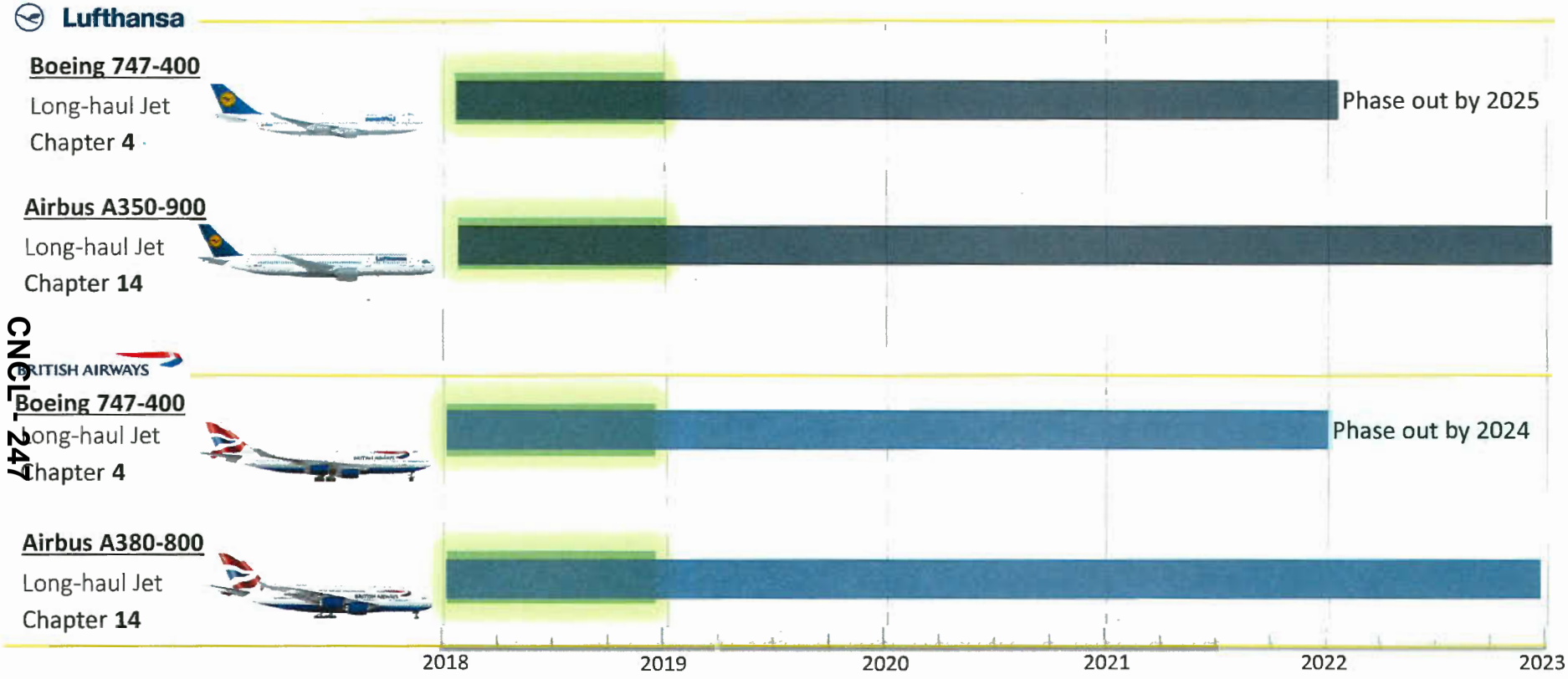



CNCL 246

Graphic displays known aircraft fleet for the next 5 years. Airline specific aircraft Chapter provided (may vary from certification Chapter).

AIRLINE FLEET PLANS

# INTERNATIONAL OPERATORS: EUROPE



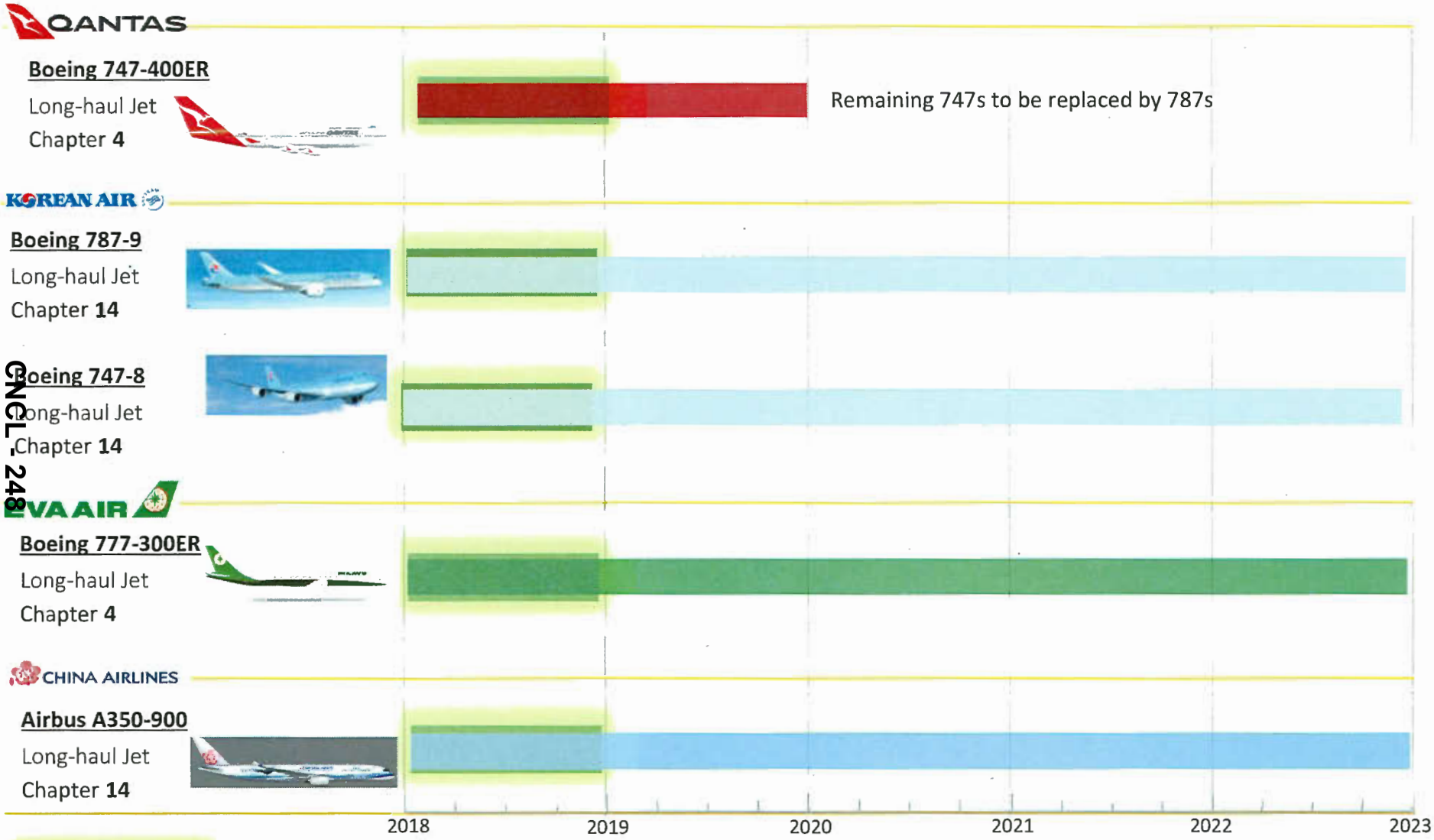



Scheduled to serve YVR in CY 2018

Graphic displays known aircraft fleet for the next 5 years. Airline specific aircraft Chapter provided (may vary from certification Chapter).

AIRLINE FLEET PLANS

# INTERNATIONAL OPERATORS: ASIA PACIFIC




Scheduled to serve YVR in CY 2018

Graphic displays known aircraft fleet for the next 5 years. Airline specific aircraft Chapter provided (may vary from certification Chapter).

AIRLINE FLEET PLANS

# AIR CANADA EXPRESS

AIR CANADA EXPRESS

**Beechcraft 1900D**
Regional Turboprop
Chapter **N/A**



**Bombardier Dash 8 - Q100 & Q300**
Regional Turboprop
Chapter **3***



**Bombardier Dash 8 – Q400**
Regional Turboprop
Chapter **4**



**Bombardier CRJ 100 & 200**
Regional Jet
Chapter **4**

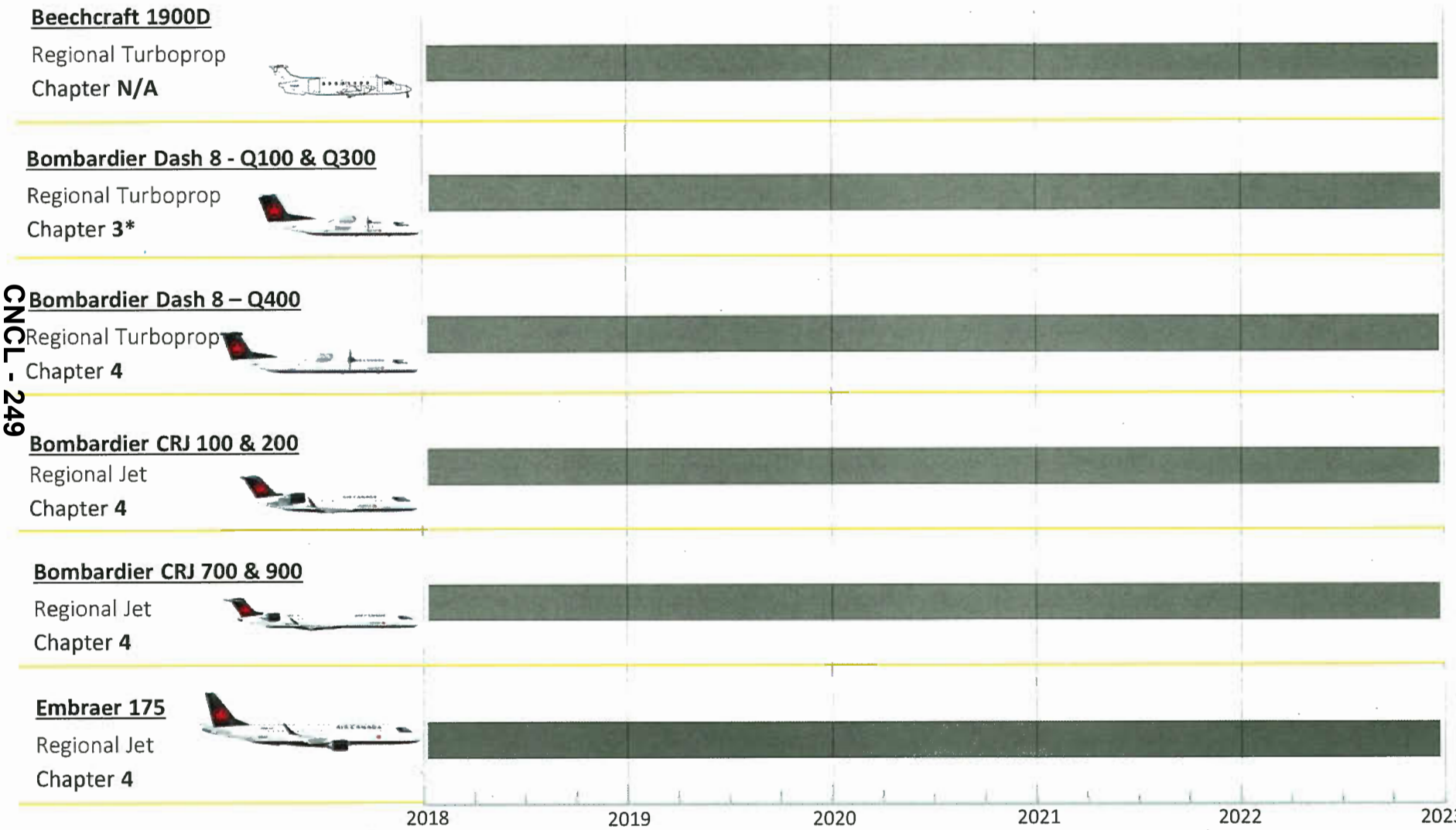


**Bombardier CRJ 700 & 900**
Regional Jet
Chapter **4**



**Embraer 175**
Regional Jet
Chapter **4**

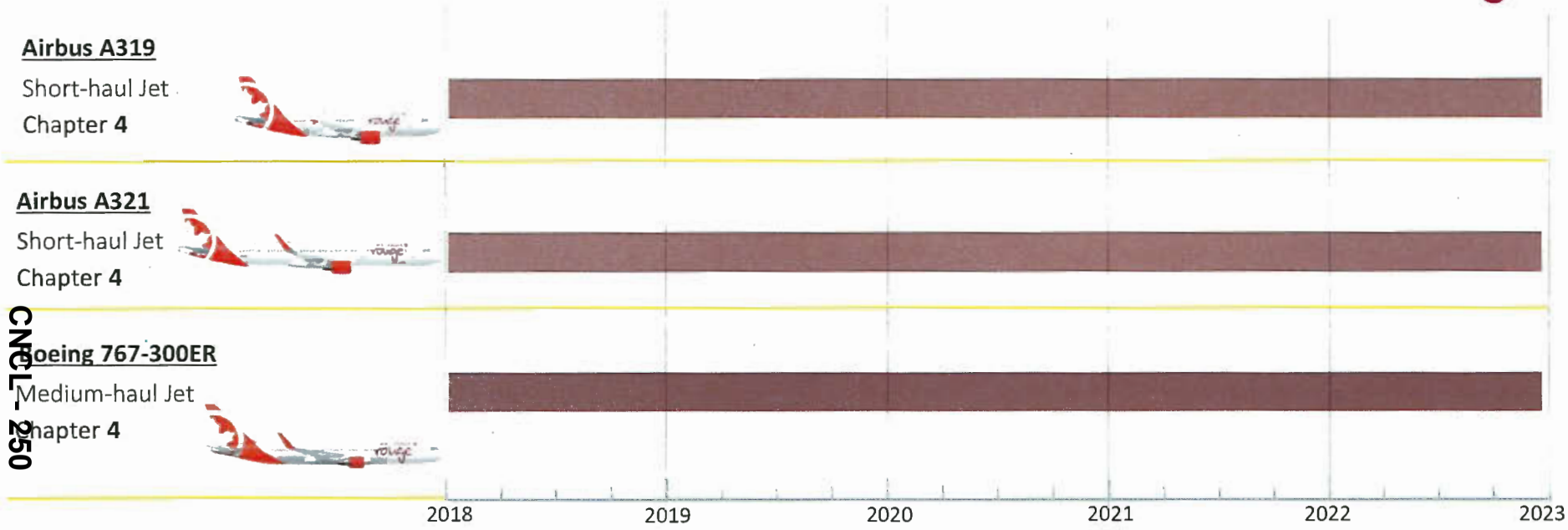





Graphic displays known aircraft fleet for the next 5 years. Airline specific aircraft Chapter provided (may vary from certification Chapter).
*Some variants are Chapter 4

AIRLINE FLEET PLANS

# AIR CANADA ROUGE






Graphic displays known aircraft fleet for the next 5 years. Airline specific aircraft Chapter provided (may vary from certification Chapter).

# A1

## NOISE MANAGEMENT PRACTICE REVIEW

# APPENDIX A1: INTERNATIONAL AIRPORT PROFILES & PRACTICES

# AMSTERDAM SCHIPHOL, THE NETHERLANDS

IATA: AMS | ICAO: EHAM | City: Amsterdam | Country: Netherlands

Airport Elevation

-3m

Operating Hours

No closure of airport, procedure restrictions in place

14 km

CNCL-252

68.5 million

Passengers

496,748

Aircraft Movements

1,752,500

Tonnes

Cargo Throughput


**Major** Hub

SKYTEAM

6

Runways

Runway Orientations

3 x N/S


2 x NW/SE


1 x E/W


Airport - City Orientation

SW

# NOISE MANAGEMENT PRACTICES

IATA: AMS ICAO: EHAM City: Amsterdam Country: Netherlands


Amsterdam Schiphol Airport (AMS) is one of Europe's major hubs and the primary airport serving Amsterdam and the Netherlands. It is located on 2,787ha of land approximately 14km south-west from central Amsterdam in the municipality of Haarlemmermeer. AMS is surrounded by suburbs and pastoral land with the North Sea to the west. AMS operates five runways on a 24/7 basis with the newest and longest (3,800m long x 75m wide) Polderbaan Runway (18R/36L) opening in 2003. Its nearest end is located around 5km from the terminal precinct and is used only for northerly operations. A sixth runway, 04/22, is typically used for GA operations.

Alongside the opening of the Polderbaan Runway, new noise and environmental restrictions were introduced in the Aviation Act. The Act came into effect in 2003 and was supplemented by the Airport Traffic Decree and Airport Planning Decree, stipulating limits for noise pollution, maximum noise volume and land use surrounding the airport. In 2009, the Alders Platform (a consultative advisory body) also recommended an annual flight movement cap until 2020. In 2015, the maximum total growth of the airport until 2020 was reduced from 510,000 to 500,000 annual movements.

There are provisions under the Aviation Act limiting the total noise volume and once reached air traffic must be distributed to other runways once the maximum noise level had been reached. In line with the Airport Traffic Decree, the maximum noise calculated over a year of use:

- Daytime: <63.46dB(A) and Night-time (23:00-07:00): <54.44dB(A).

# NOISE MANAGEMENT PRACTICES

IATA: AMS ICAO: EHAM City: Amsterdam Country: Netherlands

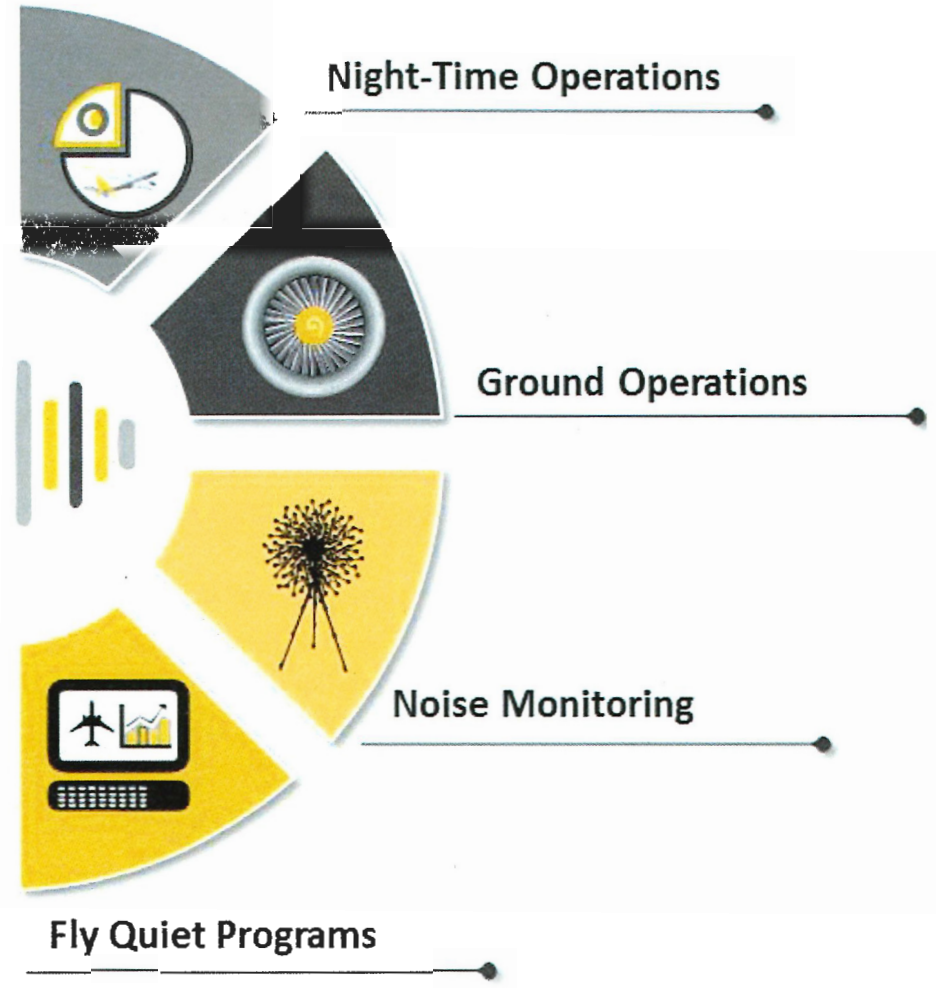


Daily operations at AMS are based on a runway alternation scheme during peak periods for either inbound or outbound traffic. This is principally driven by the business model of the national carrier operating at the airport, KLM. Approximately 70% of KLM's passengers connect to other flights instead of point-to-points. Therefore a model of inbound peaks, transfer and outbound peaks is critical to minimum connection times and affords a high reliability to minimize missed connections.

While AMS operates 24/7 night-flight restrictions are in place which permit a maximum of 32,000 movements annually. Flights are capped between the 23:00 and 05:59 local to 24 arrivals and 25 departures per hour.

Other notable practices include (**quantifiable noise benefits are not available**):

- CDA is only used between 22:00-05:30 on Runways 06 and 18R to avoid overflying of noise sensitive communities and minimizing any potential loss to capacity during daytime hours.
- A preferential runway system is operated by the ANSP according to likely aircraft noise influences and traffic flow conditions, along with a flight dispersion system to minimize overflying sensitive residential areas.
- Aircraft engine ground running is only permitted at specific locations and times around the airport.
- An aircraft APU ban exists for turnarounds where 400Hz FEGP is available.



# FRANKFURT, GERMANY

IATA: FRA | ICAO: EDDF | City: Frankfurt | Country: Germany

Airport Elevation

111m

Operating Hours

Closed between
2300 - 0400

12 km

CNCL 255

64.5 million

Passengers

475,537

Aircraft Movements

2,228,971

Tonnes

Cargo Throughput

**Major** Hub

STAR ALLIANCE

4

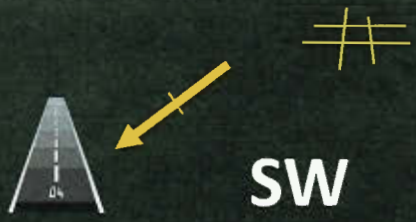
Runways

Runway Orientations

3 x E/W


1 x N/S

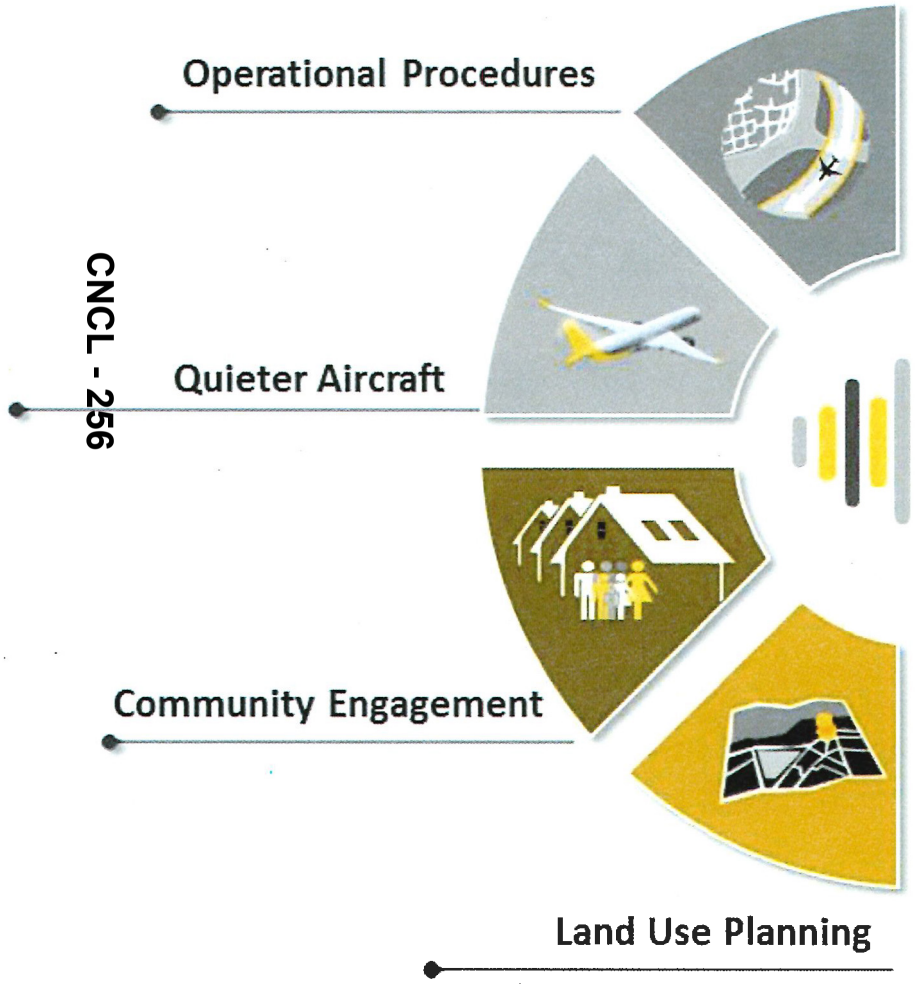

Airport - City Orientation



SW

# NOISE MANAGEMENT PRACTICES

IATA: FRA ICAO: EDDF City: Frankfurt Country: Germany




FRA is the fourth busiest hub airport in Europe and Germany's largest airport. The airport is located on 2,300ha approximately 12km south-west from central Frankfurt. It operates two terminals and four runways – under normal operations, two runways are used for landings and two runways are used for take-offs.

In 2011, a new fourth runway (07L/25R) opened increasing capacity by 40% (i.e. from 90 to 126 movements per hour) and triggering the establishment of new noise regulations for the airport.

From a land use planning standpoint, noise abatement zones encircle the airport in line with the Aircraft Noise Abatement Act. There are three zones comprising a day protection zone 1 and 2, and the night protection zone, classified according to the modified equivalent continuous sound level ($L_{Aeq}$). Residential dwellings located in these statutory protection zones are eligible for passive noise abatement measures.

Since October 2011, a ban has been in place on all flights between 23:00-05:00 subject to the granting of special permission. This is also supported by cap on the maximum number of flights in the shoulder period (22:00-23:00 and 05:00-06:00) which was reduced from 150 to 133 movements. All aircraft operating during these time periods must comply with ICAO Annex 16, Chapter 4 limits. Aircraft that are only marginally compliant with ICAO Annex 16, Chapter 3 limits are prohibited from taking off or landing between 20:00-08:00 every weekday and restricted from flying between Friday 20:00 and Monday 08:00.

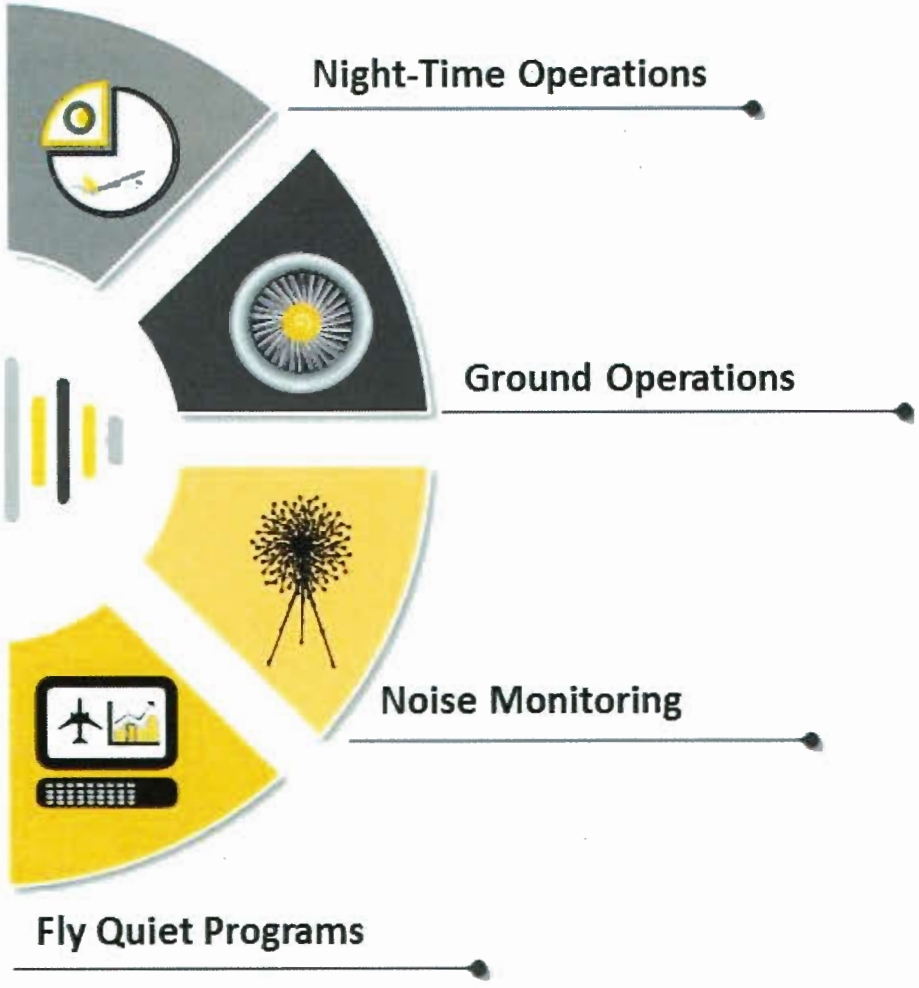
# NOISE MANAGEMENT PRACTICES

IATA: FRA | ICAO: EDDF | City: Frankfurt | Country: Germany

Differential noise charges are levied as part of the aeronautical charging regime for all take-offs and landings. These are based on the aircraft's noise category.

Other key noise management practices implemented at FRA include (**quantifiable noise benefits are not available**):

- Dedicated runway operations (DROps) provides overflown communities with respite from aircraft noise at night and during 05:00-06:00 local.
- Aircraft engine ground tests, run-ups and extensive maintenance is restricted to designated areas and between 06:00-22:00 local.
- Phased introduction of continuous climb operations.
- Ground Based Augmentation Scheme (GBAS) improves precision satellite-based navigation and landings and also permits steeper approach angles to $3.2^0$ on Runways 25L/C and 07R/C. An ILS glideslope of $3.2^0$ is in place on Runway 07L/25R (slight noise benefit of between 0.5-1.5dB(A)).
- Reverse thrust is not permitted on landing at any of the runways.
- CDA is to be used between 23:00-05:00 local and will commence earlier and finish later subject to traffic flow conditions and runway capacity.
- Fraport, the operators of FRA, is working with airlines to install vortex generators on their A320s – Lufthansa has retrofitted its entire A320 fleet.



# HELSINKI VANTAA, FINLAND

IATA: HEL ICAO: EFHK City: Helsinki Country: Finland

Airport Elevation

55 m

Operating Hours

Preferential runways for night-time operations

17 km

CNCL - 258

18.9 million

Passengers

165,320

Aircraft Movements

194,273

Tonnes

Cargo Throughput


**Regional** Hub

ONEWORLD

3

Runways

Runway Orientations

2 x NE/SW

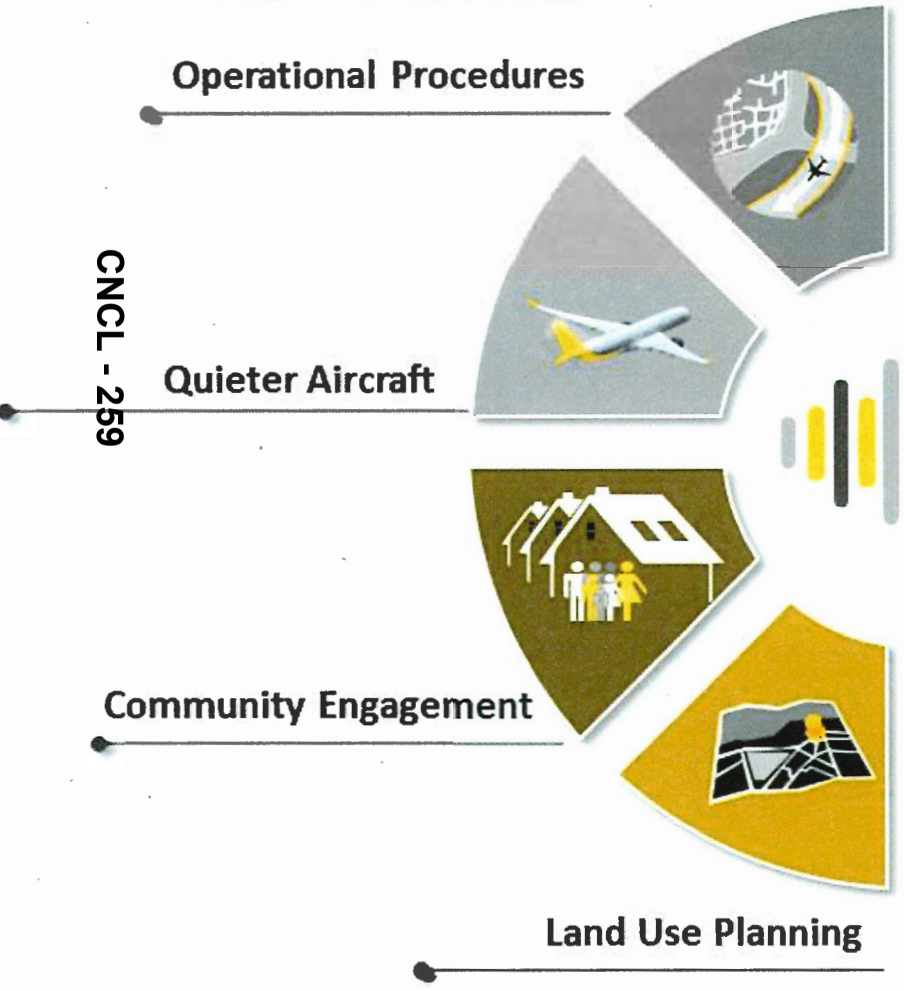

1 x NW/SE


Airport - City Orientation

N

# NOISE MANAGEMENT PRACTICES

IATA: HEL ICAO: EFHK City: Helsinki Country: Finland




CNCL - 259

Helsinki Vantaa (HEL) is located approximately 17km north of central Helsinki and is the international gateway of Finland. It is Northern Europe's leading long-haul hub connecting to Asia with 90% of Finland's international flights passing through HEL.

HEL operates three runways, which are used according to weather conditions, traffic flow and environmental considerations, particularly noise.

There are 20 different runway combinations in use at HEL. The primary runway for landings is Runway 2 (15) from the north-west or Runway 1 (22L) from the north-east. Runway 3 (22R) is used as the primary departure runway. Chapter 4 or quieter aircraft can depart from Runway 1 (22L) simultaneously.

Some of the key noise management practices implemented by Finavia, the operators of HEL include (**quantifiable noise benefits are not available**):

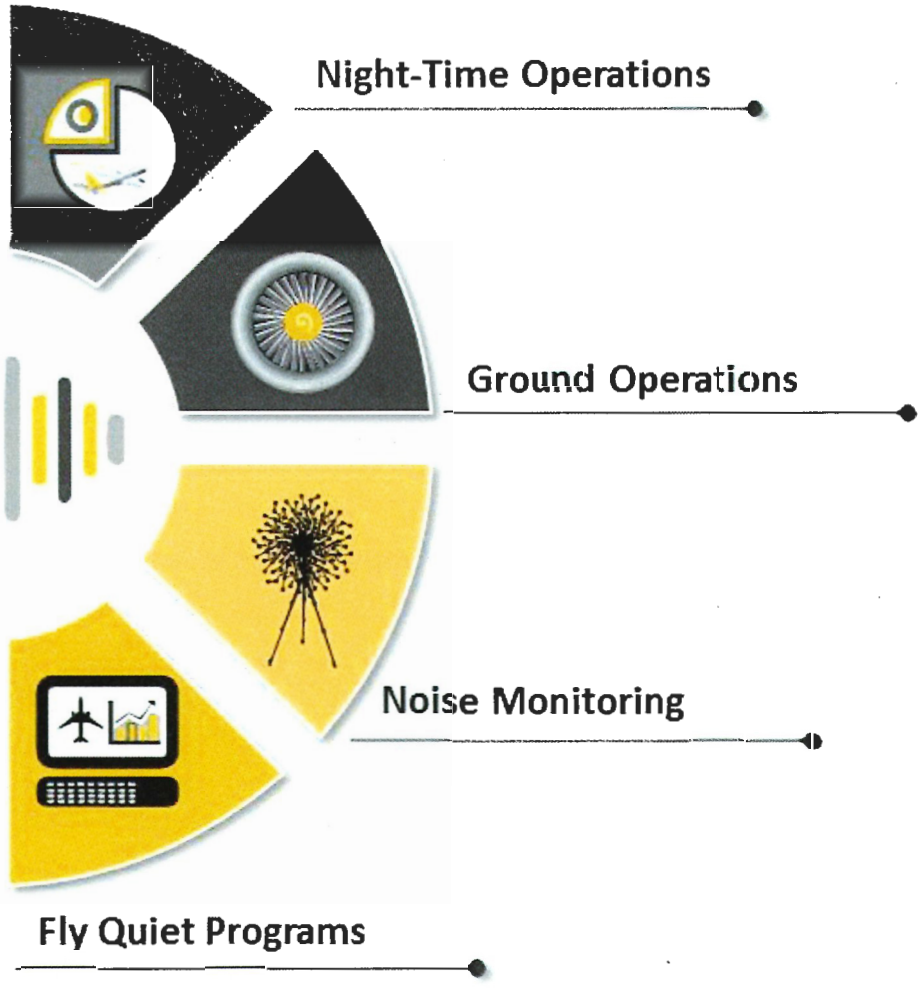
- CDA and low power/low drag (LPLD) procedures are to be used by all arriving aircraft according to safety and weather conditions (approximately, 66% of aircraft arrivals currently use CDA).
- A preferential runway system in place with Runway 15 preferred for arrivals and Runway 22R preferred for departures between 23:00-06:00. use of Runway 33 for arrivals and Runway 15 for departures is prohibited between 22:00-07:00, except for propeller aircraft between 22:00-23:00 and 06:00-07:00.

INTERNATIONAL PERSPECTIVES

# NOISE MANAGEMENT PRACTICES

IATA: HEL ICAO: EFHK City: Helsinki Country: Finland

- Low noise flight procedures are to be used by arriving aircraft between 4-7nm from the touchdown threshold through optimizing aircraft speed (i.e. this starts from 12nm) and landing configuration – on established final approach until 4nm DME speed is to be maintained between 150-180kt.
- All arrivals are to avoid overflying populated areas around 9nm from the Runway 15 touchdown threshold
- Reverse thrust is prohibited after touchdown during the landing roll unless there is a safety requirement to do so.
- RNAV approach routes/procedures have been in place since 2001 with ATC vectoring aircraft onto shorter finals to avoid or minimize overflying populated areas.
- Noise Preferential Route SIDs require all departing aircraft to climb as quickly as possible to 2,000ft aal before keeping to the SID routes and ATC vectors until leaving the TMA.
- There is a night curfew between 00:30-05:00 if the certified noise level of the aircraft is greater than 89 EPNdB at take-off.
- Differential noise changing regime for night-time departures between 23:00-06:00 for turbojet aircraft exceeding 89 EPNdB at take-off.
- Continuous noise monitoring system (8 NMTs) and a flight path monitoring system (WebTrak) measuring day/night $L_{Aeq}$ and Lden levels.




CNCL - 260

# LONDON HEATHROW, UK

IATA: LHR ICAO: EGLL City: London Country: United Kingdom

Airport Elevation

25 m

Operating Hours

Night-time restrictions
2300-0700

24 km

CNCL - 261

78 million

Passengers

474,033

Aircraft Movements

1,698,455

Tonnes

Cargo Throughput

**Major** Hub

Several carriers and alliances

2

Runways

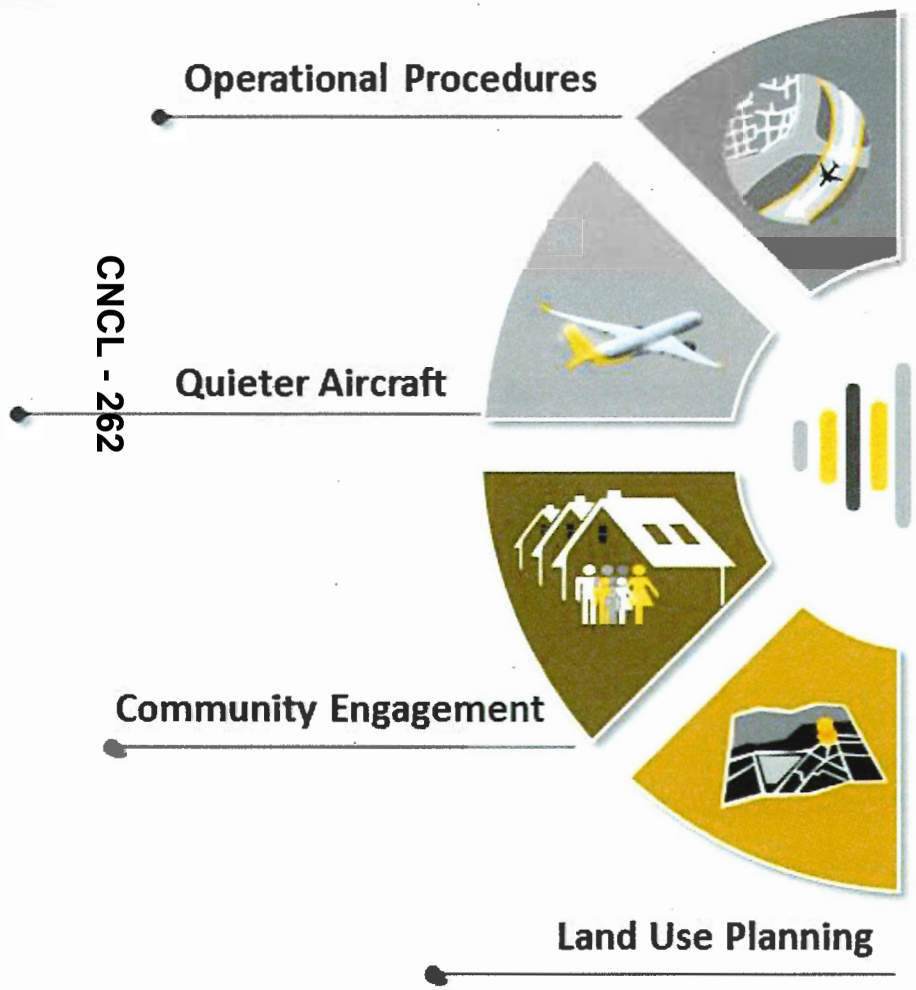
Runway Orientations

2 x E/W


Airport - City Orientation

# NOISE MANAGEMENT PRACTICES

IATA: LHR | ICAO: EGLL | City: London | Country: United Kingdom




CNCL - 262

London Heathrow (LHR) is the UK's busiest international airport and one of the busiest two runway airports in the world.

LHR must operate within a legal flight movement cap of 480,000 ATMs per year. The cap cannot increase without planning permission and Government approval.

A series of night-flight restrictions are in place and these are reviewed every 5 years by the UK Government. Also, LHR must ensure that the area enclosed by the average summer daytime 57 dB $L_{Aeq\ 16hr}$ does not exceed 127km$^2$ – a condition attached to the 2001 T5 planning permission.

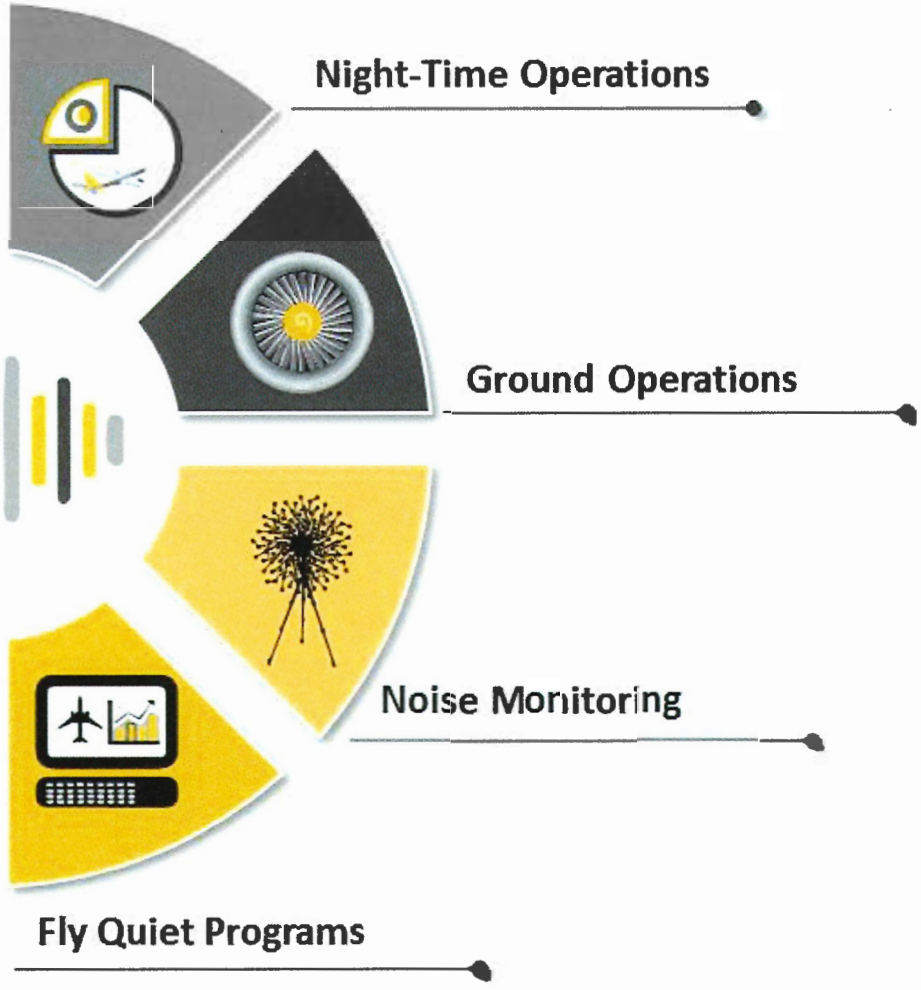
LHR is a world leader in noise management boasting a highly sophisticated program of measures and initiatives. Some of the more notable noise management practices implemented at LHR, include (**quantifiable noise benefits are not available**):

- After take-off all aircraft must climb to a height of not less than 1000 ft aal at 6.5km from start of roll as measured along the departure track of that aircraft – in 2017 there were 536 infringements recorded.
- Adherence to departure noise limits set by the UK Government for daytime, shoulders and night-time hours.
- Night-time noise movement and noise quota limits set by the UK Government with quota controlled flights limited to 15/16 long haul arrivals from the USA and Far East, usually arriving after 04:00 local.

# NOISE MANAGEMENT PRACTICES

IATA: LHR | ICAO: EGLL | City: London | Country: United Kingdom

- Noise Preferential Route SIDs up to 4,000ft aal in tandem with a sophisticated noise and flight track keeping system to monitor on-track performance – i.e. aircraft flying within a designated 3km track swathe extending 1.5km either side of the track centreline – in 2017 96.23% of all flights were on-track.
- CDA used by all aircraft arrivals below 6,000ft – the reported 24-hour average in 2017 was 88.46% on all flights.
- Actively working with airline partners to fit quiet technology (vortex generators) to A320 aircraft – in 2017 over 50% of aircraft have been retrofitted.
- Incentivizing airlines to operate their quietest aircraft in their fleets – in 2017 99.5% of all aircraft in the fleet mix meet or exceed Chapter 4 noise certification standards.
- Differential noise charges levied on all aircraft according to noise category.
- UK's first Fly Quiet program which publishes a league table every quarter comparing the top 50 airlines across six different noise metrics.
- Steeper approach trials completed at $3.25^0$ descent angles to keep aircraft higher for longer with departing aircraft required to maintain a climb gradient of not less than 4% to a minimum altitude of 4,000ft.
- Sound Insulation Grant Scheme available for eligible properties within LHR's day and night scheme boundaries.



# MANCHESTER, UK

IATA: MAN | ICAO: EGCC | City: Manchester | Country: United Kingdom

Airport Elevation

78 m

Operating Hours

Night-time restrictions
2300-0700

14 km

CNCL-264

27.9 million

Passengers

203,631

Aircraft Movements

123,576

Tonnes

Cargo Throughput

**Regional** Hub

Various Airlines

2

Runways

Runway Orientations

2 x NE/SW


Airport - City Orientation

SW

# NOISE MANAGEMENT PRACTICES

IATA: MAN ICAO: EGCC City: Manchester Country: United Kingdom


Manchester Airport (MAN) is the UK's third busiest airport. It is served by three passenger terminals and an array of aviation support facilities. MAN is one of only two airports in the UK operating two full-length runways.

MAN operates on a 24/7 basis and is located approximately 14km to the south-west of Manchester city centre on 625ha. With the opening of its 3,050m long second runway (05R/23L) in 2001, noise controls at MAN were significantly strengthened through a number of legally binding objectives and targets. At present, there are more than 50 commitments in place to manage and reduce the impacts of noise at and around MAN.

A selection of notable noise management practices at MAN include (**quantifiable noise benefits are not available**):

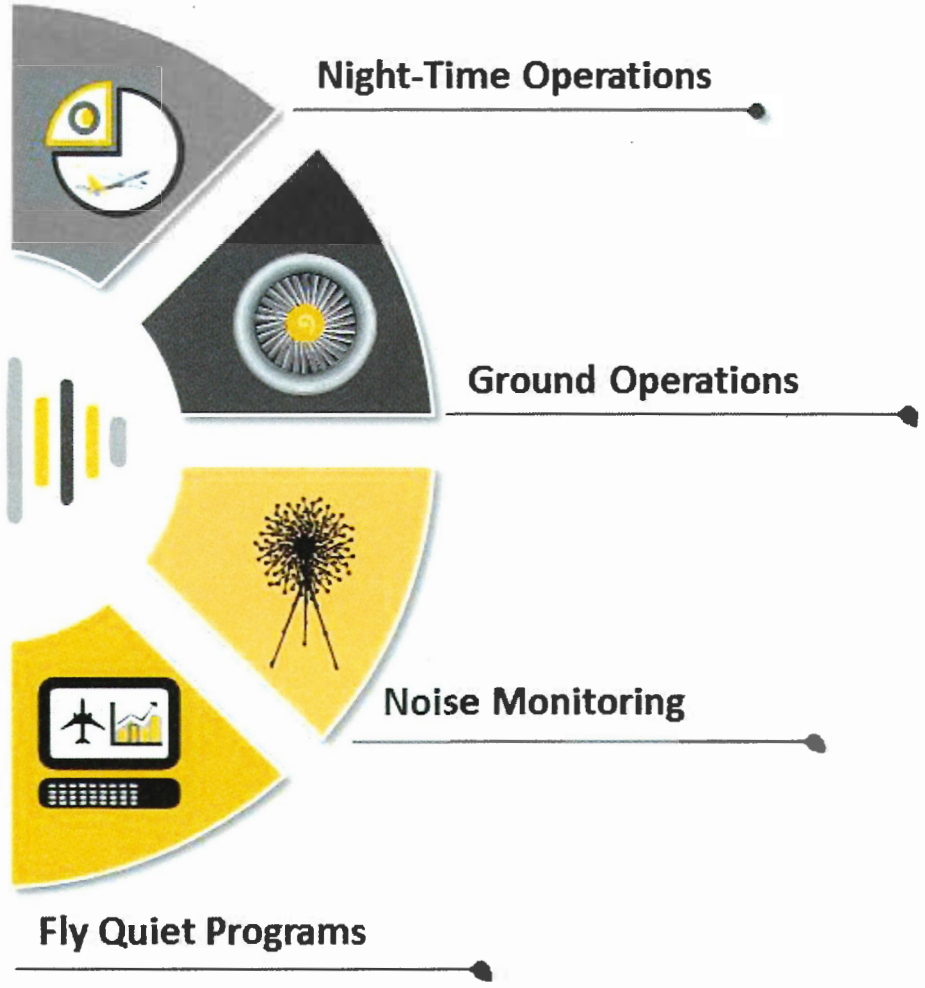
- Dual Runway System is used during the morning and afternoon/evening peaks – the second runway is permitted for use between 06:00-22:00 with operations reverting back to Runway 05L/23R between 22:00-06:00.
- Westerly Preference in place for runway take-off directions subject to weather conditions (typically around 80% of the time).
- Night Noise Policy sets the movement (23:00-07:00) and noise quota limits (23:30-06:00) for the night-time and levies penalties for any breach of noise levels (90 dB(A) daytime and 82 or 81 dB(A) at night - <7% of total flights are permitted to operate between 23:30-06:00 local.
- No aircraft engine tests permitted outside the engine-test bay between

# NOISE MANAGEMENT PRACTICES

IATA: MAN | ICAO: EGCC | City: Manchester | Country: United Kingdom

22:00-06:00 on weekdays and 22:00-07:30 on weekends.

- Preferential Noise Routes up to 5,000ft aal on most SIDs to direct aircraft over less populated areas during the initial potentially more noisy stages of flight.
- CDA used by all aircraft arrivals between 22:00-06:00 local.
- LPLD procedures on all approaches.
- Departure noise surcharge to penalise any breach of maximum daytime maximum noise level of 90dB(A) – based on a standard penalty flat rate plus indexed for every decibel above.
- Use of reverse thrust must be avoided during landing roll unless safety requirements dictate otherwise.
- Aircraft using the ILS on approach must not descend below 2,000ft before joining the glide path.
- Non-essential running of aircraft APUs is not encouraged during block turns where 400Hz FEGP is available with reduced engine taxiing used according to traffic flow and weather conditions.
- Sound Insulation Grant Scheme is available to eligible properties within the 2010 63 dB $L_{Aeq\ 16hr}$ noise contour and a Home Relocation Assistance Scheme launched in 2006 for residential properties within the 2002 69 dB $L_{Aeq\ 16hr}$ or those that have been exposed to a large increase in noise.




CNCL - 266

# SYDNEY KINGSFORD-SMITH, AUSTRALIA

IATA: SYD | ICAO: YSSY | City: Sydney | Country: Australia

Airport Elevation

6 m

Operating Hours

Curfew

2300 - 0600

9 km

CNCL - 267

43.3 million

Passengers

348,522

Aircraft Movements

414,124

Tonnes

Cargo Throughput


**Regional** Hub

ONEWORLD

3

Runways

Runway Orientations

2 x N/S


1 x E/W


Airport - City Orientation

# NOISE MANAGEMENT PRACTICES

IATA: SYD ICAO: YSSY City: Sydney Country: Australia


CNCL - 268

Sydney Kingsford-Smith (SYD) is one of the world's most noise sensitive airports. It lies at the heart of Australia's aviation network and is the single most important asset for the Australian tourism industry. As at many airports, creating a balance between the economic potential derived through growth in the aviation sector and the environmental and social impacts of aircraft noise on certain parts of the community is difficult to reconcile.

SYD is located 9km from downtown Sydney and is surrounded on three sides by residential areas and urban development with a major water body, Botany Bay, located immediately to the south and Kurnell a residential area beyond. Its three terminal campuses, three runways and aviation support facilities are situated on a compact site of 905ha.

SYD's third runway (16L/34R) opened in 1994. The opening of the runway was heavily criticized for the additional noise it created over residential areas and the lack of transparency in the communication of the expected impacts in the runway's Environmental Impact Statement.

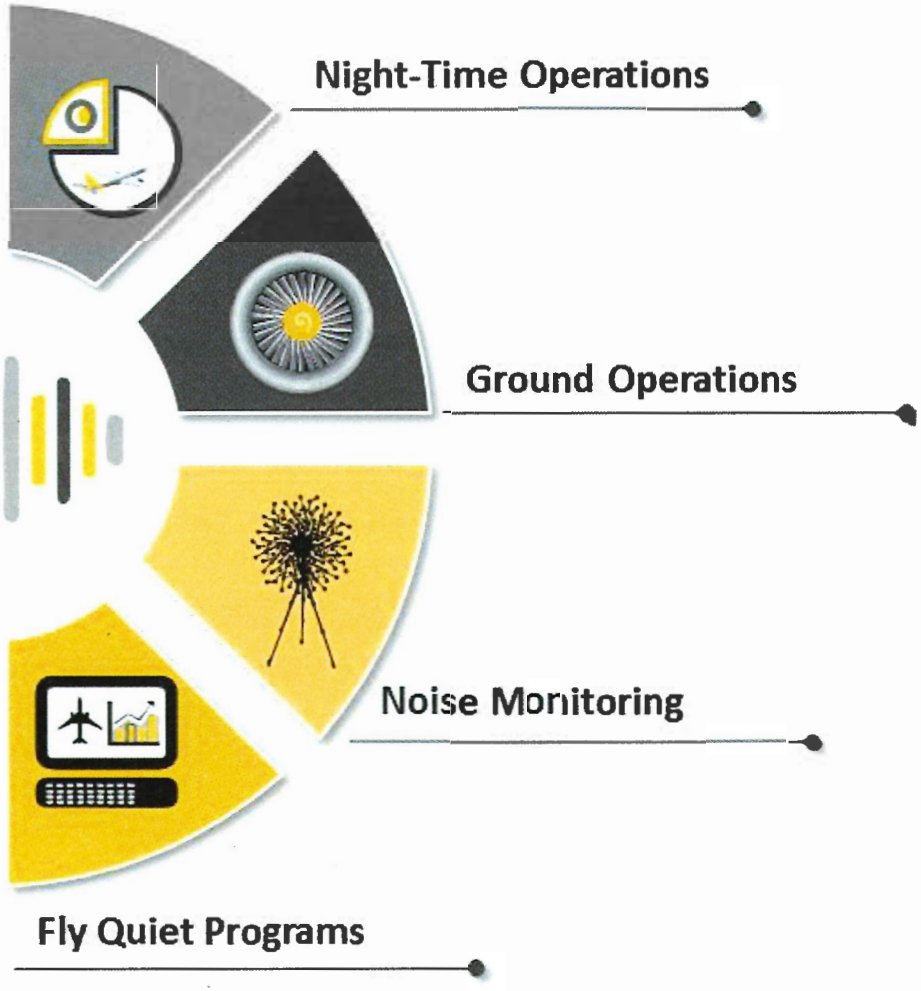
In response the Government introduced several key pieces of legislation to balance the impact of aircraft noise with the efficient operation of the airport. These legislative measures along with the airport's Long Term Operating Plan (LTOP) were also designed to share the aircraft noise across the community rather than it being concentrated under the same flight paths. The implementation of LTOP established the noise sharing arrangements after an exhaustive consultation process with the Sydney community.

# NOISE MANAGEMENT PRACTICES

IATA: SYD ICAO: YSSY City: Sydney Country: Australia

Key measures to address aircraft noise at SYD included the introduction of the of the Sydney Airport Curfew Act 1995 and Sydney Airport Demand Management Act 1997. The provisions set out under both legislative pieces included (**quantifiable noise benefits are not available**):

- A ban on night flights (curfew) between 23:00-06:00 local with the exception of except BAe-146 aircraft.
- A curfew shoulder period movement cap of 24 between 05:00-06:00 and 23:00- 00:00.
- A cap of 80 runway movements per hour counted in 15 minute blocks on an ongoing basis to limit the number of daytime aircraft take-offs or landings – this differs from the slot management regime which allocates up to a maximum 80 slots per hour based on airline demand.
- LTOP which varies the use of runways and flight paths for arrivals and departures to spread noise and share noise as equitably as possible using a range of different combinations of flight paths and runways.
- LTOP noise sharing targets for the areas surrounding the airport in conjunction with continual monitoring and reporting of results.
- Directing as many flights as possible over water and non-residential areas.
- Restrictions on when 'noisy' aircraft can operate, including aircraft engine ground run tests.



# ZURICH KLOTEN, SWITZERLAND

IATA: Zurich | ICAO: LSZH | City: Zurich | Country: Switzerland

Airport Elevation
432m

Operating Hours
Curfew
0000 - 0700

13 km

CNCL - 270

27.7 million
Passengers

269,160
Aircraft Movements

433,577 Tonnes
Cargo Throughput

**Regional** Hub
STAR ALLIANCE

3
Runways

Runway Orientations

2 x NW/SE


1 x E/W


Airport - City Orientation

INTERNATIONAL PERSPECTIVES

# NOISE MANAGEMENT PRACTICES

IATA: ZRH ICAO: LSZH City: Zurich Country: Switzerland


CNCL - 271

ZRH is the largest international airport in Switzerland. It operates 3 runways with the airport's location distributing noise from arriving/departing aircraft across the German/Swiss border.

In 2003, Germany imposed airspace restrictions affecting inbound flights to ZRH through German airspace due to noise concerns. This resulted in an increase of flights over the most populated areas of Zurich, including the more wealthy suburbs giving rise to increased political pressure to reduce noise impact.

As such, ZRH operates a complex system of noise management with flight operations restricted.

A runway alternation scheme is in place, with Runway 34 typically used in the morning/early afternoon (up to 15:00) and Runway 28 after that. Exceptions may occur, however, if aircraft are unable to land on Runway 28 due to performance limitations; traffic may be vectored onto Runway 34.

Particular runway restrictions are in place to ensure no aircraft arriving at or departing from ZRH enter German airspace. These restrictions apply between 00:00-07:00 local Monday-Friday and 22:00-09:00 Saturday, Sunday and on German public holidays. Zurich Airport's departure routes and procedures are configured in such a way as to avoid overflying densely populated areas wherever possible. Adherence to these flight paths is mandatory during the daytime up to an altitude of 5,000ft above mean sea level, and at night up to flight level 80 (approximately 8,000ft).

# NOISE MANAGEMENT PRACTICES

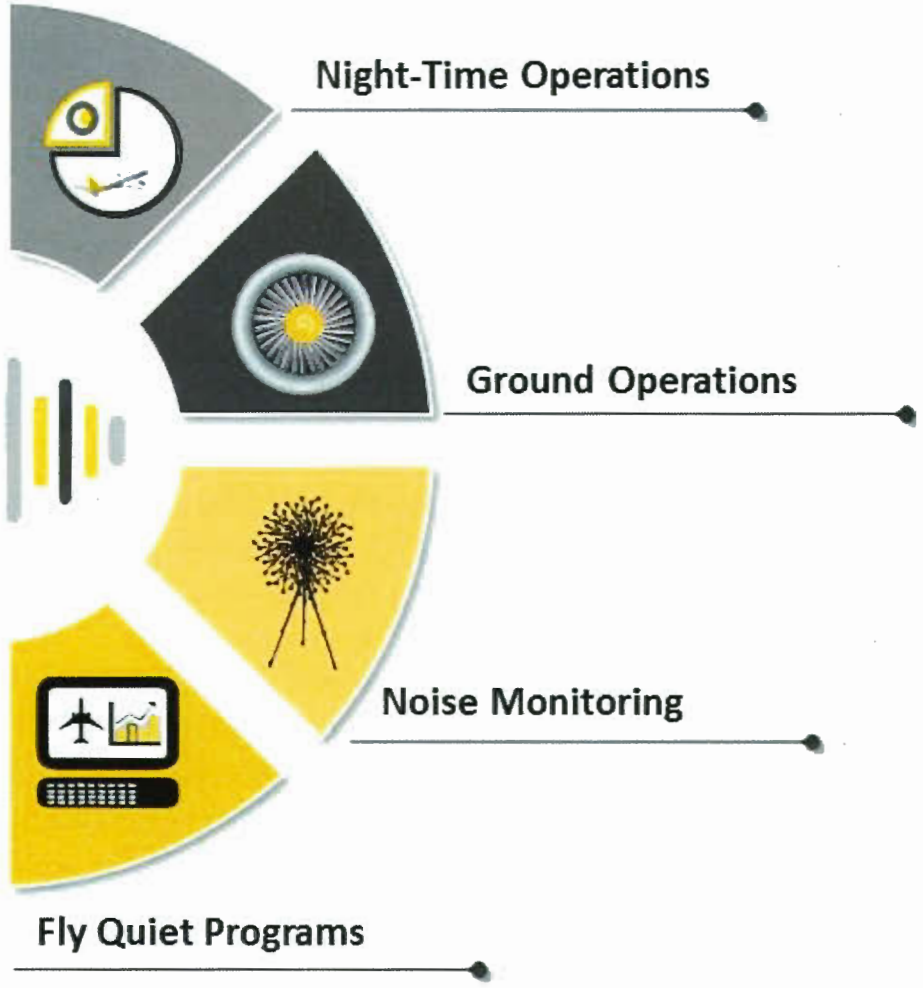
IATA: ZRH ICAO: LSZH City: Zurich | Country: Switzerland

At all times arriving or departing aircraft at ZRH are prohibited from flying at an altitude lower than 12,000ft in German airspace.

Flughafen Zürich AG, the operators of ZRH also operate a network of 14 fixed noise monitoring terminals around the airport. The data recorded is compiled and published monthly in the noise bulletin, enabling trends in noise levels at specific locations to be tracked over the long term (Source: https://www.zurich-airport.com/the-company/noise-policy-and-the-environment/noise-monitoring).

In 2016, a total of 860 engine ground tests (2015: 840) were carried out in the noise protection hangar. Of these, 360 (41%) were run at night between 22:00-06:00 and 500 (59%) during the day between 06:00-22:00 local. In line with the airport's operating regulations, the permitted noise exposure level may be exceeded 25 times annually. In 2016, only one exceedance was reported.

Night flights, often a major source of community annoyance and disturbance, accounted for 4.7% of total flight movements in 2016 which was slightly higher (0.2%) than in 2015.




CNCL-272

# PORTLAND INTERNATIONAL, USA

IATA: PDX | ICAO: KPDX | City: Portland | State: Oregon

Airport Elevation

9 m

Operating Hours

Preferential runways

22:00 – 06:00

10 km

CNCL 273

19.1 million

Passengers

199,668

Aircraft Movements

246,917

Tonnes

Cargo Throughput

**Regional** Hub

Alaska Airlines

3

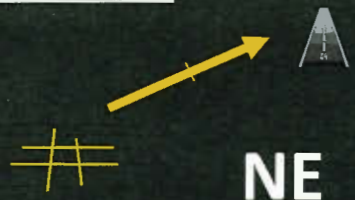
Runways

Runway Orientations

2 x NW/SE


1 x NE/SW

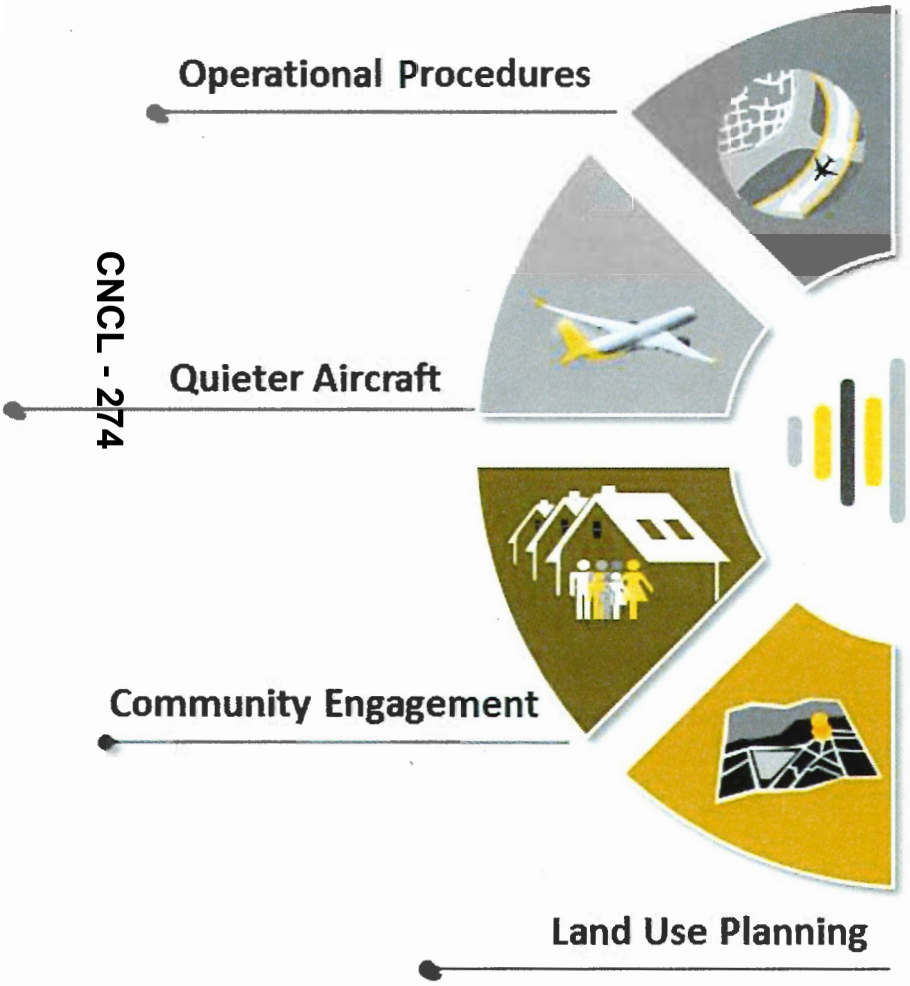

Airport - City Orientation



NE

# NOISE MANAGEMENT PRACTICES

IATA: PDX ICAO: KPDX City: Portland State: Oregon




Portland International (PDX) is a joint civilian-military airport operated by the Port of Portland. It is the largest airport in the US state of Oregon and is located approximately 10km to the north-east of downtown Portland. PDX occupies around 1,334ha and is served by a main passenger terminal split into two main areas (North and South) with five concourses (A-E) and three runways the longest being 10R/28L at 3,353m. Alaska Airlines and Horizon Air use the airport as a secondary hub.

In 1979, the Port of Portland Noise Management Department was established. The Department is responsible for the management of noise from aircraft, ground operations and other airport activities at PDX, Hillsboro and Troutdale Airports.

The types of noise management practices being implemented at PDX include (**quantifiable noise benefits are not available**):

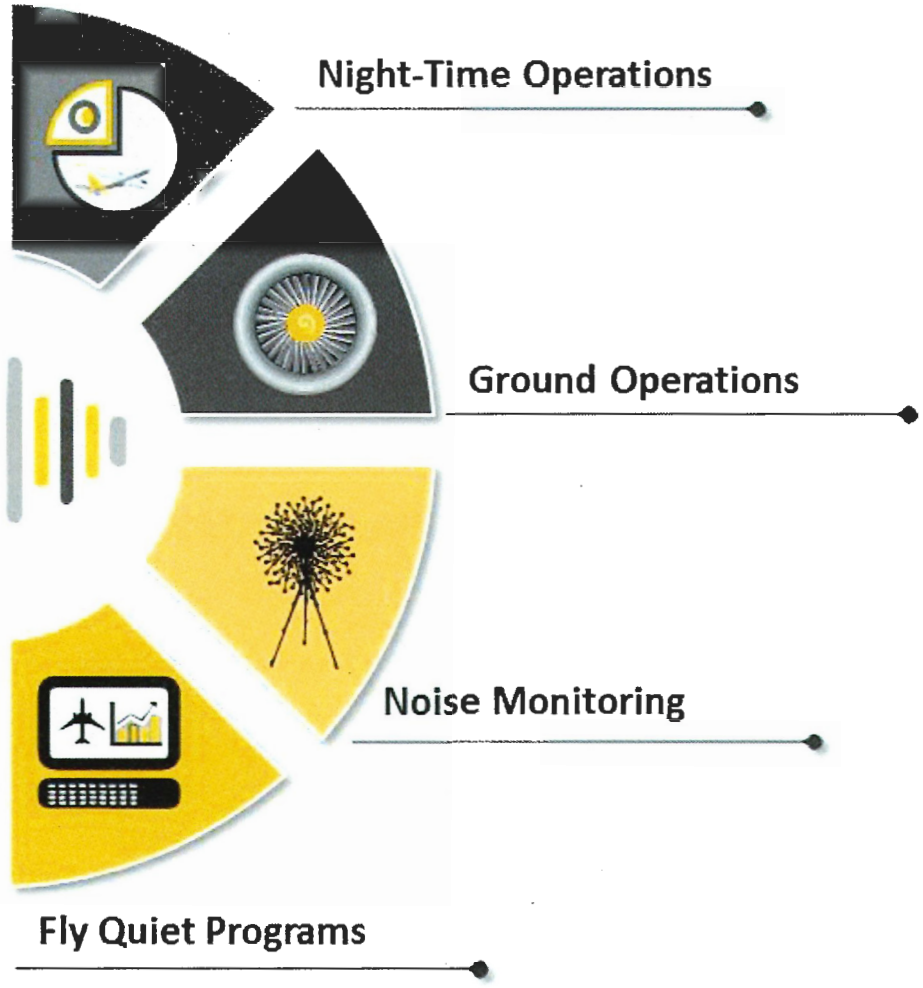
- "Portland International Airport Noise Impact Zone" (known as the Airport Noise Zone) was created in 1991 by the City of Portland to control sensitive residential development near the airport where aircraft noise levels are highest.
- A Preferential Runway System is in place between 22:00-07:00 largely for easterly or westerly aircraft arrivals. Runway 10R/28L (Southern Runway) is preferred for departing aircraft when conditions allow. The use of Runway 03/21 is discouraged subject to weather conditions, medical emergencies and/or aircraft technical issues.

INTERNATIONAL PERSPECTIVES

# NOISE MANAGEMENT PRACTICES

IATA: PDX ICAO: KPDX City: Portland State: Oregon

- Noise Abatement Flight Corridors (North and South) are in place to confine jet aircraft to narrow track swathes along the Columbia River to avoid overflying noise sensitive communities as much as possible. Departing aircraft climb in a straight-line to 7,000ft aal or fly up to 13km from the departure runway before turning onto their destination heading.
- A range of optimized flight procedures are used by arriving aircraft, including CDA (all aircraft) and RNAV procedures for arrivals from the north-west and the south and south-west. RNP AR Approaches are used by aircraft equipped with satellite-based navigation systems to fly narrow routes to reduce the spread of noise and number of people overflown.
- All aircraft engine ground tests (except propeller aircraft <5,670kg MTOW and some other types) must be performed within the GRE subject to certain restrictions for tests between 22:00-07:00 local. Unsuppressed run-ups for scheduled/unscheduled maintenance are prohibited.
- A voluntary Fly Quiet Program is in place to monitor and recognize noise reduction efforts in line with three core elements: on-track performance within the Columbia River Noise Abatement Corridor, use of RNAV procedures and operation of the quietest available aircraft in airline fleets.
- The airport operates a network of 10 permanent noise monitors around PDX and provides an online flight tracking system, WebTrak, to allow users to view aircraft activity in the greater Portland/Vancouver metropolitan area.



# SEATTLE-TACOMA, USA

IATA: SEA | ICAO: KSEA

City: Seattle | State: Washington

Airport Elevation

132m

Operating Hours

Preferential runways
2200 - 0600

21 km

CNCL-276

46.9 million
Passengers

416,124
Aircraft Movements

425,856
Tonnes
Cargo Throughput

**Large** Hub
Alaska Airlines
Delta

3
Runways

Runway Orientations

3 x N/S

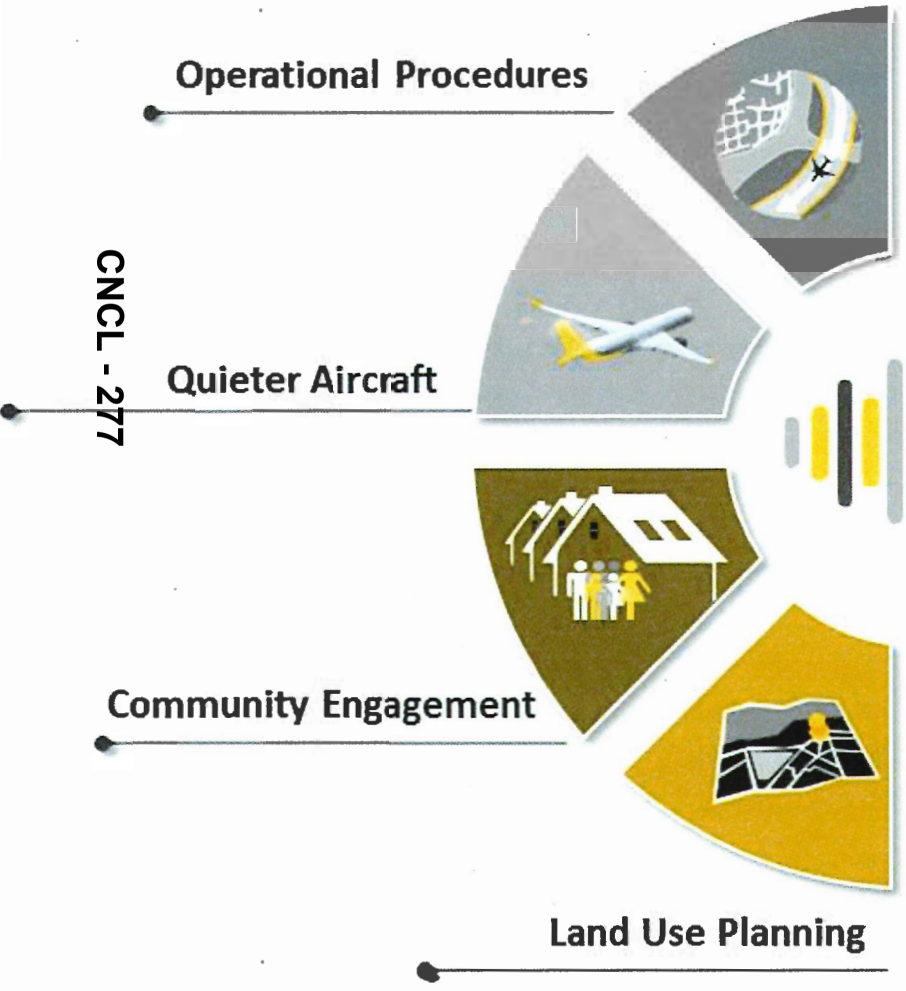
N

Airport - City Orientation

S

# NOISE MANAGEMENT PRACTICES

IATA: SEA | ICAO: KSEA | City: Seattle | State: Washington




CNCL - 277

Seattle-Tacoma (SEA) is the ninth busiest airport in the USA and gateway to the Pacific North West. The airport occupies around 1,012ha approximately 21km south of downtown Seattle. It is served by a main 'x-shaped' passenger terminal campus with two satellites and operates three parallel runways. SEA is a major hub for Alaska Airlines and Delta, and one of the fastest growing airports in the USA.

The types of noise management practices being implemented at SEA include (**quantifiable noise benefits are not available**):

- A Preferential Runway System is used between 22:00-06:00 and requires all northerly jet aircraft departures to fly a narrow corridor before heading west to continue north over the Duwamish industrial area and Elliot Bay before turning to onto their destination heading on reaching 10,000ft aal.
- Noise Abatement Flight Corridors (North and South) are in place to confine jet aircraft to narrow track swathes until they climb in a straight-line to minimum altitudes aal or reach a certain distance from the departure runway before they can turn onto the heading of destination.
- CDA used by all aircraft arrivals in line with RNAV procedures known as "MARNR" for arrivals from the north-west and "HAWKZ" for arrivals from the south and south-west.
- RNP AR Approaches using precise, satellite-based navigation systems along narrow flight paths to minimize the spread of noise and number of people affected by overflights.

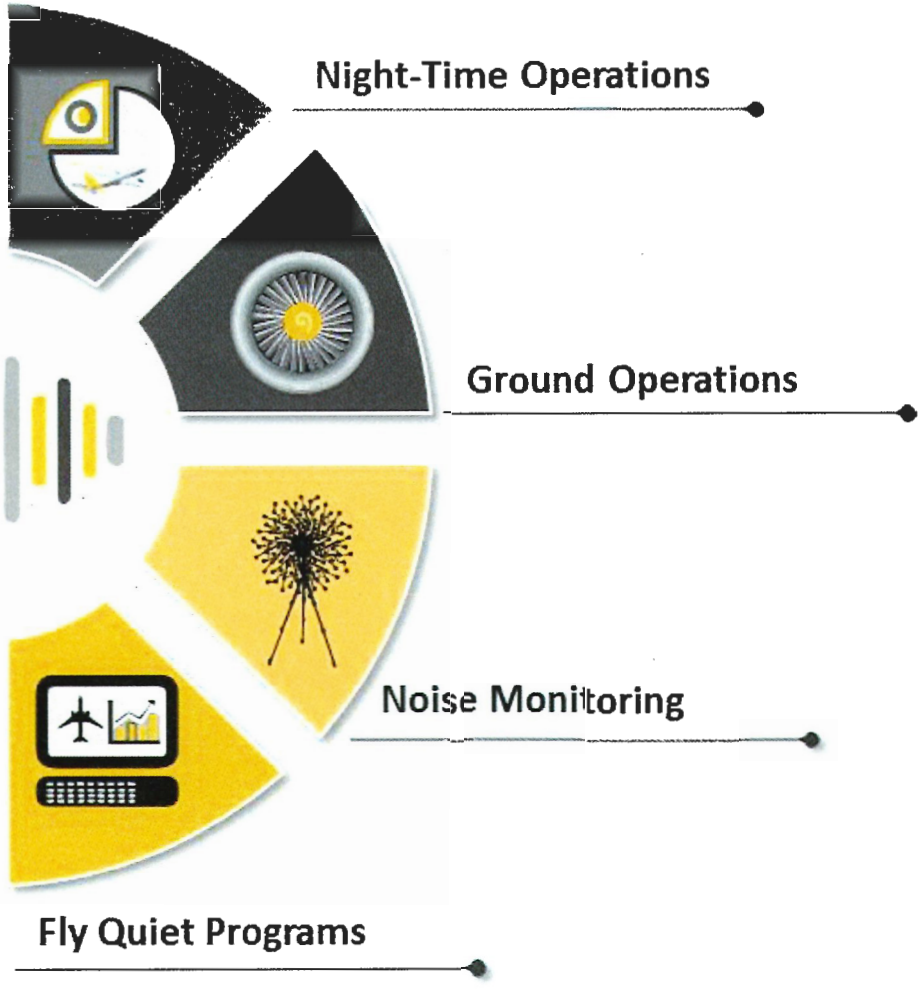
INTERNATIONAL PERSPECTIVES

# NOISE MANAGEMENT PRACTICES

IATA: SEA ICAO: KSEA City: Seattle State: Washington



- Restrictions on aircraft engine ground run tests between 22:00-07:00 local and must takes place at one of four designated areas on-airport. Necessary tests during these hours for safety or maintenance must not exceed 2 minutes in duration. Longer tests are permitted between 06:00-07:00 local only if the aircraft is scheduled to depart between 07:00-08:30 local.
- A Fly Quiet Program based on three core categories is in place to recognize the efforts made by airlines in noise reduction and abatement along with incentivizing airlines to continue operating their quietest available aircraft at the airport.
- SEA continually measures noise through a network of 25 permanent noise monitoring terminals in conjunction with a sophisticated flight track keeping system to monitor airline compliance with noise abatement procedures, investigate noise enquiries and to identify any changes or new/emerging trends in the local noise environment.
- A Sound Insulation Scheme was first launched at SEA in 1985 and is available to eligible residential dwellings and sensitive public buildings (i.e. schools) significantly impacted by aircraft overflight noise.
- 'Greener Skies Over Seattle' initiative as part of the FAA's NextGen airspace modernization program involving Performance Based Navigation (PBN) procedures and greater operational efficiency through the use of RNP and CDA procedures.



# MONTREAL TRUDEAU, CANADA

IATA: YUL ICAO: CYUL City: Montreal Country: Canada

Airport Elevation
36m

Operating Hours
Preferential runways
2300 - 0700

20 km

CNCL - 279

18.2 million
Passengers

234,254
Aircraft Movements

94,103
Tonnes
Cargo Throughput

**Regional** Hub
Various Airlines

3
Runways

Runway Orientations

2 x NE/SW

N

1 x E/W

N

Airport - City Orientation

SW

# NOISE MANAGEMENT PRACTICES

IATA: YUL ICAO: CYUL City: Montreal Country: Canada


Montreal-Trudeau (YUL) is Canada's third busiest airport and operates 24/7. it is located on 1,320ha approximately 20km south-west of downtown Montreal. YUL is served by a main terminal campus which is split into different zones to handle domestic, trans-border and international traffic.

Three runways are operated at YUL (2x parallel and 1x cross-wind) with the longest, Runway 06L/24R being 3,353m x 63m wide.

The types of noise management practices being implemented at YUL include (**quantifiable noise benefits are not available**):

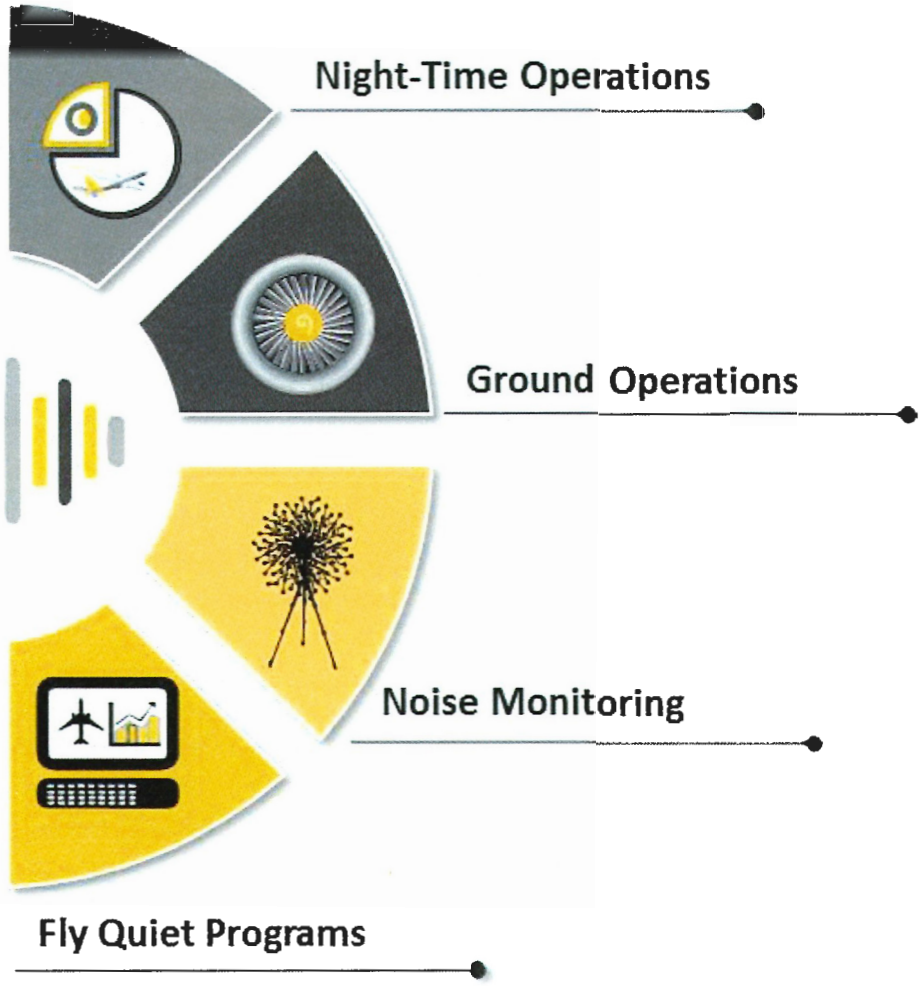
- A Preferential Runway System is in use between 23:00-07:00 local with Runway 24L favoured for departures due to the closer proximity of the airport to Lake St-Louis and overflying of less densely populated areas. Runway 24R is favoured for arrivals subject to weather conditions.
- Night Flight Restrictions for aircraft in excess of 45,000kg which are permitted to depart between 07:00-00:00 local and arrive between 07:00-01:00 local albeit exemptions do apply for a small number of operations for medical emergencies, inclement weather and delays beyond the airline's control. Runway 28 departures between 23:00-07:00 local are restricted to turboprop and piston powered aircraft on a specific SID.
- Noise Preferred Routes are in place for aircraft departing Runways 24L and 24R which must climb along a straight-line trajectory to a minimum altitude of 3,000ft aal before executing a turn toward their onward

# NOISE MANAGEMENT PRACTICES

IATA: YUL ICAO: CYUL City: Montreal Country: Canada

destination – all turboprop and piston (propeller) aircraft are able to turn immediately after take-off subject to weather conditions and safety. For 70% of operations aircraft depart off Runways 24L and 24R towards Lake St-Louis and Runway 28.

- Aircraft engine ground run tests that require power above idle settings are prohibited between 23:00-07:00 local unless authorized for essential maintenance or flight safety. Engine tests above idle power on the hangar line (cargo/maintenance area) are also prohibited at all times. Engine ground run tests are limited to 20 minutes and must be performed at designated areas around the airport to minimize noise disturbance to local residents.
- Eight permanent noise monitoring terminals and one mobile monitoring station are used to continuously monitor noise levels around the airport. Data recorded from this network is linked to the airport's ANOMS system (Airport Noise and Operations Monitoring System). ANOMS integrates radar data provided by NAV CANADA on aircraft position, altitude and speed with the noise data measured by the noise monitors and weather information.



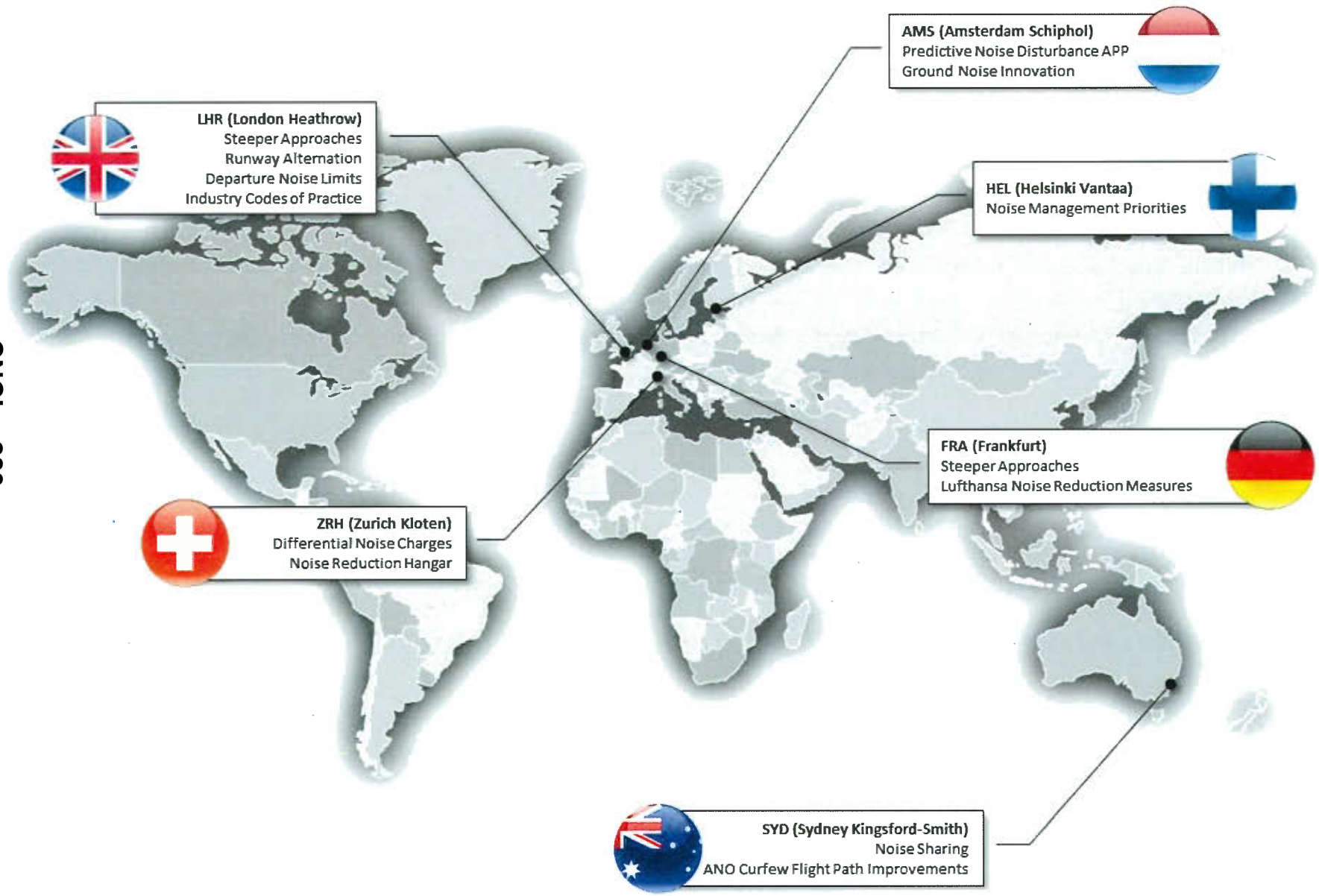
# A2

## NOISE MANAGEMENT PRACTICE REVIEW

# APPENDIX A2: SELECTED CASE STUDIES

CASE STUDIES

# INTERNATIONAL AIRPORT PRACTICE SHOWCASE

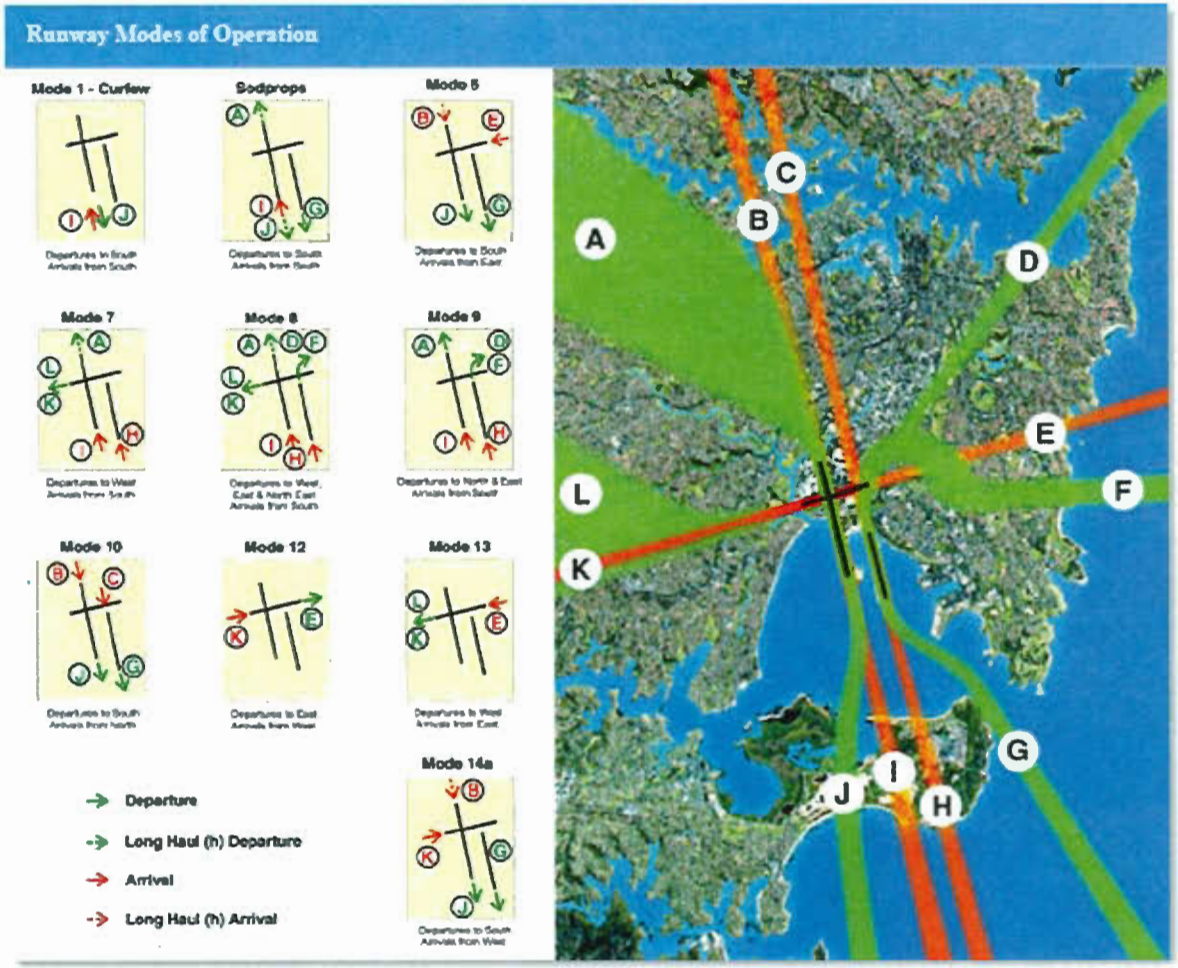



CNCL - 283

CASE STUDIES

# NOISE SHARING

IATA: SYD ICAO: YSSY City: Sydney Country: Australia




Fair & equitable sharing of noise

**10** different runway operating modes

**Targets** for noise sharing

CNCL - 284

*Source: DIRDC Factsheet*

CASE STUDIES

# NOISE SHARING

IATA: SYD ICAO: YSSY City: Sydney Country: Australia

The Long Term Operating Plan (LTOP) was developed in response to community pressure to share the noise generated by flight operations at SYD.

Airservices Australia (the ANSP) developed options for operating the airport in a way that shares the noise in areas around the airport as fairly as possible. These options were released for public comment in late 1996 and formed the basis for LTOP.

LTOP provides 10 possible runway operating modes (see previous page), in practice a preferential runway system, with 2 high capacity modes (parallels), 3 noise sharing modes (5, 7, 14a), 1 overwater modes (SODPROPS), 2 low single runway modes (07 or 25). It is premised on "fair and equitable" noise sharing albeit there is constant jousting between E-W vs. N-S noise sharing.

Under LTOP, when making daily runway selections, Airservices Australia must ensure that in line with safety, capacity and noise requirements, as many flights arrive/depart over water or non-residential areas where aircraft noise has the least impact on people; the rest of the air traffic is spread or shared over surrounding communities as fairly as possible; and as runway modes change throughout the day individual communities receive a break (or respite) from aircraft noise.

A unique feature of LTOP is noise sharing targets. These targets aim to route as many flights as possible over water (55% to the south) and for the remaining flights to be shared between the other three directions as equitably as operationally feasible to do so.

The benefits of LTOP are cumulative and depend on the ability to meet targets. LTOP's performance was the subject of a comprehensive review in 2005 following seven years of operation. Relevant information on LTOP can be found at: http://sacf.infrastructure.gov.au/LTOP/index.aspx

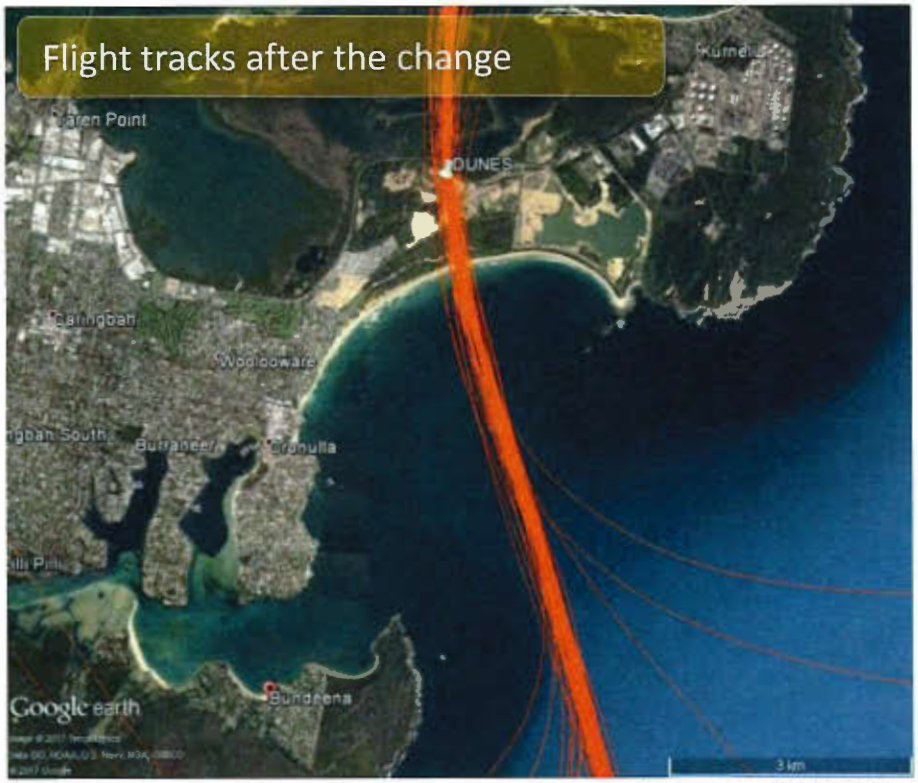
SYD's utilization of runway modes and total runway movements performance are constantly monitored and routinely reported on a monthly basis by Airservices Australia. The two fundamental factors influencing runway selection and therefore the LTOP targets at SYD are forecast or prevailing weather and traffic levels. The results for December 2017 as published by Airservices Australia were as follows:

- North 32.41% vs. target level of 17% (November 2016 - 33.16%)
- South 51.53% vs. target level of 55% (November 2016 – 55%)
- East 15.83% vs. target level of 13% (November 2016 - 13.97%)
- West 0.23% vs. target level of 15% (November 2016 - 1.12%)

CASE STUDIES

# NIGHT CURFEW FLIGHT PATH IMPROVEMENTS

IATA: SYD | ICAO: YSSY | City: Sydney | Country: Australia


CNCL - 286

An ANO investigation conducted during 3Q 2017 led to a change to the departure flight path during SYD's curfew and a reduction in noise impacts for coastal residents during the curfew hours of 23:00-06:00.

*Source: ANO*

CASE STUDIES

# NIGHT CURFEW FLIGHT PATH IMPROVEMENTS

IATA: SYD ICAO: YSSY City: Sydney Country: Australia

In Australia, the Aircraft Noise Ombudsman (ANO) was established in 2010 following a proposal outlined in the Australian Government's aviation policy paper.

The primary role of the ANO is to conduct independent administrative reviews of Airservices' and Defence's management of aircraft noise. Specifically this entails:

- The handling of complaints
- The community consultation processes relating to aircraft noise
- The presentation and distribution of aircraft noise-related information

The ANO's position is reviewed and renewed every three years.

Following the ANO's assessment of progress in implementing recommendations for making aircraft noise information available at SYD, Airservices published a series of fact sheets about the LTOP, noise-sharing and progress to implement alternate arrival flight paths known as 'High and Wide' and 'Trident'.

Furthermore, in March 2016 the ANO examined the possibility of adjusting flight paths over water during curfew hours (23:00-06:00 local) at SYD.

The ANO asked Airservices to consider if a better noise outcome could be achieved for coastal residents south of SYD affected by flights departing during the night curfew.

Following ANO analysis and feedback, Airservices revisited its initial investigation into the feasibility of changing the Standard Instrument Departure (SID) track. Airservices considers a change could now be possible and has commenced the formal change process, including detailed procedure design, necessary assessments and relevant consultation. This work continues to proceed smoothly. Barring any unexpected issues, a change is likely to be introduced in early 2018 that will potentially benefit thousands of coastal Sydney residents as tolerances during night-time hours are noticeably less.

Nonetheless, a perennial challenge for SYD to help secure long term growth in international air services is to rebalance aircraft operations on the main and parallel north-south runways, particularly during peak periods.

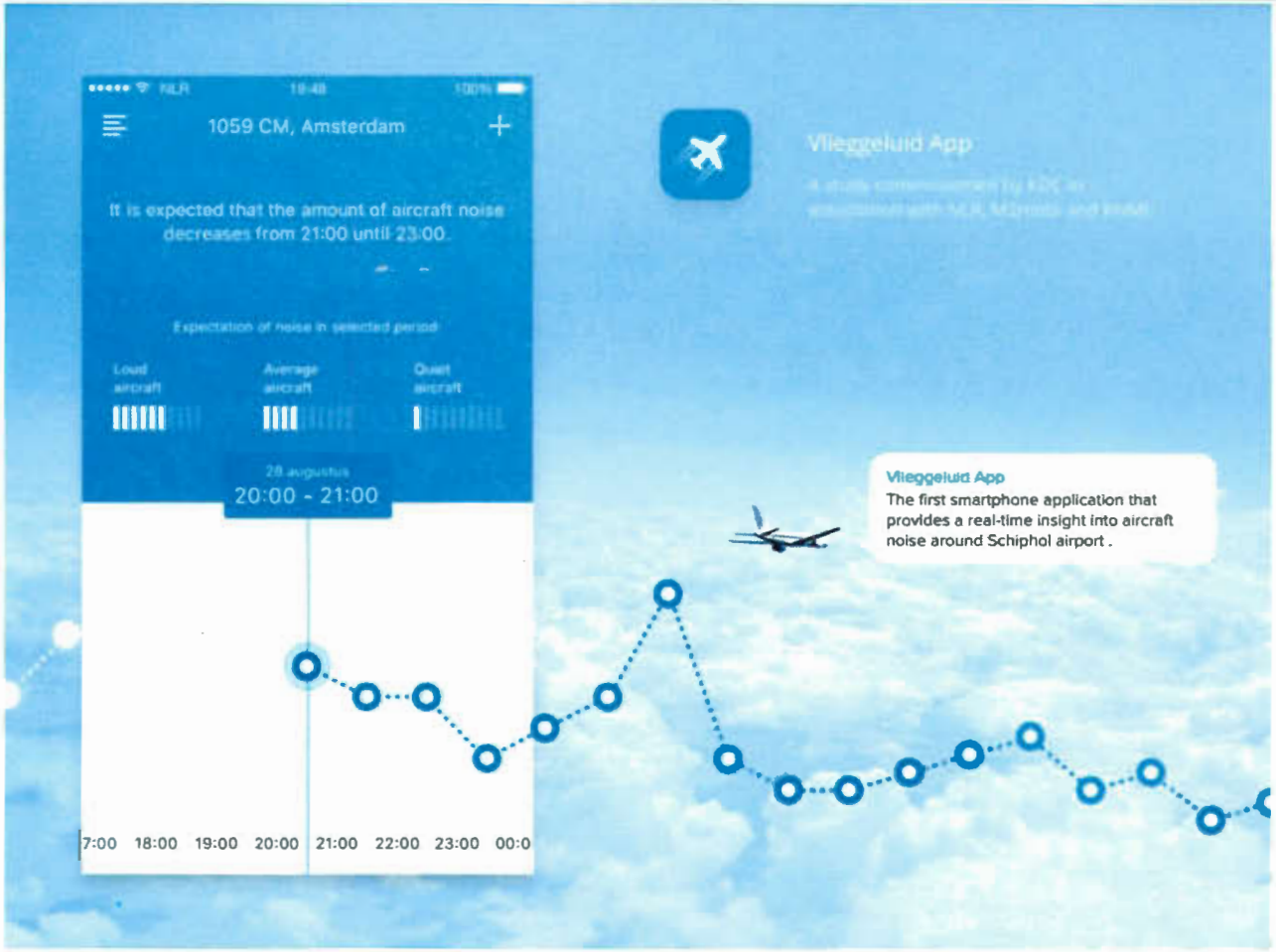
No information on quantifiable benefits is available (Source: http://www.airservicesaustralia.com/projects/flight-path-changes/sydney-curfew-departures-noise-improvement/)

CASE STUDIES

# PREDICTIVE NOISE DISTURBANCE APP

IATA: AMS ICAO: EHAM City: Amsterdam Country: Netherlands

CNCL - 288




**Real-time** Smartphone access

**Greater** certainty for local residents

**30 hour** predictor period

*Source: Schiphol Knowledge Development Centre*

CASE STUDIES

# PREDICTIVE NOISE DISTURBANCE APP

IATA: AMS ICAO: EHAM City: Amsterdam Country: Netherlands

In response to community concerns about aircraft noise and to be as transparent as possible about its operation AMS, in collaboration with KDC Mainport, have been developing an aircraft noise predictor APP

The aircraft noise predictor APP is designed to allow local residents living around AMS to know when and how much aircraft noise is to be expected, as well as the duration it will last. This aims to help local residents to better anticipate the future noise conditions and adapt their plans accordingly – i.e. when or when not to hold and participate in outdoor social gatherings and recreational activities, particularly during the longer summer days.

The APP will work by a smartphone user entering their location to immediately predict the level and duration of aircraft noise likely to be experienced over the next 30 hours. The APP will also be able to show how noise levels will develop during each 20-minute period over the 30-hour forecast.

This represents a significant step change for local residents affected by aircraft noise, particularly with respect of being able to better predict the timing, number of overflights and associated noise exposure – greater certainty.

**No information on quantifiable noise benefits is available.**


*Source: KLM*

CASE STUDIES

# GROUND NOISE SOLUTIONS

IATA: AMS ICAO: EHAM City: Amsterdam Country: Netherlands


Landscape design solution

Sound reflecting ridges

**LFN** deflection & dispersal

*Source: H+N+S Landscape Architects*

CASE STUDIES

# GROUND NOISE SOLUTIONS

IATA: AMS | ICAO: EHAM | City: Amsterdam | Country: Netherlands

Around AMS, the residents of Hoofddorp-Noord have been affected by low frequency ground noise nuisance since the opening of the airport's longest and newest Polderbaan Runway 18R-36L in 2003, especially in winter, when the ground is wet or hard and reverberates the ground noise waves.

Hoofddorp-Noord is located approximately 1,700m to the south-west of the Runway 36L head. Since its opening, the Polderbaan Runway has been a source of great annoyance to affected residents. In 2002, 82 ground noise complaints were made and after the runway's opening this increased to 5,257 complaints.

This resulted in AMS devising an innovative landscape design plan to reduce the nuisance created by low frequency noise (LFN) to local residents. The objective of the plan was to reduce ground noise by 10dB at 31.5Hz which was achieved through the trial testing period (Source: https://www.schiphol.nl/en/you-and-schiphol/page/landscape-design-as-a-solution-to-ground-noise/)

A series of ground ridges were contoured into the local terrain on a 33ha site (Buitenschot Park) in the area between Hoofddorp-Noord and Runway 18R-36L. Each ridge was designed to deflect the sound waves upwards from their sloping surfaces. The ridges are 3m high (1.5m agl and 1.5m bgl).

The scheme was completed in 2013 and today the residents of Hoofddorp-Noord experience less nuisance from LFN as a result.

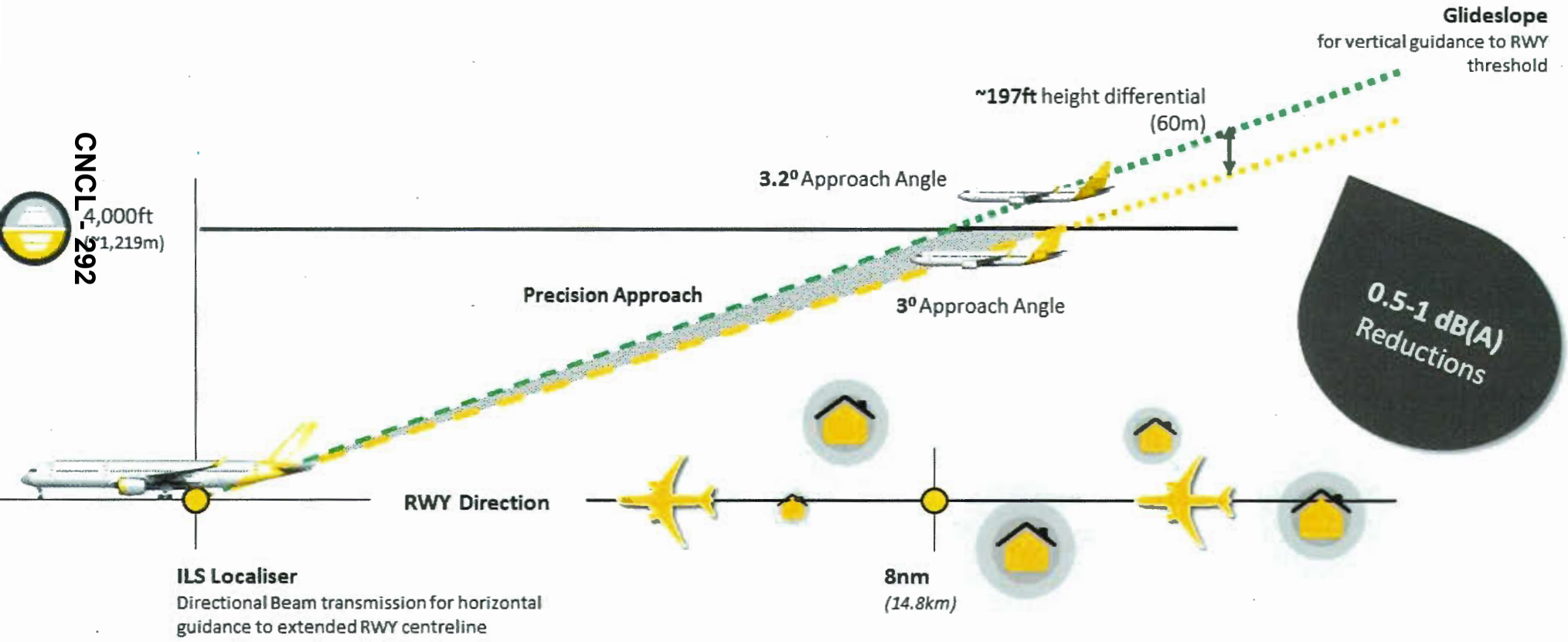
This is a clever example of best practice and innovation working in tandem, combining an airport noise solution with public art and recreational space – i.e. cycleways and sport fields.

*Source: H+N+S Landscape Architects*

CASE STUDIES

# STEEPER APPROACHES

IATA: LHR & FRA ICAO: EGLL & EDDF City: London & Frankfurt Country: UK & Germany




Note: Illustrative schematic showing the height gained by a 3.2⁰ steeper approach vs. a 3⁰ degree approach at approximately 8nm from touchdown

CASE STUDIES

# STEEPER APPROACHES

IATA: LHR & FRA ICAO: EGLL & EDDF City: London & Frankfurt Country: UK & Germany

The international standard Instrument Landing System (ILS) is a beam which is aligned with the runway centreline in order to guide aircraft in a straight line approach to the runway threshold for landing. It consists of two signals, one giving vertical guidance (the glideslope) which is typically set at a $3^0$ glide path angle. Increasing an aircraft's glide path reduces noise in two ways:

- Firstly, it slightly increases the height of the aircraft over the ground, increasing the distance over which sound travels before it reaches residents living in local communities.
- Secondly, it increases an aircraft's rate of descent, and where engine power for a $3^0$ descent is not at the minimum setting (idle), it will reduce the amount of engine power required and in turn reduce the amount of noise being generated on approach.

FRA's new north-west runway, 07L-25R opened in 2011 for bi-directional landings. It is equipped with two ILS systems for each landing direction to enhance operational resilience.

On March 31, 2017 the first satellite-supported precision landings using a steeper 3.2° approach commenced on FRA's southern and central runways. The precision-landing, ground-based augmentation system (GBAS) introduced by DFS Deutsche Flugsicherung GmbH, Fraport AG. and Lufthansa in Frankfurt in 2014 facilitates the steeper $3.2^0$ approach angle on all of FRA's runways for appropriately equipped aircraft. According to the DLR German Aerospace Centre's Institute of Flight Systems in Braunschweig, steeper approaches at FRA have provided 0.5-1.5dB(A) noise reductions depending on the aircraft type and location of the noise measurement station.

LHR trialled an RNAV $3.2^0$ approach procedure between September 2015 and March 2016. Results were analysed to compare the differences between the RNAV 3.2° steeper approach and the existing 3° ILS/MLS approach. Unlike ILS approaches the RNAV procedure is sensitive to temperature and operating the trial during winter reduced the approach angle actually flown, from $3.2^0$ to $3.14^0$. Notably, temperatures above $15^0$C will lead to angles above $3.2^0$, the UK CAA requested further trials to be completed. LHR therefore conducted a second $3.2^0$ trial on May, 25 2017 to assess the effect of warmer temperatures on the approach angle flown during the summer months. The trial was completed on October, 11 2017.

Noise reduction benefits from the trials ranged from an average 0.5 dB(A) per approach up to 1.4 dB(A) SEL (Source: Heathrow Airport Limited https://www.heathrow.com/noise).

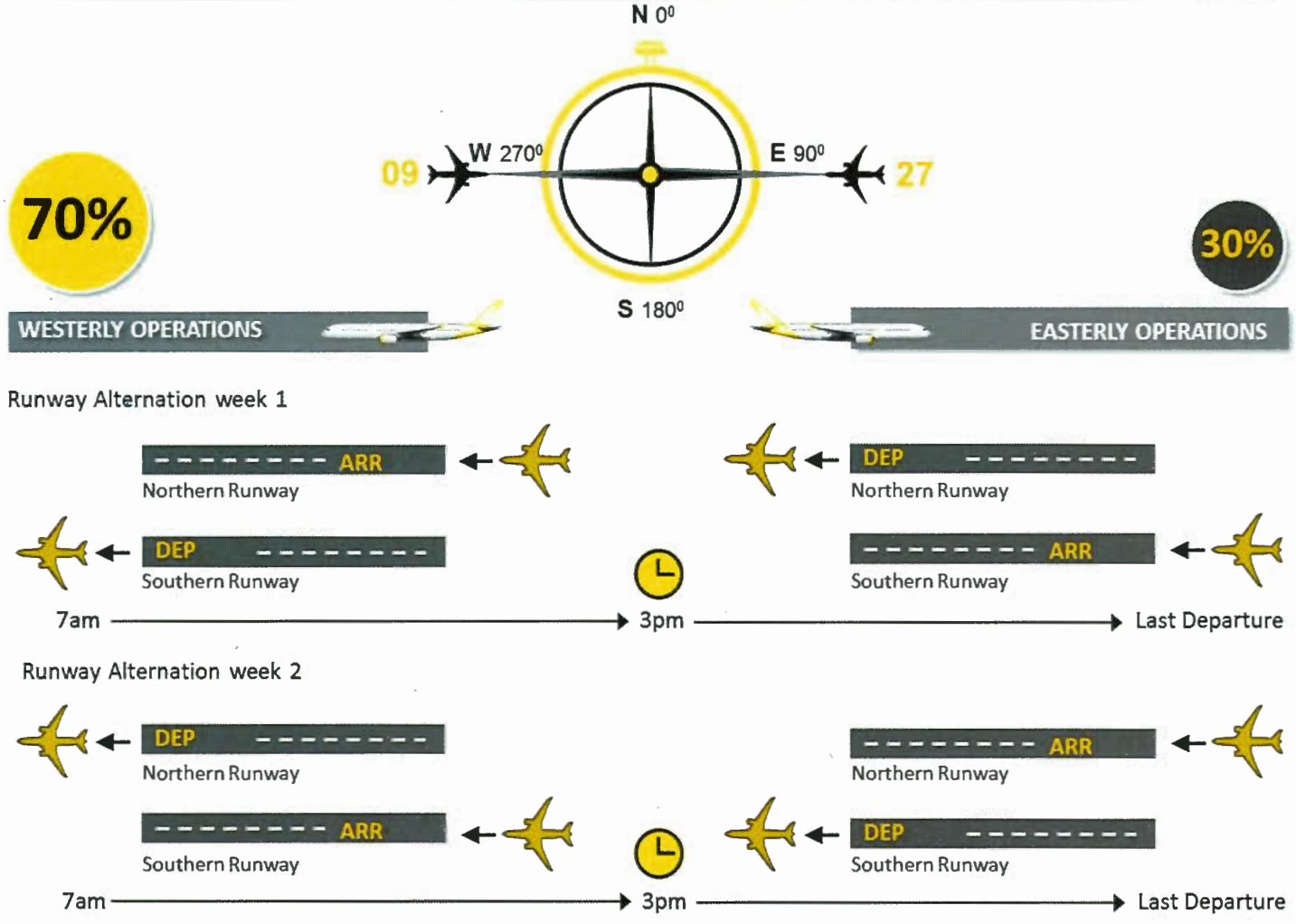
Looking to the future, the aim is to introduce approaches of up to $3.5^0$. The redesign of LHR's airspace in line with the UK Government's Future Airspace Strategy is considering $3.5^0$ approaches.

CASE STUDIES

# RUNWAY ALTERNATION

IATA: LHR ICAO: EGLL City: London Country: United Kingdom

CNCL - 294




*Source: Adapted from HAL*

CASE STUDIES

# RUNWAY ALTERNATION

IATA: LHR ICAO: EGLL City: London Country: United Kingdom



LHR implements partial runway alternation to provide a level of noise respite for residents affected by aircraft arrivals descending on their final approach to land on the runway(s). The historic Cranford Agreement which has been in place since 1952 prevents departures from the Northern Runway on easterly operations (09L), which in turn prevents the use of full runway alternation at LHR. Cranford is a village at the eastern end of the northern runway (09L).

During the day, and when the airport is on westerly operations, 'runway alternation' is used. Primarily this is to provide local communities living under the final approach into the airport with periods of relief from aircraft noise. Residents place great importance on the alternation system at LHR and every effort is made to adhere to it.

The alternation pattern means that for part of the day one runway is used for arrivals and the other for departures. A unique feature of LHR's runway alternation is that it is scheduled, using a two-week cycle giving predictable respite for a half the day (the switch occurs daily at 15:00) to the extent prevailing winds allow for it (as shown on the previous slide).

The inability to alternate runway use when LHR is on easterly operations due to the Cranford Agreement means that any relief provided by runway alternation from westerly operations is offset by the unpredictable changeover to easterly operations due to prevailing wind conditions.

Since the 1950s, the Cranford Agreement favoured residents of Cranford at the expense of other communities such as Windsor and southern parts of Hounslow.

In 2010, the then Government confirmed that the Cranford Agreement should be removed and that Heathrow should take the necessary steps to implement easterly alternation as soon as possible to ensure a fairer distribution of noise when operating on easterlies.

After a lengthy planning process a decision was reached to end the Agreement with planning permission granted by the UK Planning Inspectorate in February 2017. Although the Agreement is no longer in place LHR is unable to implement full runway alternation on easterly operations due to insufficient taxiway infrastructure being in place.

Furthermore, LHR is planning to move forward with the taxiway infrastructure development in line with London airspace changes to support full easterly operations in 2022/23.

No information on quantifiable noise benefits is available (Source: https://www.heathrow.com/file_source/HeathrowNoise/Static/Runway_Alternation_Programme_2018.pdf).

# DEPARTURE NOISE LIMITS

IATA: LHR ICAO: EGLL City: London | Country: United Kingdom

CNCL - 296

**Daytime**

**94**dB(A)
07:00-23:00hrs

**Shoulder**
**89**dB(A)
06:00-07:00hrs

**Night-time**

**Shoulder**
89dB(A)
23:00-23:30hrs

**87**dB(A)
23:30-06:00hrs

*Source: UK Department for Transport*

CASE STUDIES

# DEPARTURE NOISE LIMITS

IATA: LHR ICAO: EGLL City: London Country: United Kingdom

All aircraft departing from LHR must adhere to noise limits set by the UK Government. The current limits were introduced early in 2001. There are three limits in place for the day, shoulder and night-time periods.

The limits are (all times local):

- Day (07:00-23:00) 94dBA Lmax
- Shoulder (23:00-23:30 and 06:00-07:00) 89dBA Lmax
- Night (23:30-06:00) 87dBA Lmax

There are 12 permanent noise monitors located around Heathrow to monitor departure noise limits. The noise limits are based on the assumption that the noise monitors are exactly 6.5km from the start of the roll point on the runway and at the same elevation as the airfield. As this is difficult to achieve due to many factors, adjustments are made to the limits to take account of any variances in the monitor position.

Each noise monitor has an additional calibration allowance of 0.7dBA to provide a margin of error for the microphone. An aircraft is deemed to have infringed the limits for the time period if it exceeds the limit at any of the permanent monitors.

Aircraft exceeding these noise limits must pay a fine, which is transferred to the Heathrow Community Fund. All proceeds fund local community projects in areas affected by the airport's operations.

A higher number of infringements typically occur during the night-time reflecting the number of large, heavy, long haul aircraft which depart later according to international flight schedules or due to disruptions from their planned operational schedules.

In 2017 there were 22 noise infringements (16 at night and 6 during the day), which is noticeably lower than the 36 infringements recorded in 2016.

**No information on quantifiable noise benefits is available.**

# INDUSTRY CODES OF PRACTICE – NOISE REDUCTION

IATA: LHR | ICAO: EGLL | City: London | Country: United Kingdom

LHR

Heathrow

Heathrow Noise

CNCL - 298


*Source: Heathrow Airport Limited*

CASE STUDIES

# INDUSTRY CODES OF PRACTICE – NOISE REDUCTION

IATA: LHR | ICAO: EGLL | City: London | Country: United Kingdom

Heathrow Airport Limited, the operators of LHR, are committed to limit and where possible reduce the number of people affected by aircraft noise. As part of a group of representing the UK aviation industry, namely aerospace manufacturers, airlines, airports (i.e. LHR), air traffic control (ATC) and the ERCD of the UK CAA, voluntary codes of practice were compiled to provide guidance on operational techniques which could reduce the environmental impacts of aircraft operations during ground operations and flight arrivals and departures. HAL actively contributed to these codes of practice.

Although these codes of practice were primarily developed for London Heathrow, Gatwick and Stansted airports, many of the techniques are relevant and applicable to other airports in the UK and worldwide, including YVR. Some of the techniques include the use of Fixed Electrical Ground Power (FEGP) and Preconditioned Air (PCA) instead of running aircraft APUs during block turns; reduced engine taxiing; CCO; CDA; LPLD; speed control; and Airport Collaborative Decision Making (A-CDM).

The codes of practice benefited from the collective experience and knowledge of all participants, to identify steps which could reduce the noise generated by arriving/departing aircraft. As a result the Codes are technical documents principally written for pilots and ATC controllers, but they also contain highly relevant advice for airport operators and aviation regulators.

LHR has identified many strategies to reduce noise – some with quantifiable noise improvements. More information can be found here: https://www.heathrow.com/file_source/HeathrowNoise/Static/Heathrow_Blueprint_for_Noise_Reduction_2.pdf


*Source: Sustainable Aviation & Heathrow Airport Limited*

# LUFTHANSA GROUP – NOISE REDUCTION AT FRA HUB

IATA: FRA ICAO: EDFF City: Frankfurt Country: Germany

CNCL - 300

## The Airbus A320neo
Less noise. Less fuel. More comfort.

### 116 aircraft
The Lufthansa Group has a total of 116 aircraft of the A320neo family on order: "neo" stands for "new engine option".

### Aerodynamic advantages
Wing tip extensions that are 2.4 meters tall produce enhanced aerodynamic performance.


### Quieter engines
Geared turbofan technology ensures that the engines are significantly quieter and use less fuel.

### 50% less noise
At takeoff, the noise footprint is only about half as large as that of comparable preceding models.

### 15% fuel reduction
The A320neo is over 15% more fuel efficient than current comparable models.

### Reduction of noise levels
All new A320neo and A321neo planes are fitted with noise-reducing vortex generators as standard equipment.

### More efficient utilization of space
A new, more space-efficient cabin configuration offers an increased seat pitch in Business Class and more seating capacity in Economy Class.

*Source: Lufthansa Group*

CASE STUDIES

# LUFTHANSA GROUP - NOISE REDUCTION AT FRA HUB

IATA: FRA | ICAO: EDFF | City: Frankfurt | Country: Germany

The Lufthansa Group and its system partners have pioneered many noise prevention and reduction measures for quieter flight operations at FRA and other airports across its route network. Taking centre stage has been the Group's continual investment in modern, quieter, cleaner aircraft through active fleet renewal, the implementation of optimized flight procedures and the retrofitting of its existing fleet of aircraft to reduce noise at source.

Interestingly, almost the entire fleet of the Lufthansa Group in active service meets or exceeds ICAO's stringent Chapter 4 noise standard. In January 2016, Lufthansa became the launch customer for the new A320neo which boasts a 50% smaller noise footprint than the model it is replacing (i.e. A320-200). At the end of 2016, Lufthansa started operating the ultra modern, quiet A350-900 which again is reported to have a 40-50% smaller noise footprint compared to the A340-300s/600s it is replacing.

The Lufthansa Group has been actively retrofitting older A320s in its fleet with noise-reducing technologies through close collaboration with the German Aerospace Center (DLR) and various aircraft manufacturers. In early 2014, Lufthansa was also the first airline worldwide to start operating A320s equipped with noise-reducing vortex generators and, thereby, setting an industry standard. Today, all A320s in the Lufthansa fleet are equipped vortex generators which help to eliminate unpleasant tones on approach by up to 4dB.

To fly more quietly at FRA, the Lufthansa Group, together with its system partners, also adopt continuous rates of descent, steeper approaches ($3.2^0$), scheduled runway alternation to provide predictable periods of noise respite.


*Source: Lufthansa Group*

# NOISE MANAGEMENT PRIORITIES

IATA: HEL ICAO: EFHK City: Helsinki | Country: Finland

CNCL - 302

## Finavia's noise control measures in a nutshell

We are reducing air-traffic noise in a variety of different ways. Our goal is as little air-traffic noise as possible and as few inhabitants as possible in the area. The safety and fluidity of air traffic are always the priority.

**FINAVIA'S OPERATIONS**

**How runways are used**
Principal runway for take-offs and landings

**Optimisation of flight paths**
Take-off paths to avoid residential areas as much as possible

**Vectoring of landing on runway 15**
Landing planes are directed past the centre of Nurmijärvi

**Continuous Descent Operations (CDO)**
Continuous descent approaches (CDA)

**Using the Low Power/Low Drag (LP/LD) method**
Optimising configuration

**Noise limits on take-off paths**
Some flight paths limited to low-noise aircraft


*Source: Finavia*

CASE STUDIES

# NOISE MANAGEMENT PRIORITIES

IATA: HEL ICAO: EFHK City: Helsinki Country: Finland

Finavia, the operators of HEL, implement a comprehensive package of noise management both in the air and on the ground.

In 2016, 21% of all landings and 30% of night-time (22:00-07:00 local) landings used the primary landing direction - i.e. Runway 2 (15). This was lower than the previous year due to runway maintenance and rehabilitation. 62% of all take-offs and 70% of night-time take-offs used the primary take-off direction - Runway 3 (22R). Only 4% of take-offs were towards the south-east.

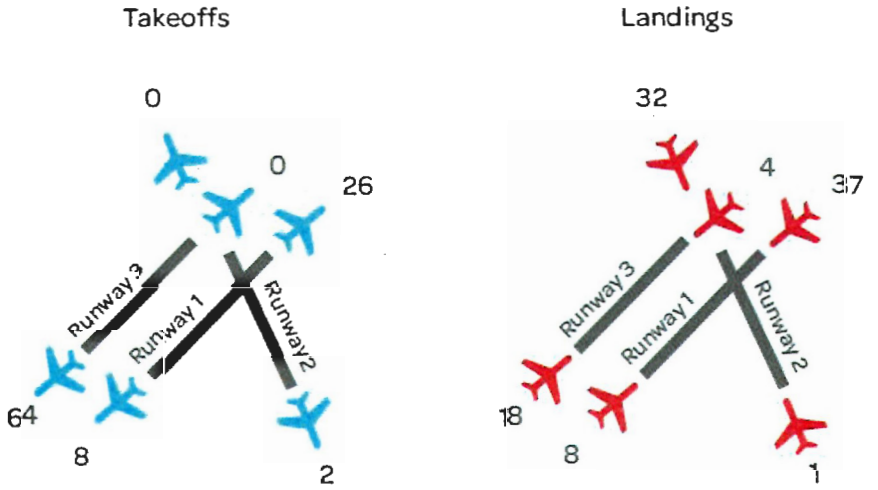
In 2017, 71% of aircraft arrivals used CDA (slightly up from 70% in 2016). Source: https://www.finavia.fi/en/about-finavia/responsibility/environment/environmental-work

Finavia has also worked closely with its airlines, particularly Finnair on the late deployment of landing gear according to safety and operational criteria.

Landing gear is typically deployed in the final approach phase and for some aircraft its deployment can also be linked to a flap setting. It significantly increases aircraft drag and airframe noise, and to maintain the flight path/descent profile increased engine power is required giving rise to increased engine noise. This could in some instances increase the noise of arriving aircraft by up to 5dB (Source: Finavia).

Landing gear deployment must align with airline and manufacturer safety requirements and SOPs, which vary by aircraft type. Typically deployment must occur no later than 5nm or 1,500ft aal to safely stabilise the aircraft on approach in the landing configuration by 1,000ft.

Newer generation aircraft glide through the air with less friction, significantly reducing noise ad emissions. This benefits the communities they fly over.




*Source: Finavia*

CNCL-303

CASE STUDIES

# NOISE REDUCTION HANGAR

IATA: ZRH ICAO: LSZH City: Zurich | Country: Switzerland


Up to 30dB noise reduction

**High Spec** cladding systems

**24/7** tests in almost all wind conditions

*Source: Flughafen Zurich A.G.*

CASE STUDIES

# NOISE REDUCTION HANGAR

IATA: ZRH | ICAO: LSZH | City: Zurich | Country: Switzerland

In 2014, Flughafen Zurich AG, the operators of ZRH, opened a new 'state-of-the-art', noise protection hangar to reduce the noise impacts on residents living in the surrounding municipalities from aircraft engine tests. Hangar construction was completed in 20 months and followed by a 6-week testing and training program before it was fully operational on August, 1 2014.

The hangar's design lets air through while reducing noise at the same time. It can accommodate aircraft up to Boeing B747-8 size with a wing span of 68.5m. All aircraft types which are serviced regularly at ZRH can use the hangar for engine tests. The key dimensions of the hangar are as follows:

- Interior Height: 12m at the side walls to 16m in the centre
- Width: 86m
- Length: 111m long (doors closed) and 126m (doors opened)
- Jet Blast Deflector: 16m high and flat at the rear of the hangar to redirect the high-speed jet blast up at an angle of 90° without generating turbulence

The hangar's facade is cladded with high-performance sound insulation materials. Six microphones have been installed inside the hangar to measure and record noise levels during the tests.

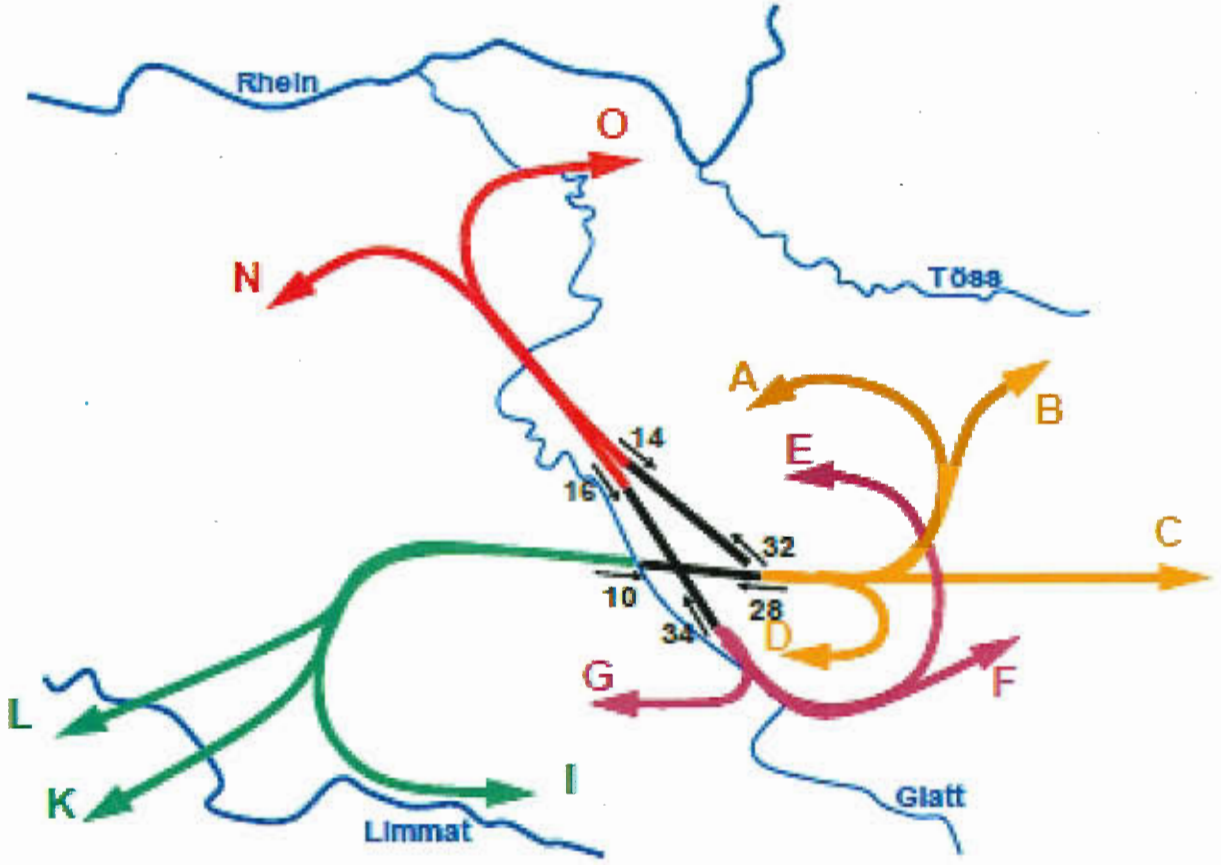
A noise reduction of between 25-30 dB(A) was published by Flughafen Zurich and the G+H Group, respectively (Source: https://www.zurich-airport.com/the-company/zurich-airport-ag/completed-construction-projects/construction-of-new-noise-protection-hangar and the G+H Group).

*Source: Flughafen Zurich A.G.*

# DIFFERENTIAL NOISE CHARGES

IATA: ZRH ICAO: LSZH City: Zurich | Country: Switzerland

CNCL - 306




Apply to **all** aircraft types

**5** aircraft noise categories

**Extra** charges levied at night-time

*Source: Flughafen Zurich A.G.*

CASE STUDIES

# DIFFERENTIAL NOISE CHARGES

IATA: ZRH | ICAO: LSZH | City: Zurich | Country: Switzerland

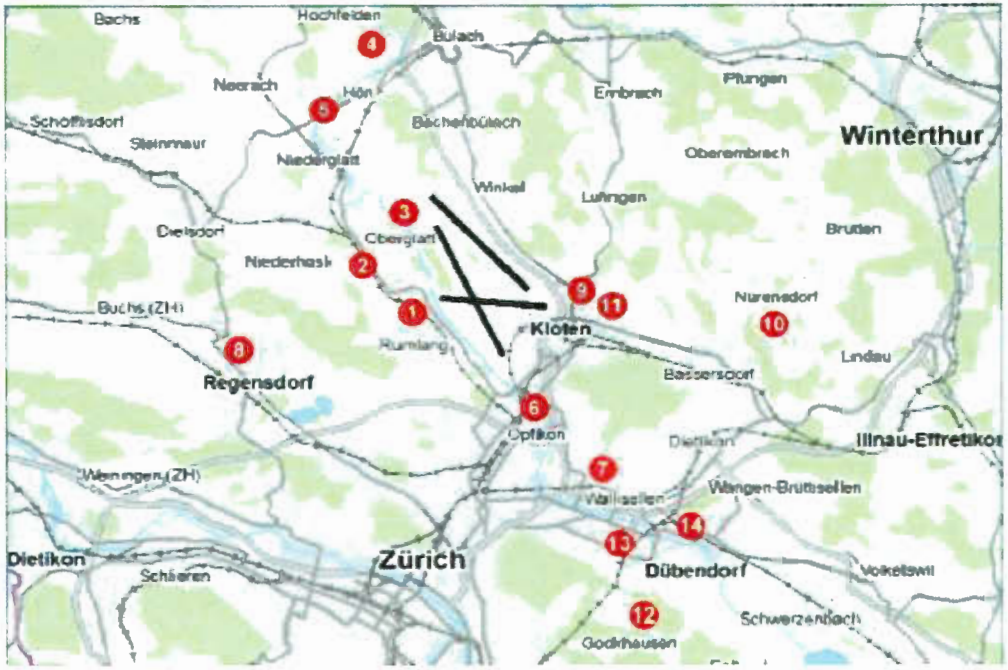
Differential noise charges are levied on all aircraft types operating at ZRH. Every aircraft is classified in one of five noise categories based on average peak noise values during take-off, as measured at the noise monitoring stations at and around the airport.

Noise class I comprises the noisiest and noise class V the least noisy aircraft types. The noise charge increases with each noise class and ranges in the daytime per landing from CHF 0 (noise class V) to CHF 2,000.00 (noise class I). During the night between 22:00-06:00 local additional night-time noise charges are levied, which increase in half-hourly increments. Since 2013, flights between 06:00-07:00 local and 21:00-22:00 local have also had to pay a noise charge supplement. The aim is to ensure that as few noisy flight movements as possible occur in the sensitive shoulder hours and during the night.

All revenue from noise charges is credited to the Airport of Zurich Noise Fund (AZNF) and is used only for specific purposes, i.e. for costs relating to aircraft noise.

The charging regime is designed to incentivize airlines to operate their newest, quietest aircraft. In doing so, communities around the airport benefit from less noise exposure on an individual aircraft overflight basis.

The current noise charges regime are valid from September 1, 2016.




*Source: Flughafen Zurich A.G.*

*Source: [www.zurich-airport.com/business-and-partners/flight-operations/charges](www.zurich-airport.com/business-and-partners/flight-operations/charges)*

CNL-07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# Summary of Work Against Initiatives in the 2014-2018 YVR Noise Management Plan

| No. | Issue | Objective | Initiative/Action | | Summary and Highlights of Completed Actions |
|---|---|---|---|---|---|
| 1 | Land use planning | **Build on existing collaborative partnership and work with local municipalities on land use planning to minimize the level of aircraft noise, nuisances and disturbances for those living in the vicinity of the airport.** | 1.1 | ***Review the 2015 YVR Noise Exposure Forecast Contours*** The 2015 Noise Exposure Forecast planning contours, created in 1994, were meant to provide guidance to municipalities on land use planning efforts. To account for future growth in air traffic and changes in aircraft fleet mix, the Airport Authority will review the existing 2015 Noise Exposure Forecast contour to assess future noise exposure and provide information to municipalities to help with long term land use planning decisions. Following this review, relevant noise mitigation measures and documents (e.g., brochures, policies, bylaws covenants, noise mitigation standards) will be updated as required. | • *Review of 2015 Noise Exposure Forecast (NEF) Contours was completed as part of YVR 2037 Master Plan process.*<br>• *Review concluded that the current 2015 NEF contour provides sufficient protection for future traffic growth and potential airfield expansion; as a result, the 2015 NEF contour was retained as the airport's long-term planning contour and was included in the Master Plan documents.*<br>• *Methodology and results of the review were shared with the YVR Noise Management Committee and City of Richmond policy planning staff.* |
| | | **Maintain and enhance safe aircraft operations, while minimizing aircraft noise exposure, and consider desires to maximize building heights.** | 1.2 | ***Review of existing YVR Aeronautical Zoning Regulations*** The heights of buildings and obstacles in close vicinity to the airport are governed by the YVR Aeronautical Zoning Regulations, which set maximum building heights to ensure safe aircraft operations. The Airport Authority will conduct a review of the Zoning Regulations to seek protection for runway options identified in the YVR Master Plan, and to protect existing runways given increased zoning requirements. As part of this review, the Airport Authority will also consult with the City of Richmond and other stakeholders to explore maximizing City Centre viability by possible increases in building height around City Hall to improve sustainability, social, economic and environmental benefit. | • *The project to create new Airport Zoning Regulations is ongoing.* |
| 2 | Awareness - Community | **Better inform the public about aircraft operations, flight paths, and noise management measures to enable a greater understanding of the implications of aircraft noise and airport operations, and to match public expectations with experience.** | 2.1 | Improve online media tools to enhance communication with the public of noise management information and program efforts. | • *Noise management factsheets were translated in both French and simplified Chinese and made available online.*<br>• *Completed a review of noise management information on the YVR website and updated information and materials where required.* |
| | | | 2.2 | Explore and implement better methods of communicating with the public regarding aircraft noise and over-flight impacts, such as respite charts, N70 (number of events over 70 dBA) Contours, and flight path density maps. | • *To support the YVR 2037 Master Plan process, Number of Event (N70) contours and flight path maps were created to help communicate the possible changes in air traffic levels to accommodate forecasted growth.* |

| No. | Issue | Objective | Initiative/Action | | Summary and Highlights of Completed Actions |
|---|---|---|---|---|---|
| | | | | | • *This materiol was used in information session and online materials for the YVR 2037 Master Plan and was also included in the 2016 annuol noise management report.* |
| | | | **2.3** | Track, report, and profile progress and trends towards the use of quieter aircraft at YVR and provide this information in the annual noise report. | • *Completed and ongoing.*<br>• *The breakdown of jet aircraft daytime and nighttime movements by noise certification is included in the noise management annual reports.* |
| | | | **2.4** | Provide better information to the public on airport operations and aircraft noise management efforts to help educate new homebuyers and provide existing homeowners with suggestions on how to sound insulate older homes. | • *Completed.*<br>• *Home Buyer & Owner Guide was created to provide information on airport and aircraft operations and recommendations for sound insulation.*<br>• *The guide is avoilable on the YVR website and hardcopies are available upon request.* |
| **3** | **Awareness – Industry** | **Engage with aviation stakeholders to improve noise management activities and discussions about aircraft noise management.** | **3.1** | Develop a training module on noise management for flight schools to raise awareness of noise issues within the aviation community. | • *It was decided not to undertake this initiotive.*<br>• *The objective of this initiative was to create materials to increase awareness and promote good noise management practices amongst aircraft operators at YVR. This objective has been achieved by presenting at the annual YVR Chief Pilots Meeting and awarding the YVR Fly Quiet Awards to recognize airline performance.* |
| | | | **3.2** | Host regular meetings with Transport Canada to discuss roles and responsibilities, and exchange information on noise management opportunities. | • *Ongoing dialogue with Transport Canada occurs and will continue.* |
| | | | **3.3** | Host regular meetings with NAV CANADA to dialogue and exchange information on noise management opportunities. | • *Ongoing dialogue with NAV CANADA occurs and will continue.* |
| | | | **3.4** | Host regular meetings with other major airports in Canada to dialogue and exchange information on noise management opportunities, and to coordinate responses and positions to national issues. | • *Completed and ongoing.*<br>• *A new Noise & Communications Working Group was formed under the Canadian Airports Council (CAC), and meetings are hosted regularly to share noise management practices and information and to discuss issues on a national level.*<br>• *While participation on the Working Group is open to any CAC member airport, the core active participants include staff from Vancouver, Calgary, Toronto, Montreal, and Hamilton.*<br>• *Mark Cheng (YVR) serves os the current chair of this Working Group and Anne Marcotte (YUL) serves as co-chair.* |

| No. | Issue | Objective | Initiative/Action | | Summary and Highlights of Completed Actions |
|---|---|---|---|---|---|
| | | | 3.5 | Review the YVR Fly Quiet Award and explore possible opportunities for further recognition and engagement of the aviation community. | • *Airport Authority explored options to introduce floatplane and helicopter categories in the YVR Flight Quiet Awards; however, this was not pursued due to the low number of float plane and helicopter operators at YVR, the challenges of capturing good noise monitoring data required for the analysis, and the high variability of the flight tracks associated with these operations.* |
| 4 | **Night-time Operation** | **Monitor and report on the number of night operations.** | 4.1 | Ongoing review of approval guidelines for night-time operations. | • *Completed and ongoing.* |
| | | | 4.2 | Report annually on the number of night operations by aircraft noise certification. | • *Completed and ongoing. Information provided in the annual noise management report.* |
| | | | 4.3 | Review and create a summary report on the nature of marginally compliant Chapter 3 aircraft operations at YVR. | • *This initiative is no longer relevant as the number of marginally compliant Chapter 3 aircraft operating at YVR (i.e. the Boeing B737-200 and the Boeing 727) has decreased significantly over the past four years at YVR.*<br>• *In 2014, there were a total of 2,028 operations of the Boeing 727 and 737-200 aircraft at YVR, which accounted for 1.4% of all jet aircraft operations during that year.*<br>• *In 2017, this number decreased to a total of 76 operations at YVR, which accounted for 0.05% of all jet aircraft operations that year.* |
| 5 | **YVR ANMC** | **Ensure that the YVR ANMC remains relevant and functional.** | 5.1 | Update the Terms of Reference for the YVR ANMC and review membership, expectations, scope, objectives, etc. | • *Review underway. Will be completed before end of this year.* |
| 6 | **Run-ups** | **Further manage noise from engine run-ups.** | 6.1 | Review existing engine run-ups procedures and directives with a focus on optimizing noise reduction opportunities at all non-GRE run-up locations. | • *A review of run-up operations occurring outside the GRE facility was completed to identify further procedural or operational controls to mitigate noise.*<br>• *The review concluded that the existing procedures used to manage run-ups provides the best possible noise reduction based on the current aircraft types being maintained at YVR.*<br>• *The review recommended regular monitoring of the types of run-ups and consider additional remedies if the nature and trends of maintenance activities change in the future (e.g. new aircraft types or changes/additions to the approved run-up locations).*<br>• *This recommendation has been carried into the 2019-2023 YVR Noise Management Plan.* |
| 7 | **Performance Based** | **Better understand the potential impacts associated with PBN procedures, and** | 7.1 | Support and participate in national discussions on PBN arrival and departure procedures through the Canadian Airports | • *Canadian Airports Council assigned a representative, James Hall from Kelowna Airport, to this group.* |

| No. | Issue | Objective | Initiative/Action | | Summary and Highlights of Completed Actions |
|---|---|---|---|---|---|
| | Navigation (PBN) Procedures | ensure that noise, emissions and capacity impacts of PBN are considered during implementation. | | Council, and in conjunction with the Transport Canada PBN Working Group (soon to become the Canadian Performance Based Aviation Action Team). | |
| | | | 7.2 | Provide assistance with the evaluation of noise associated with PBN procedures, and assist with the review of altitudes when turns can be commenced, degree of turns, aircraft destination, RNAV departure routes or vectors, aircraft altitude over residential communities, etc. | • *Input provided during the development of the Required Navigation Performance (RNP) arrival procedure for runway 08L.* |
| | | | 7.3 | Undertake a study to determine and better understand potential flight routings associated with PBN arrival and departure procedures. | • *Not completed, as only one PBN procedure was published for YVR between 2014-2018.* |
| | | | 7.4 | Ensure community is advised before any changes to flight paths are implemented. | • *The Airspace Change Communications and Consultation Protocol (ACCCP) was developed in 2015 jointly by Canadian airports and NAV CANADA to address communication and consultation requirements for changes to airspace procedures. YVR contributed to the development of the ACCCP by working with other airports through the Canadian Airports Council.*<br>• *During the time period 2014-2018, only one RNP arrival procedure was introduced at YVR. This procedure was for Runway 08L arrivals and was published in October 2015. Prior to the implementation, the Airport Authority worked collaboratively with NAV CANADA to communicate the change per provisions outlined in the ACCCP. Information was made available online by YVR and NAV CANADA, and a briefing was provided to the YVR Noise Management Committee.* |
| 8 | YVR Float Plane Operations | Further manage noise impacts from YVR float plane operations. | 8.1 | Continue ongoing dialogue and work with YVR float plane operators to assess ways to further manage noise. | • *Ongoing participation on the YVR Noise Management Committee by the Floatplane Operators Association is appreciated.* |
| | | | 8.2 | Review current float plane operating procedures and routes and identify opportunities if any to mitigate noise. | • *Ongoing review of float plane operations completed.* |
| 9 | Noise Abatement Procedures | Ensure procedures to manage noise remain relevant and current. | 9.1 | Undertake annual review of published Noise Abatement Procedures for YVR with the aim of ensuring clarity and continual improvement. | • *Annual reviews of the published Noise Abatement Procedures were completed.* |
| | | | 9.2 | Undertake a gap analysis of the YVR Aeronautical Noise Management Program by comparing to other airports of similar size to identify opportunities for improvement in core program elements. | • *Completed the AIRBIZ report in 2018 to support the creation of the 2019-2023 YVR Noise Management Plan.* |

| No. | Issue | Objective | Initiative/Action | | Summary and Highlights of Completed Actions |
|---|---|---|---|---|---|
| 10 | **Managing Runway Demand** | **Ensure runway system at YVR is used effectively to reduce delays while managing noise impacts on the community.** | **10.1** | Quantify current level of delays at YVR and associated costs. | • *This initiative is deferred to the 2019-2023 YVR Noise Management Plan.* |
| | | | **10.2** | Assess airside capacity and determine optimal use of runway system. | • *This initiative is deferred to the 2019-2023 YVR Noise Management Plan.* |

# DRAFT 2019-2023 YVR Noise Management Plan Initiatives

| No. | Work Focus | Objective | | Initiative / Action |
|---|---|---|---|---|
| 1 | Awareness - Community | Inform the community about aircraft / airport operations and noise management efforts. | 1.1 | Identify and implement new online web tools to enhance information sharing and analytical capabilities to better inform the community about aeronautical noise and aircraft operations. |
| | | | 1.2 | Report the results of noise monitoring, aircraft operations, complaints statistics, and progress on noise management initiatives in the annual noise report. |
| | | | 1.3 | Track the trend of the use of quieter aircraft designs at YVR and provide updates in the annual noise report. |
| | | | 1.4 | Review noise management information on the YVR website to ensure information is up-to-date and relevant. Where possible, look to convert materials to other forms of media to increase accessibility of information. |
| | | | 1.5 | Engage Musqueam Indian Band to provide information and enhance knowledge of airport and aircraft operations. |
| | | | 1.6 | Track and provide educational information on emerging trends in aircraft and navigation technologies. |
| | | | 1.7 | Include information on annual traffic forecasts and growth in the annual noise report to provide clear expectations to the community. |
| 2 | Awareness – Industry | Engage with aviation stakeholders on noise management activities at YVR. | 2.1 | Participate in discussions with other major airports in Canada to share and exchange information on emerging trends and noise management strategies, and to coordinate responses and positions on national issues. |
| | | | 2.2 | Host regular meetings with NAV CANADA to discuss and exchange information on noise management strategies. |
| | | | 2.3 | Acknowledge airline partners that demonstrate good noise management practices by presenting the YVR Fly Quiet Awards annually and explore opportunities for further recognition and engagement. |

| No. | Work Focus | Objective | Initiative / Action | |
|---|---|---|---|---|
| 3 | Night-time Operation | Monitor and report on the number of night operations. | 3.1 | Perform an annual review of the Airport Authority's guidelines for approving operations at night to ensure the guidelines remain relevant. |
| | | | 3.2 | Report on the number of night operations by aircraft noise certification in annual noise reports. |
| | | | 3.3 | Monitor compliance with the night-time approval requirement and report suspected violations to Transport Canada. |
| | | | 3.4 | Assess and communicate the benefits and economic contribution of 24-hour operations. |
| 4 | YVR Aeronautical Noise Management Committee (ANMC) | Ensure that the YVR ANMC remains relevant and functional. | 4.1 | Review the YVR ANMC Terms of Reference for membership, expectations, scope, objectives, etc. Host at least three meetings in a year and consult members on emerging issues |
| | | | 4.2 | Develop customized reports for ANMC city staff and citizen representatives to support their role on the Committee |
| 5 | Aircraft Noise Monitoring & Flight Tracking System (ANOMS) | Ensure functional and reliable collection of noise and operations data. | 5.1 | Assess the current network for Noise Monitoring Terminals (NMTs) and determine locations in the City of Delta, Musqueam, and other areas Metro Vancouver area where new NMTs could be located to capture noise data related to current and future operations. |
| | | | 5.2 | Prepare a multi-year system plan for ANOMS to schedule hardware replacement and software enhancements. |
| 6 | Temporary Noise Monitoring | Deploy the portable NMT to capture objective data on noise exposure. | 6.1 | Identify potential locations for temporary noise monitoring, deploy the portable Noise Monitoring Terminal, and make available a summary of results. |
| 7 | Run-ups | Further manage noise from engine run-ups. | 7.1 | Undertake an annual review of the Engine Run-up Directives and Procedures with a focus on optimizing noise reduction opportunities at all run-up locations. |
| | | | 7.2 | Report the number of run-ups by hour, location, and power setting in the annual noise report. |
| | | | 7.3 | Provide new operators at YVR with information on engine run-up procedures and directives. |

| No. | Work Focus | Objective | Initiative / Action | |
|---|---|---|---|---|
| 8 | Performance Based Navigation (PBN) Procedures / Flight Path Changes | Identify opportunities for noise mitigation during the development of new flight paths or procedures where feasible. | 8.1 | Assist with evaluating community and noise impacts associated with the introduction of new flight paths and procedures, and ensure that noise and emissions reductions and capacity impacts are considered during design. |
| | | | 8.2 | During the design phase of creating new procedures, provide baseline information on current aircraft activity levels over the community to assist with identifying mitigation options to lessen current impacts where feasible. |
| | | | 8.3 | Support the development and introduction of PBN procedures at YVR by providing resources, information, and data to assist in the design process. |
| | | | 8.4 | Collaborate with aviation partners to ensure community is engaged and advised before any changes to flight paths are implemented as outlined in the *Airspace Change Communication & Consultation Protocol*. |
| 9 | Noise Abatement Procedures | Ensure procedures to manage noise remain relevant and current. | 9.1 | Perform an annual review of the published Noise Abatement Procedures for YVR with the aim of ensuring clarity and continual improvement. |
| 10 | Managing Capacity | Ensure runway system at YVR is used effectively to reduce delays while managing noise impacts on the community. | 10.1 | Work to quantify current level of delays at YVR and costs associated with various aspects of operations, including noise restrictions. |
| | | | 10.2 | Support efforts to assess airside capacity and determine optimal use of the runway system at YVR, and assist with the assessment of short, medium, and long term capacity enhancement strategies. |
| | | Develop analytics and identify data requirements to evaluate impacts of future runways. | 10.3 | Identify evaluation criteria, metrics, and analysis requirements to assess future noise impacts associated with potential new runways and airfield infrastructure and work collaboratively with Cities and stakeholders to ensure required data is collected. |
| 11 | YVR Float Plane Operations | Further manage noise associated with YVR float plane operations. | 11.1 | Continue ongoing dialogue and work with YVR float plane operators to assess ways to further manage noise. |
| 12 | Land Use Planning | Promote compatible land use planning in the vicinity of the airport. | 12.1 | Work with adjacent communities to promote the adoption of compatible land use and design standards that reflect airport operations and plans. |
| | | | 12.2 | Provide comment and input into community plans, rezoning, and development applications where and when applicable. |
| | | Minimize noise from future airport developments on Sea Island | 12.3 | As part of the process for development on airport property, assess the use of berms, barriers, and landscaping as ways to minimize noise from airport ground based activities. |