Best practices in noise management

Commissioned by the Greater Toronto Airports Authority (GTAA)

Document information

Document title	Best practices in noise management Commissioned by the Greater Toronto Airports Authority (GTAA)
Author	Kevin Tucker, Steve Leighton, Matt Brookes, Ravi Khiroya, Helios
Produced by	Helios 29 Hercules Way Aerospace Boulevard - AeroPark Farnborough Hampshire GU14 6UU UK
Produced for	Cynthia Woods, Manager, Nosie Management Office, GTAA
Helios contact	Kevin Tucker Tel: +44 1252 451 651 Fax: +44 1252 451 652 Email: kevin.tucker@askhelios.com
Produced under contract	2045385
Version	1.5 (FINAL)
Date of release	23 September 2017
Document reference	P2338DD003

Contents

List of figures

List of tables

1   Introduction

1.1   This report

This report summarises a study undertaken on behalf of the Greater Toronto Airports Authority (GTAA) to research noise management activities and best practices at 26 comparator airports worldwide. The output of the study is a set of potential new programmes and initiatives for GTAA to pursue that are aimed at mitigating the impacts of aircraft noise and/or enhancing community engagement.

1.2   Background

Toronto Pearson has the opportunity to become North America's next global hub airport. By 2037, it is expected that annual demand for the airport will reach 85 million passengers and approximately 630,000 aircraft movements. The GTAA understands that, while growth will provide economic benefits for the community and wider economy, it will also bring impacts, including aircraft noise. Therefore, GTAA recognises that any growth must be sustainable and in partnership with local communities. This will include noise mitigations that provide a material benefit for the community.

With this in mind, on the basis of best practice techniques used at other airports around the world, the GTAA wishes to understand how:

- Aircraft noise is managed and mitigated elsewhere in the world.

- Community engagement can be enhanced.

1.3   GTAA Noise Management Programme

The GTAA has a Noise Management Programme that follows the principles of the International Civil Aviation Organisation (ICAO) Balanced Approach to Aircraft Noise Management[1]. The GTAA Noise Management Programme uses a mixture of elements to mitigate operational impacts, including:

- **Land Use Planning** which identifies an Airport Operating Area (AOA) to support municipalities in developing compatible land uses in the areas surrounding Toronto Pearson.

- **Noise Operating Restrictions** which includes a night flight programme and night-time preferential runway assignments.

- **Noise Abatement Procedures** to minimise the noise impacts on communities in the immediate vicinity of Toronto Pearson during take-off and landing.

- **Reduction of Noise at Source** through restrictions on older/noisier aircraft types.

- **An Enforcement Office** which investigates, audits, and reports on potential violations of the GTAA Noise Management Programme.

- **A Noise Management Office** which investigates complaints, monitors noise levels, and acts as an informational resource.

---

[1] The ICAO Balanced Approach to Aircraft Noise Management is based upon four principles - reduction of noise at source, land-use planning and management, noise abatement operational procedures and operating restrictions. Guidance on the Balanced Approach is provided in ICAO Doc 9829, Guidance on the Balanced Approach to Aircraft Noise Management.

- **Consultation and Outreach** to engage with communities on concerns about aircraft noise, and build awareness and understanding about the airport's role in the community.

1.4 Objective of this study

The GTAA has a Five-Year Noise Management Action Plan (2013-2017) aimed at reviewing, validating and updating the airport's existing Noise Management Program.

One element of the current Action Plan is to review noise management programmes at other airports similar to Toronto Pearson, with the objective of identifying similarities and potential new programmes or initiatives for GTAA to pursue (this study). Any new programmes or initiatives should be viable within the existing regulatory and operational environment at Toronto Pearson, and aimed at mitigating the impacts of aircraft noise and/or enhancing community engagement.

The proposals for new programmes and initiatives will form the basis of the GTAA's next Five-Year Noise Management Action Plan (2018-2022).

1.5 Overview of approach

The study has researched 11 areas of noise management at 26 comparator airports worldwide (see Figure 1) using publicly available material. Using the information gathered and current/planned noise management activities at Toronto Pearson, potential new programmes and initiatives for GTAA to pursue have been proposed.

It is noted that an assessment of the financial costs and resources associated with any potential new programmes or initiatives was not in the scope of this study.

Airports researched (26 plus Toronto Pearson)		
• Toronto Pearson	• Atlanta (Hartsfield-Jackson)	• Copenhagen (Kastrup)
• Vancouver	• New York (JFK)	• Madrid Barajas
• Montreal	• London Heathrow	• Dubai International
• Ottawa	• London Gatwick	• Istanbul Ataturk
• Calgary	• Frankfurt	• Sydney
• Los Angeles (LAX)	• Amsterdam (Schiphol)	• Auckland
• San Francisco International	• Zurich	• Hong Kong
• Chicago O'Hare	• Paris (Charles de Gaulle)	• Shanghai Pudong
• Santa Ana (John Wayne)	• Brussels	• Singapore Changi
Eleven areas of noise management investigated		
• Quieter fleet initiatives	• Noise abatement procedures	• Independent noise ombudsman
• Runway schemes	• Fly Quiet programmes	
• Night flight restrictions	• Land use planning	• Community outreach
• Ground and gate operations	• Noise complaints	• Noise reporting and metrics

Figure 1: Airports and areas of noise management researched by the study

1.6   Contents of this report

This report is structured as follows:

- Section 2 summarises the methodology used in the study. The questions investigated by the research can be found in Annex A.

- Sections 3 to 13 document the practices at the 26 airports researched, current activities at Toronto Pearson and the potential new programmes or initiatives for GTAA to pursue in each of the 11 areas of noise management researched. This is supported by a more detailed write-up of the research, including case studies, in Annex C.

- The potential new programmes and initiatives proposed for GTAA to pursue are summarised in Section 14. A summary list of potential new programmes and initiatives can be found in Annex B.

2   Methodology

The approach used for the study is summarised in Figure 2 and the subsequent text.
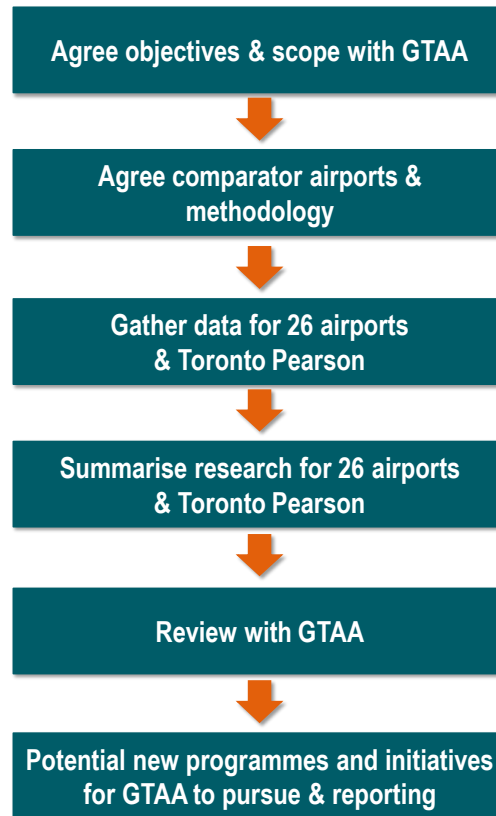
Figure 2: Overview of approach

- **Agree objective & scope with GTAA:** This task reconfirmed the objectives of the study, agreed upon 11 areas of noise management to be researched[2], and agreed that the research would be undertaken using publicly available information.

- **Agree comparator airports & methodology:** An initial list of 45 candidate airports was established comprising other major airports in Canada, global hubs and other large and medium size airports known for their good noise management practices. Each airport was reviewed against a simple set of criteria to ensure compatibility with Toronto Pearson (Table 1)[3], based upon which it was agreed with GTAA[4] to research 26 of these airports (Figure 3). Objectives were set for each of the 11 areas of noise management to be researched (Table 2). These objectives were then sub-divided into a small number of questions to be investigated for each airport (Annex A).

---

[2] The original terms of reference were to research 6 areas of noise management. This was extended to encompass all the noise management activities undertaken by GTAA.

[3] The terms of reference for the study were that comparator airports should be similar in operations, projected growth and urban environment to Toronto Pearson. It was subsequently agreed with GTAA to include the other main airports in Canada, and some airports with fewer annual aircraft movements than Toronto Pearson that were known to apply a broad range of noise management practices.

[4] The terms of reference for the study were that comparator airports should be jointly determined with GTAA.

Criteria	Comments
Canadian airports	To provide a national comparison, the other main airports in Canada were included.
Operations and aircraft movements	Airports were classified according to their annual number of Air Transport Movements (ATMs) - less than 250,000 ATMs per annum, 250,000-349,000 ATMs per annum and greater than 350,000 ATMs per annum. The purpose was to ensure that the research included airports with a comparable number of annual ATMs to Toronto Pearson. The rationale for this criteria was that (i) airports with less traffic/lower growth than Toronto Pearson may be able to apply more stringent noise restrictions and (ii) airports comparable in size to Toronto Pearson are more likely to have similar levels of resources/budget dedicated to noise management activities.
Urban environment	The location of each airport relative to population centres was investigated. Airports were grouped into those (i) located in the immediate vicinity of population centres, (ii) not located close to population centres, but population centres located under the flights paths and (iii) rural locations. Again, the intention was to ensure that the sample of airports researched included airports that, similar to Toronto, are located close to population centres.
Noise management practices	Similar studies in the public domain were reviewed to identify which airports had a wide range of noise management practices. This resulted in some airports that have fewer annual aircraft movements than Toronto Pearson, but a broad range of noise management practices, being included in the study.
Availability of public data	A review of the airports' websites was undertaken to determine if a suitable level of information was publicly available to support the study.

Table 1: Qualitative criteria for selecting airports
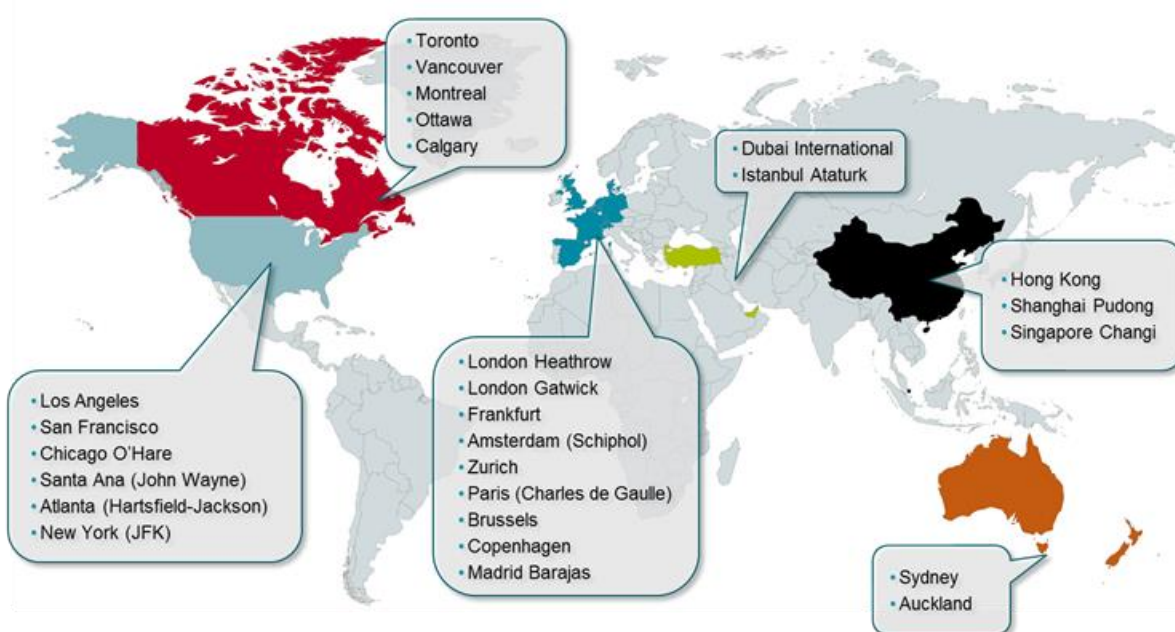
Figure 3: Airports researched during the study (26 plus Toronto)

Area	Objective
Quieter fleet initiatives	Identify incentive programmes used at other airports to encourage airlines to adopt/expedite the purchase of quieter fleets and/or pursue known airframe noise issues such as those that occur with some A320 family aircraft.
Night flight restrictions	Identify practices in night-time operating restrictions at other airports.
Runway schemes	Identify runway schemes that are used at other airports for the purpose of providing periods of respite/relief from aircraft noise.
Ground & gate operations	Identify practices in noise operating restrictions for aircraft on the ground/at the gate at other airports.
Noise abatement procedures	Identify noise abatement procedures applied at other airports for arriving and departing aircraft.
Fly Quiet programmes	Determine the benefits and impacts of a Fly Quiet programmes in place at other airports.
Land-use planning	Identify how other airports deal with pressures for residential developments in areas deemed 'incompatible' due to noise exposure.
Noise complaints	Review the noise complaints process/policy at other airports.
Community outreach	Identify the best practices, structures and processes of community engagement committees similar to CENAC.
Noise ombudsman	Explore the role of the independent noise ombudsman around the world.
Noise reporting and metrics	Identify best practices in noise metrics and reporting to reflect the current noise environment.

Table 2: Objectives for each area of noise management researched

- **Gather data for 26 airports & Toronto Pearson:** Data for the 26 airports was gathered from publicly available sources. These included noise pages on the airports' website, noise management programme brochures, annual noise reports, airport master plans, the noise abatement pages from the airports' aeronautical information publication (AIP), documents published on the websites of community noise forums and other recent research documents on noise programmes.

- **Summarise research for 26 airports:** The research across the 11 areas of noise management was summarised into a set of best practices. Where useful, this was complemented by short case studies and simple benchmarking.

- **Review with GTAA:** The findings of the research was reviewed with GTAA. This allowed for further information gathering on current practices at Toronto Pearson as well as understanding which noise management measures would provide benefit.

- **Identify potential programmes and initiatives for GTAA to pursue & reporting:** Based on the research, and current/planned noise management activities at Toronto Pearson, potential new programmes or initiatives for GTAA to pursue were proposed. Each potential new programme and initiative was supported by a rationale.

> **Identification of potential new programmes and initiatives for GTAA to pursue**
> The potential new programmes and initiatives presented in this report have primarily been developed on the basis of best practices in noise management at other comparator airports, the existing regulatory environment and operations at Toronto Pearson, and our best judgement as to which practices could provide a meaningful benefit to local communities and/or GTAA. An assessment of the financial costs and resources associated with any potential new programmes or initiatives was not in the scope of this study.

3 Quieter fleet initiatives

3.1 Introduction

Most of the airports researched have measures to encourage airlines to use the quietest aircraft types in their fleet and/or expedite the purchase of quieter fleets. These include restrictions on certain types of aircraft (typically at night), incentive schemes, voluntary arrangements and comparing fleets between airlines.

3.2 Summary of best practice research

A summary of the findings of the research is presented below. More detail, including case studies, is provided in Annex C.

- **Operating restrictions – restricting the operations of the noisiest aircraft types:** These involve restricting the operation of certain, often older/noisier, aircraft types, particularly at night. Such restrictions are typically based on some form of noise categorisation, for example, using the certified noise values on the aircraft operating certificate or ICAO Chapter number. Airports ban or tightly restrict the operation of ICAO Chapter 2[5] aircraft. In addition to this, some place night-time bans or restrictions on marginally compliant[6] Chapter 3 aircraft, Chapter 3 aircraft or aircraft above certain certified noise levels.

- **Financial mechanisms - noise based charging schemes:** All but one of the European airports researched incentivise quieter fleets by including a noise charge in the landing and/or take-off fee. These schemes group aircraft into charging bands based upon the certified noise levels found on an aircraft's noise certificate or its ICAO Chapter number. Lower noise charges are levied on aircraft in the 'quieter' charging bands to incentivise their use. In addition, noise charges are increased at night. For example, at London Heathrow, charges are increased by a factor of 2-2.5 at night for all aircraft. Similarly, at Amsterdam Schiphol, noise charges for the noisiest category of aircraft are more than doubled at night.

- **Financial mechanisms - financial incentives to operate quieter aircraft types:** Two airports were found to use financial incentives to encourage airlines to replace existing aircraft types with quieter ones. The scheme operated by Zurich airport incentivises airlines to use a quieter aircraft on one of its existing routes by reducing landing charges for up to 3 years. Amsterdam Schiphol incentivises cargo airlines to replace marginally compliant Chapter 3 dedicated freighter flights with a quieter freighter aircraft through a financial incentive per departure during the first year of operation.

- **A320 family retrofit schemes:** A relatively new initiative is addressing the 'whine' generated on approach by the Airbus A320 family of aircraft. The aircraft have small vents on each wing designed to help equalise the fuel pressure in the intra wing tanks. When air rushes past the vents, it creates a high pitched 'whine'. There is a simple modification (known as a vortex generator) which can resolve the issue and reduce

---

[5] The International Civil Aviation Organisation (ICAO) has a number of noise standards, these are referred to as Chapters. For subsonic jet and heavy propeller driven aircraft there are four Chapters – Chapter 2, Chapter 3, Chapter 4 and Chapter 14. The higher the Chapter number, the more stringent the noise standard (i.e. the Chapter 2 standard was adopted in 1972, and is much less stringent that the most recent standard, Chapter 14).

[6] Most aircraft meet the Chapter 3 noise standard by a certain noise margin. Marginally compliant Chapter 3 aircraft meet this Chapter 3 standard within a cumulative margin of not more than 5 decibels Effective Perceived Noise level (5EPNdB). EPNdB is a noise unit used for aircraft noise certification tests.

the noise generated by the aircraft by up to 4-9 decibels[7]. Six of the 26 airports researched have encouraged airlines to retrofit their aircraft with a vortex generator either through modified landing charges or voluntary agreements.

- **Fly Quiet Programs**: Heathrow and San Francisco have metrics in their Fly Quiet programmes that compare airline fleets against one another with quieter fleets scoring better.

3.3   Toronto Pearson today

Toronto Pearson does not allow the operation of Chapter 2 aircraft, or aircraft with no Chapter number, at night (see table below). Additionally, Chapter 3 or quieter aircraft operating at night on a scheduled or repetitive basis must obtain an exemption or extension:

- Exemptions are for aircraft scheduled to operate at night.

- Extensions are for aircraft scheduled within normal airport hours (0630-0029 local) and delayed on the day of operation due to weather, mechanical, security and ATC delays.

Aircraft (noise certification type)	Restricted hours (local time) - arrivals and departures	Type of restriction
No Chapter number assigned	2000-0800	No allowed to operate
Chapter 2 aircraft	0000-0700	No allowed to operate
Chapter 3 aircraft	0030-0630	Exemption or extension required to operate
All other Chapters	0030-0630	Exemption or extension required to operate

Table 3: Noise related operating restrictions at Toronto Pearson

3.4   Potential new programmes and initiatives for GTAA to pursue

Objective
Encourage airlines to use the quietest fleet possible for a given operation (e.g. long-haul, short-haul, regional) through a combination of voluntary initiatives, operating restrictions and, as appropriate, financial mechanisms.

Ref	Potential new programmes and initiatives
QF1	Investigate more stringent restrictions on the noisiest aircraft types at night.
QF2	Establish a programme to retrofit A320 family aircraft operating to/from Toronto Pearson with vortex generators.
QF3	Establish a programme to determine how financial mechanisms could be used to incentivise the use of the quietest aircraft types, should they be required in the future.

Table 4: Potential new programmes and initiatives for quieter fleets

---

[7] Source: www.a320whine.com.

The rationale for potential new programmes and initiatives is explained below:

- **Further restricting the operation of the noisiest aircraft types:** A number of the airports researched restrict the operation of Chapter 3 aircraft at night. The types of restrictions vary but broadly include marginally compliant Chapter 3 aircraft, Chapter 3 aircraft and aircraft above a certain certified noise levels. It is therefore proposed that, depending on the current fleet mix, GTAA determine the benefit/impact of applying similar practices at Toronto Pearson.

- **A320 retrofit:** In 2016, A319/A320/A321 aircraft accounted for approximately 18% of all flights at Toronto Pearson[8]. While to date only a small number of airports have encouraged airlines to retrofit A320 family aircraft with wake vortex generators, it is an activity that has recently gained traction as awareness of the issue and its ease of resolution have spread. Although there is a cost involved, retrofitting can be achieved in relatively short timescales, and there is a demonstrable noise benefit. As per other airports, this could be addressed through voluntary agreements with airlines or via financial mechanisms. Other North American airports have started to lead on this issue, and it is advisable for GTAA to do the same at Toronto Pearson.

- **Financial mechanisms:** Best practice in Europe is for airports to use financial mechanisms to incentivise airlines to use the quietest aircraft possible for a given type of operation (long-haul, short-haul and regional), primarily through the inclusion of a noise charge in the landing/take-off fee. The implementation of financial mechanisms, particularly noise based charging, could take considerable time and consultation with airlines. Therefore, at this stage, it is proposed that GTAA establish a programme to determine how financial mechanisms could be used to incentivise the use of the quietest aircraft types at Toronto Pearson, if required in the future.

The GTAA has an interest in pursuing a Fly Quiet programme. This is addressed in section 8.

---

[8] Source: GTAA

4 Night flight restrictions

4.1 Introduction

Many of the airports researched define a night period where a different and more stringent set of operating rules is applied compared to the day-time. Examples of night-time practices include operating restrictions, movement limits, noise quotas and noise surcharges. The intent of all restrictions is to reflect the need for a quieter airport operation during those hours where residents in affected local communities could be expected to be sleeping.

4.2 Summary of best practice research

A summary of the findings of the research is presented below. More detail, including case studies, is provided in Annex C.

Duration of the night period

Thirteen of the airports researched had a defined night period where a different and more stringent set of operating rules was applied compared to the day-time. Night periods were 6-9 hours in duration, typically starting at 2200 or 2300 and ending at 0600 or 0700 (see Figure 4 and Figure 5 below). Airports without a defined night period were primarily those in the Middle East and United States. In the United States, airports tend to have a set of voluntary measures in place at night rather than a defined night period with more stringent restrictions than the day-time[9].
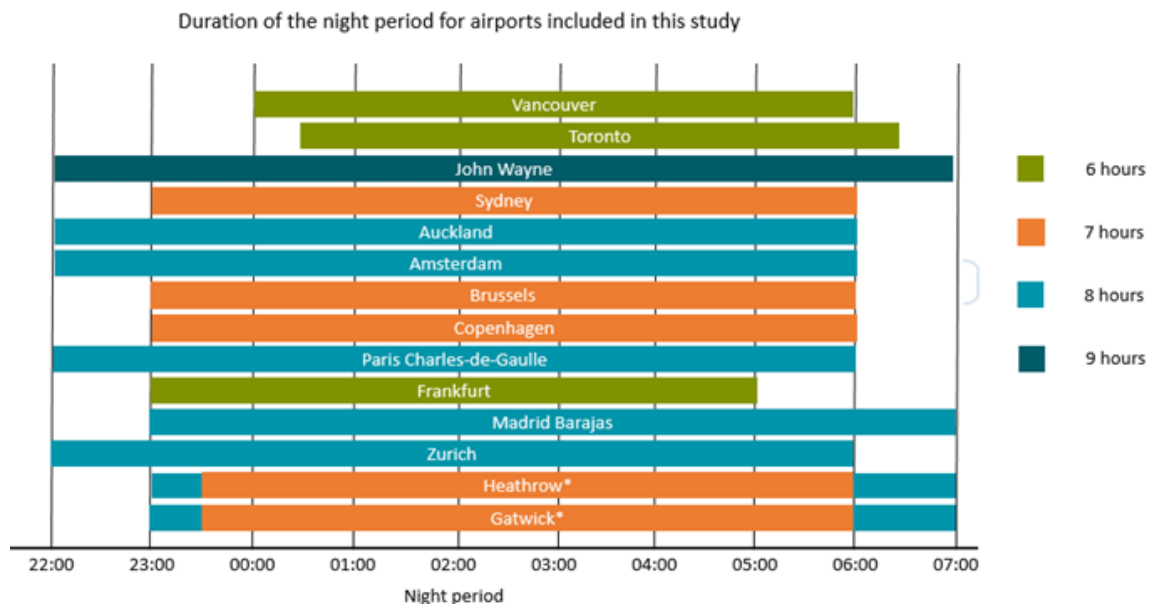
Figure 4: Duration and start/end times of night periods[10]

---

[9] For example, both Chicago and San Francisco have night-time measures in their voluntary Fly Quiet programmes. These typically start between 2200 and 0100, and end between 0600 and 0700.
[10] Heathrow and Gatwick have a night period from 2300-0700, within this period there is an operational ban on the noisiest aircraft types. There is also a night quota period from 2330-0600, within this period there are movement and night quota limits.
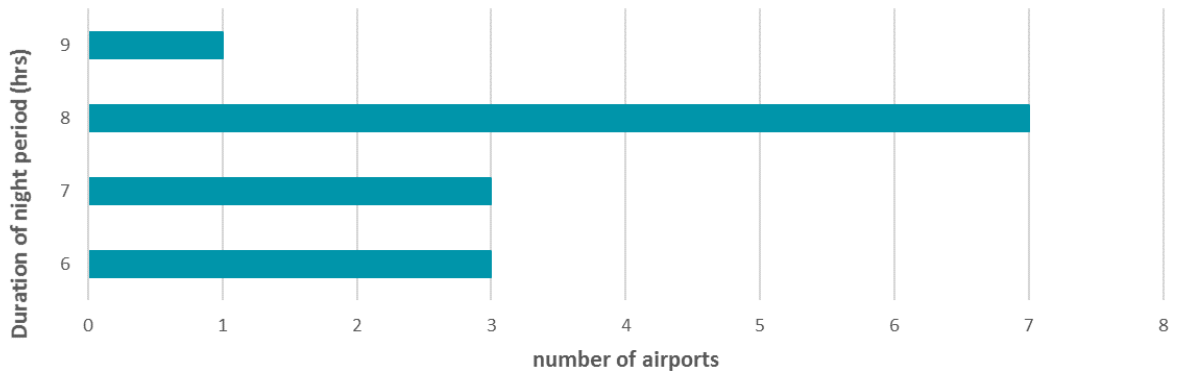
Figure 5: Durations of night periods (including Toronto Pearson)

Night-time practices

Examples of night-time practices identified by the research are summarised below:

- **Night-time operating restrictions:** Operating restrictions applied by airports at night include movement limits, curfews/night-flight bans, restrictions on the operation of certain (noisier) aircraft and runway used. Examples are given in the table below.

Night-time operating restrictions	Summary
Night-time movement limits	Similar to Toronto, four of the airports researched applied night-time movement limits. These limits are either applied annually or based upon scheduling seasons. These are set by legislation. Examples are shown in Figure 6.
Night curfews	Four of the airports researched had curfews. These ranged from restrictions on the number and type of movements that can take place during the curfew (Sydney) to a full curfew (Frankfurt). The Frankfurt curfew runs from 2300-0500, with an additional limit of 133 movements per night from 2100 to 2259.
Night-time restrictions on certain aircraft types	Airports ban or severely restrict Chapter 2 operations. In addition to this, some place night-time bans or restrictions on marginally compliant Chapter 3 aircraft, Chapter 3 aircraft or aircraft above certain certified noise levels.
Runway restrictions	Some airports also place restrictions on which runways can be used at night – see section 5.

Table 5: Night-time operating restrictions at researched airports
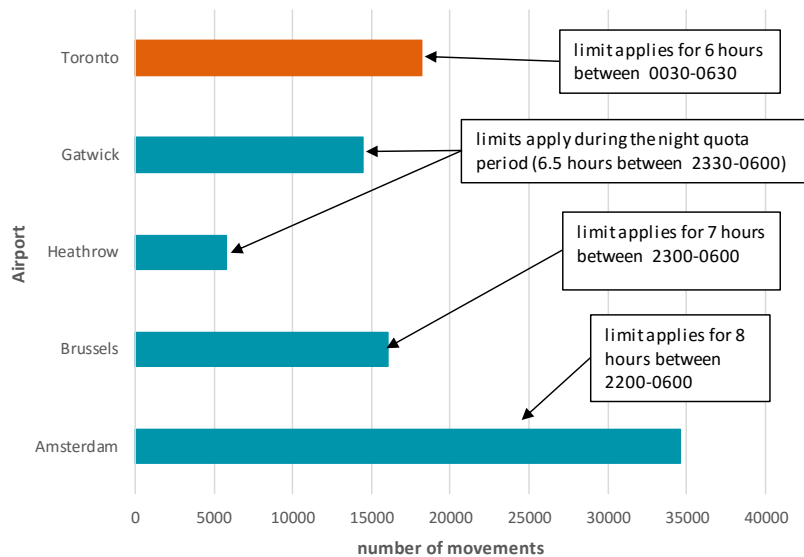
Figure 6: Example night-time movement limits[11]

- **Night quotas:** Brussels, Gatwick, Heathrow and Madrid operate night quotas (a pilot scheme is also in place at Hong Kong). In addition to movement limits, these schemes manage the overall amount of noise generated at night through a noise 'quota limit'. Airports are allocated a night-time quota limit (total quota count) which cannot be exceeded. Each night-time take-off and landing uses up part of this quota – the louder the aircraft, the more quota it uses (each aircraft is allocated a quota count depending on the amount of noise it produces - the louder the aircraft, the higher its quota count (see Table 6)). Rules are also defined as to how the quota is allocated to airlines, how much quota is held in reserve for aircraft operating late or early, and conditions under which the quota system should be temporally suspended (for example to help relieve major disruption).

Noise Classification (EPNdB)	Quota Count (QC)
More than 101.9	16
99 - 101.9	8
96 - 98.9	4
93 - 95.9	2
90 - 92.9	1
87 - 89.9	0.5
84 - 86.9	0.25
Less than 84	0 (Currently exempt)

Table 6: Quota Count points classifications used in the UK quota system

Aircraft are assigned separate Quota Count (QC) values for take-off and landing. and are derived from the certified noise levels found on an aircraft's operating certificate. In turn, these are influenced by engine type/model, maximum take-

---

[11] The movement limits for Heathrow and Gatwick are for the night quota period 2330-0600.

off/landing weight and engine/airframe modifications. Examples QC values are provided in Table 7.

Aircraft / engine type	QC(Departure)	QC(Arrival)
A320-232 / V2527-A5	0.5	0.25
777-300ER / GE90-115B	2	1
A330-343 / Trent 772B-60	2	0.5
B747-400 / CF6-80C2B1F	4	2

Table 7: Example QC points by aircraft type/engine fit

- **Night-time noise charges:** All 8 European airports that included a noise charge in their landing/take-off fees (see section 3) separated this into a day and night-time charge. The night-time charge is typically an additional percentage on top of the day-time charge. For example, at London Heathrow, charges are increased by a factor of 2-2.5 at night for all aircraft. Similarly, at Amsterdam Schiphol noise charges for the noisiest category of aircraft are more than doubled at night. Zurich operates a different scheme whereby charges increase hourly/half-hourly as the night period approaches/progresses.

Others related activities include:

- **Restrictions in the hours adjacent to the night period:** A small number of examples were found of airports applying additional restrictions in the hours adjacent to the night period. Often the rules/restrictions applied in these hours were less stringent than those applied during the night period (but more stringent than those in the day). Examples in these hours included gradual increases in night-time charges and restrictions on operating/scheduling the nosiest aircraft types.

- **Rules for managing aircraft operating late/early**: Some airports put aside a proportion of their night-time movement/quota limit to accommodate aircraft not scheduled in the night period that run late.

- **Penalties for non-conformance:** A number of airports applied penalties for non-conformance with night-time restrictions. These include severely increased landing charges or fines levied by the authorities.

4.3   Toronto Pearson today

Night flight budget

Toronto Pearson operates a night flight budget to cap the number of flights permitted between 0030 and 0629. The budget is set by Transport Canada regulations and updated annually in line with passenger growth in the previous year[12]. Toronto Pearson is the only airport in Canada to have such a budget system mandated by Transport Canada.

---

[12] For example, in a given year, if the budget was 10,000 night flights and the increase in the number of passengers in the previous year was 6%, the following year's night flight budget would be 10,600 night flights.

Night-time operations

The night period at Toronto Pearson is defined as 0030-0630 and accounts for approximately 3% of all flights. The following practices are applied during this period.

- **Night-time movement limits:** As mentioned above, Toronto Pearson has an annual night-flight budget of 18,204 take-offs and landings between 0030 and 0630 (i.e. an average of 50 per night). This is set by Transport Canada regulations, and the associated rules allow the budget to increase annually in line with passenger growth. In addition, in a year when the number of night flights reach more than 95 % of the budget, the following year's budget can be increased by an additional 10 per cent[13]. Approximately 80% of the budget is allocated to pre-scheduled flights, and the remaining 20% set aside for 'extensions' - aircraft scheduled within normal airport hours but running late and other operationally necessary flights. Medevac, military and police flights also count towards the night flight budget. The annual movement limit and actual night movements is shown in the table below.

Period	Night-flight budget	Actual night-time movements
Nov 2014 – Oct 2015	15,871	14,778
Nov 2015 – Oct 2016	16,923	14,889
Nov 2016 – Oct 2017	18,204	-[14]

Table 8: Toronto Pearson – night-flight budget

- **Night-time restrictions on certain aircraft types:** Toronto Pearson places noise related restrictions on different aircraft types (see table below). Additionally, Chapter 3 or quieter aircraft operating at night on a scheduled or repetitive basis must obtain an exemption or extension. Exemptions are for aircraft scheduled to operate at night. Extensions are for aircraft scheduled within normal airport hours (0630-0029 local) and delayed on the day of operation due to weather, mechanical, security and ATC delays.

Aircraft (noise certification type)	Restricted hours (local time) - arrivals and departures	Type of restriction
No Chapter number assigned	2000-0800	Not allowed to operate
Chapter 2 aircraft	0000-0700	Not allowed to operate
Chapter 3 aircraft	0030-0630	Exemption or extension required to operate
All other Chapters	0030-0630	Exemption or extension required to operate

Table 9: Noise related operating restrictions at Toronto Pearson

- **Night-time preferential runway scheme:** Toronto operates a night-time preferential runway scheme from midnight to 0630 (see section 5). An order of priority is published for runways used by arriving and departing aircraft. The scheme is currently under review as part of the GTAA/NAV CANADA Noise Mitigation Initiatives Engagement Plan.

---

[13] In 2016/2017, the budget was increased by an additional 3 percent.
[14] Figures not presented as the 2016/2017 budget runs to 31st October 2017.

- **Management of late running aircraft:** As per above, approximately 20% of the night-flight limit is set aside for 'extensions' - aircraft scheduled within normal airport hours, but running late for various reasons.

- **Penalties for non-conformance with restrictions:** There is a fine in place of up to 16 times the landing fee for violation of night-flight rules. Enforcement action may also be taken by Transport Canada. This could include an additional fine of up to CAD$5,000 for individuals and CAD$25,000 for corporations.

In addition, as part of its Noise Mitigation Initiatives Engagement Plan, NAV CANADA is investigating designing new arrival and departure procedures to reduce aircraft noise at night.

4.4   Potential new programmes and initiatives for GTAA to pursue

Objective
Extend the time over which night noise impacts are managed and ensure that the total amount of noise from aircraft at night does not increase.

Ref	Potential new programmes and initiatives
NF1	Extend the period during which night noise impacts on communities are managed.
NF2	Implement a programme to ensure that the total amount of noise from aircraft does not increase in the night-period/adjacent hours.

Table 10: Potential new programmes and initiatives for night flight restrictions

The rationale for potential new programmes and initiatives is explained below:

- **Extend the time over which night noise impacts on communities are managed:** One best practice is to have a defined night period where a more stringent set of operating rules is applied compared to the day-time. Compared to other airports with a defined night period, the night period at Toronto Pearson starts later, and with few exceptions, is shorter in duration. It is therefore proposed that the time over which night noise impacts on communities are managed be extended. Given that the current night-flight regime at Toronto Pearson is regulated by Transport Canada, in the first instance it is proposed that GTAA work with industry and community stakeholders to agree to a separate set of rules in the hours adjacent to the current night period.

- **Implement a programme to ensure that the total amount of noise from aircraft does not increase in the night-period/adjacent hours:** Another best practice is to manage night flights in terms of number of movements *and* overall aircraft noise. Toronto Pearson has an annual night-flight budget, albeit the practice of increasing night-flights in line with annual passenger growth is unique amongst other airports in this study with night-time movement limits. Assuming the continuation of this practice, it is proposed that GTAA implement a programme to ensure that the total amount of noise from aircraft at night does not increase. This could be managed through a night quota scheme similar to those at some European airports, and/or night-time noise contours.

5 Runway schemes

5.1 Introduction

Many of the airports researched have provisions to operate their runways in a way that enables aircraft to avoid noise-sensitive areas and/or share noise amongst communities at certain times of day.

5.2 Summary of best practice research

A summary of the findings of the research is presented below. More detail, including case studies, is provided in Annex C.

Runway schemes

Of the 26 airports researched, most operate some form of runway scheme for noise management purposes. Each is broadly intended to either provide some form of predictability to when communities will be overflown, focus aircraft on the least populated/unpopulated areas and/or share noise amongst those living under the flight paths.

Day-time and night-time runway schemes

Night-time schemes are more widely used as this is a more noise sensitive period of the day, and airports are able to operate their runways with more flexibility at night when traffic levels are lower.

Traffic levels will typically influence the start time of night-time runway schemes. Most commonly, night-time runway schemes are operated between 2300 and 0600 as shown in Figure 7 (note that the Toronto preferential runway scheme is also aimed at directing traffic over less populated areas). However, schemes were found to start operating as early as 2000 and end as late as 0900.
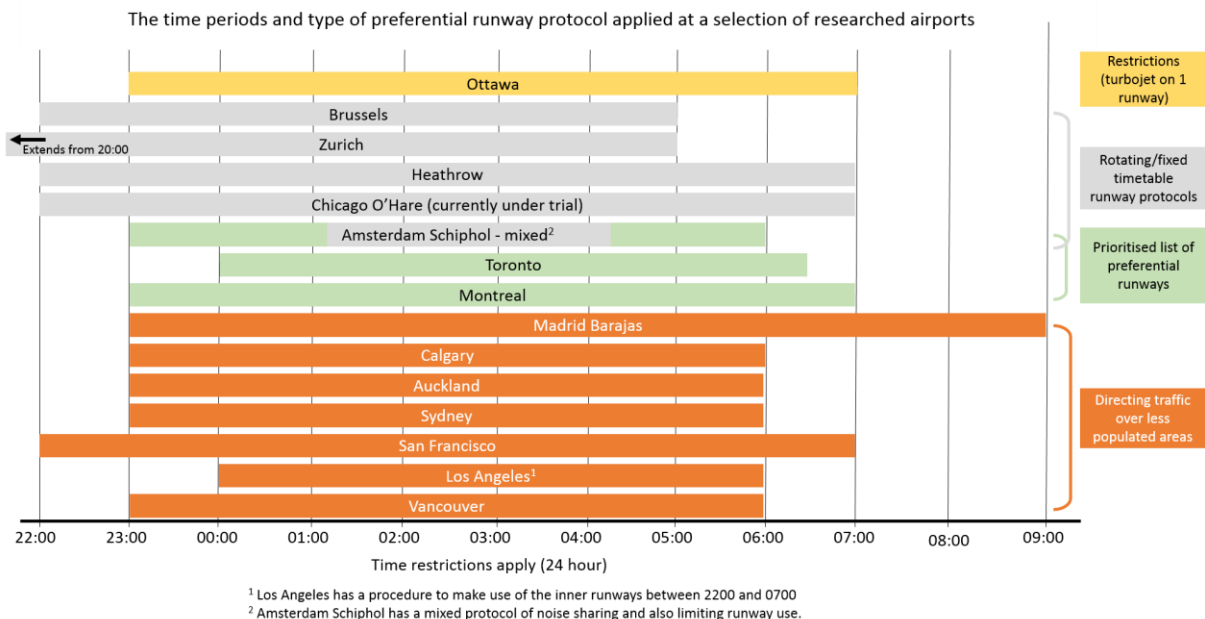
Figure 7: Time periods for selected night-time runway schemes

Types of runway schemes

The types of schemes operated vary considerably reflecting the influence of several local factors – geographical location, location relative to populations and the number/orientation of runways. Practices used for runway schemes are summarised below. In several cases combinations of these are used:

- **Prioritised list of preferential runways:** Many of the airports researched publish an order of priority for runway use. If conditions such as weather are satisfied, the first preference runway combination is used. If conditions are not satisfied, the second preference is used and so on.

- **Fixed timetable for runway usage (runway alternation):** A fixed timetable is implemented and lists, local conditions permitting, which runways are to be used during certain hours of the day. The timetable is aimed at providing those under the flights paths a degree of predictability of when they will be overflown by aircraft.

- **Rotating timetable for runway usage (runway alternation):** To ensure that those living under the flight paths were not overflown at the same time every day, some airports applied a timetable for runway use that rotated, typically on a weekly basis. This type of practice is particularly applicable to the night-time.

- **Directing traffic over the least populated areas:** These schemes are intended to direct aircraft over the least populated or unpopulated areas. This practice is particularly common at airports with a coastal location where as many aircraft as possible are directed over the sea. At night, when traffic levels were lower, this included having aircraft both arriving and departing over the sea (i.e. landing and departing in opposite directions) when weather conditions permitted.

- **Use of runways furthest from populated areas:** Some airports with multiple runways aim to only operate those runways furthest from populations during the night. A day-time example was also found at Los Angeles (LAX) which has four parallel runways. During the day-time, where practicable, arriving aircraft land on the outer runways (closest to populations) and the (noisier) departures take-off from the inner runways (furthest from populations).

- **Long-term noise sharing:** This approach aims to achieve some form of equitable sharing of noise over an extended period of time. The main example of this is Sydney airport which sets targets for the proportion of aircraft arriving/departing from/to the north, east, south and west of the airport.

Conformance with runway schemes

Research identified that it is very difficult to provide 100 percent conformance with any runway scheme. For example, the level of conformance at Heathrow is approximately 90%-95%, while the level of conformance for a recent 25-week night-time runway trial at Chicago O'Hare was 67%. There are several reasons for this, not all of which are under the control of the airport (see Table 11). For this reason, several airports state that they will apply their schemes voluntarily or 'where possible'.

Influence	Comment
Weather	This includes wind direction/speed and nearby storms which preclude the use of a preferred runway.
Traffic demand	At airports with multiple runways, preferred runway schemes involving only single runway operation can only be operated during low traffic demand.
Pilot preferences (safety)	Pilots will sometimes request a certain runway on safety grounds, for example the longest runway at the airport
Emergencies (safety)	Use of a 'non-preferred' runway in the case of emergencies.
Runway inspections & maintenance (safety)	The need use another runway while the preferred runway is being maintained or inspected.

Table 11: Examples of factors influencing conformance with runway schemes

Reporting on runway schemes

Of the 26 airports researched, 8 provided public reports on the usage of runways. The method and frequency of reporting varied from monthly, quarterly and annual written reports to a daily online report. No clear trends were spotted in the frequency of reporting periods; however, all of the reports provided graphics showing the percentage use of one particular runway direction over the reporting period.

5.3   Toronto Pearson today

Toronto Pearson operates a night-time preferential runway protocol between 0000 and 0630 local. Air Traffic control will select a runway from the following list, taking into account operational conditions (wind, weather) and safety:

	Arrivals	Departures
1st preference	05	23
2nd preference	15L	33R
3rd preference	06L	24R

Table 12: Night-time runway preferences at Toronto Pearson

As part of its Noise Mitigation Initiatives Engagement Plan, the GTAA and NAV CANADA are undertaking the following activities:

- **Reviewing the existing night-time preferential runway scheme:** Reviewing the current night-time preferential runway system to recommend a scheme that flies over the fewest residents possible.

- **Summer weekend runway alternation:** This is investigating the feasibility of alternating runways at weekends during the summer to provide periods of respite from noise for communities impacted by these operations.

5.4   Potential new programmes and initiatives for GTAA to pursue

Objective

Continue to investigate opportunities to use the runways at Toronto Pearson to equitably share, or provide relief from, aircraft noise.

Ref	Potential new programmes and initiatives
PR1	Continue to investigate night-time preferential runway schemes and summer time weekend runway alternation schemes aimed at sharing noise.
PR2	Identify opportunities to use the runways to provide relief from aircraft noise during off-peak periods on weekdays.
PR3	For current (and any future) runway schemes operated at Toronto Pearson, define expected levels of conformance, and implement a mechanism for regularly reporting adherence/reasons for non-adherence.

Table 13: Potential new programmes and initiatives for runway schemes

The rationale for potential new programmes and initiatives is explained below:

- **Night-time preferential runway schemes and summer time weekend runway alternation schemes:** Many of the airports researched have a preferential runway scheme aimed at either providing some form of predictability to when communities will be overflown, focusing aircraft on the least populated/unpopulated areas and/or share noise amongst those living under the flight paths. GTAA and NAV CANADA should continue to explore opportunities for night-time preferential runway schemes and summer time weekend runway alternation schemes. If these activities demonstrate the ability to deliver an equitable share of noise, receive sufficient support from the community, demonstrate that a suitable level of conformance can be achieved (see proposal PR3) and successfully pass through a public consultation, they should be implemented.

- **Weekday runway schemes:** A number of the airports researched also have a day-time runway scheme. If a new night-time preferential runway scheme and summer time weekend runway alternation is implemented at Toronto Pearson, opportunities to use the runways to provide noise relief during off-peak periods during the day-time on weekdays is proposed.

- **Expected levels of adherence and reporting:** Research identified that it is very difficult to provide 100 percent conformance with any runway scheme. It is therefore important that, for any current and future schemes at Toronto Pearson, GTAA set community expectations by identifying expected levels of conformance. Achievement against these and reasons for non-conformance, should be reported regularly. It is also recommended that GTAA notify communities in advance when adherence is not expected to be achieved (e.g. due to runway maintenance or forecast weather conditions).

6 Ground and gate operations

6.1 Introduction

This area of research investigated activities on the airport surface (taxiways/aircraft parking positions etc.) intended to reduce the impact of ground noise on the local area. The work in this area primarily investigated restrictions associated with engine ground runs (e.g. engine testing) and the use of the aircraft Auxiliary Power Unit (APU) when an aircraft is parked at the stand.

6.2 Summary of best practice research

A summary of the findings of the research is presented below. More detail, including case studies, is provided in Annex C.

Engine ground runs (engine testing)

Engine testing, or ground running, is often required following the completion of certain maintenance tasks on the aircraft. Fifteen of the 26 airports researched applied restrictions on engine ground runs/testing. In addition to restrictions, 6 airports applied additional measures including ground run monitoring systems and the use of ground run-up pens.

- **Night-time restrictions:** Typically, the restrictions applied by airports limited engine testing during the night. The night-time period for ground runs was defined anywhere between 2100 and 0700, with the most common definition being between 2300 and 0700 (see Figure 8).

- **Location of ground runs:** Airports also specify the locations at which ground runs above idle power can take place. This often precludes areas close to residential areas.

- **Monitoring systems:** A small number of airports have systems installed to manage, track, approve or decline ground runs. These systems can also be used to track compliance, record the noise generated by the ground run and report on the number of engine tests. Both Los Angeles and San Francisco have installed such systems.

- **Ground running pens:** Dedicated ground run pens work by either diverting or reducing the ground noise from engine ground runs. These have been shown to reduce ground noise due to engine testing by the order of 50%. Both Vancouver and Chicago O'Hare have installed dedicated ground run up pens.

- **Ground noise limits:** Frankfurt and Auckland airports apply noise limits to ground runs. These are measured by noise monitors located in/close to nearby residential areas.

- **Limits on the number of ground runs:** As part of a local planning agreement, Gatwick is limited to a maximum of 250 ground runs in a rolling 6-month period.
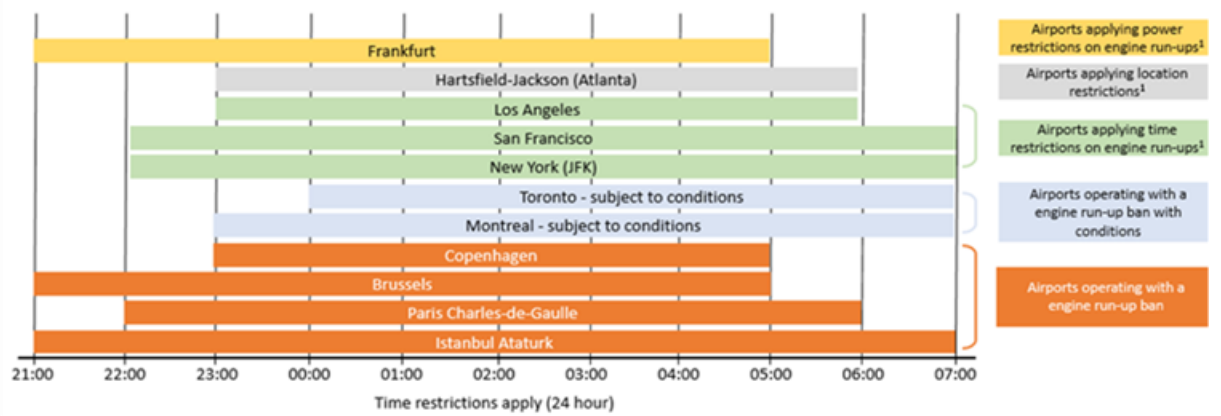
Figure 8: Durations of night-time engine ground run restrictions

APU restrictions

An Auxiliary Power Unit (APU) is a small jet engine that allows an aircraft to operate autonomously without reliance on ground support equipment.

Twelve of the 26 airports researched restricted the time an APU could be used when an aircraft was parked at the stand. For example, both Heathrow and Gatwick request shutdown of the APU within 10 minutes of arrival on stand and do not allow its activation until 15 minutes prior to departure for narrow body aircraft and 50 minutes for wide body aircraft. Extensions to these times are allowed in specific conditions such as when temperatures reach high or low extremes to manage passenger comfort. For example, at Copenhagen extensions are allowed when the outside air temperature is below –10°C or above +25°C.

6.3   Toronto Pearson today

Ground run restrictions are Toronto Pearson are as follows:

- **Location of ground runs:** All engine testing above idle power takes place in approved power run up areas that have been chosen to be as far away as possible from neighbouring residential communities. All engine testing above idle power must also be pre-approved by GTAA.

- **Night-time restrictions for ground runs:** Between the hours of 0000 to 0700 engine power run ups are prohibited unless authorised by GTAA. In the period of 0000 to 0629, power run ups will only be approved if the aircraft is certified to ICAO Chapter 3 or higher and is scheduled to depart prior to 1200 the following day. Multiple runs may be requested, but each individual run must not exceed a maximum of 15 minutes.

Toronto Pearson has no specific APU restrictions.

6.4   Potential new programmes and initiatives for GTAA to pursue

Objective

Align ground run and APU procedures at Toronto Pearson with typical practices applied at other airports.

Ref	Potential new programmes and initiatives
GG1	Apply the night-time restrictions for ground running earlier and monitor compliance.
GG2	Implement APU restrictions on stands equipped with GPU/PCA.

Table 14: Potential new programmes and initiatives for ground and gate operations

It is understood that there are currently limited complaints about ground noise. Therefore, the above are intended to align Toronto Pearson with typical practices at other airports without being too onerous. The rationale for the initiatives are as follows:

- **Night-time restrictions for ground running:** Like Toronto Pearson, several of the airports researched apply night-time ground run restrictions. These typically start at 2300 or earlier, hence the proposal for Toronto Pearson's night-time restrictions for ground runs to starts earlier. It is also proposed that GTAA monitor compliance with its current ground run restrictions. This could take the form of ad-hoc monitoring rather than the implementation of the type of ground run monitoring system used at Los Angeles and San Francisco.

- **APU restrictions:** Best practice at a number of the airports researched is to limit the use of APUs when the aircraft is parked at a stand equipped with GPU/PCA. This is typically prescribed in terms of the number of minutes after arrival/before departure that the APU should be shut down/started. Separate limits are also applied for extreme temperatures.

7 Noise Abatement Procedures

7.1 Introduction

This area of research investigated the use of noise abatement procedures to manage noise generated from aircraft during the approach and departure phases of flight. The research also investigated practices in the management and communication of trials.

7.2 Summary of best practice research

A summary of the findings of the research is presented below. More detail, including case studies, is provided in Annex C.

Arriving aircraft

Twenty-two of the 26 airports researched were found to have at least one noise abatement procedure to manage the noise from arriving aircraft. The most common procedures were Continuous Descent Approaches (CDA) and the application of altitude limitations during the approach phase of flight to keep aircraft high over populated areas.
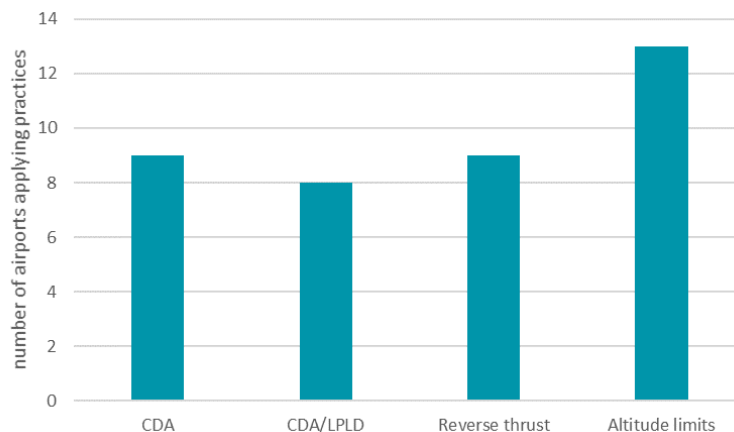
Figure 9: Summary of the procedures and practices used to manage the noise generated from arriving aircraft

The following noise abatement procedures were identified for arriving aircraft:

- **Continuous Descent Approach (CDA):** Conventional approaches to an airport involve a 'stepped approach' with periods of level flight (see Figure 10). A CDA aims to reduce the amount of time an aircraft remains in level flight during the approach phase, thereby reducing noise. Work by the UK CAA shows CDAs to provide noise reductions of up to 2.5 to 5 dB, varying over distances from touchdown of 10 to 25nm[15]. The benefits come from the aircraft being higher than a stepped approach at a given point and the need for comparatively less engine thrust. A comparison between a conventional approach and a CDA is shown in Figure 10.

---

[15] CAA Paper 1165, Managing Aviation Noise, UK Civil Aviation Authority, 2014.
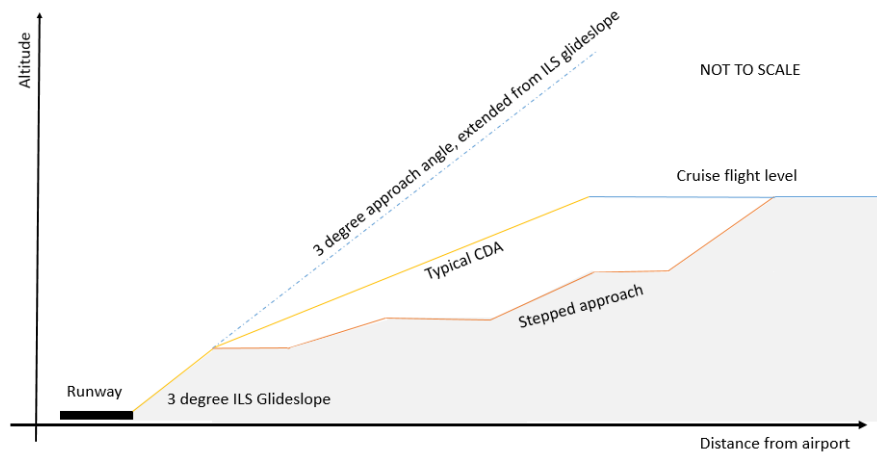
Figure 10: Typical stepped approach vs a typical CDA

In practice, it is currently difficult to enable CDAs to be flown without any level flight in the busy traffic environment experienced at international airports. For this reason, of the nine airports found to be operating CDA procedures, only four operated CDAs throughout the day, albeit allowing some periods of level flight to obtain some noise benefit[16]. The remainder only operated CDAs at night or in other periods of low traffic.

- **Low Power Low Drag (LPLD):** The lowering of flaps and the undercarriage before landing disturbs the airflow around the aircraft and creates noise. Low Power Low Drag procedures are intended to safely delay the extension of flaps and undercarriage. The practice can deliver reduction of between 3 to 5dB[17]. Eight airports, mainly in Europe, mentioned the use of LPLD or a similar configuration on approach, this was typically specified in conjunction with CDA in the AIP.

- **Restricting reverse thrust on landing:** Nine airports applied voluntary restrictions on the use of reverse thrust on landing unless it was required for safety reasons. The majority of these restrictions were applied during the night.

- **Steeper approaches:** An aircraft making a final approach to an airport will typically follow a 3-degree descent path. Both Heathrow and Frankfurt have recently trialled steeper approaches of 3.2 degrees. The slight increase in approach angle causes an aircraft to be 215 feet higher at 10 nautical miles from the airport. The trial at Heathrow showed steeper approaches provided a small noise improvement of between 0.5 and 1.4dBA SEL.

- **Voluntary industry code of practice:** In the UK, the Department for Transport, Civil Aviation Authority, airports, airlines, the air navigation service provider developed an industry code of practice for noise from arriving aircraft. The document defines options to reduce approach noise, including the implementation of CDA and LPLD procedures, and provides guidance to air traffic control, flight crews and airports on

---

[16] The UK definition of a CDA (covering Gatwick and Heathrow), as listed in the AIP, involves a continuous descent with no level segments longer than 2.5 nautical miles. A level segment defined as no more than a 50ft height change over 2 nautical miles. Similarly, at Amsterdam Schiphol a flight path is considered continuously descending when there is no level segment. A segment is considered level if the altitude loss is less than 50 ft over a distance of 2.5 NM.
[17] CAA Paper 1165, Managing Aviation Noise, UK Civil Aviation Authority, 2014.

how to deliver improvements. The document was widely circulated within the industry and is publicly available[18].

- **Altitude limits:** Thirteen airports made use of minimum altitude restrictions over certain areas such as cities, or applied minimum ILS joining point altitudes. In all situations, the restrictions aimed to keep aircraft higher for longer in order to reduce noise. For example:

Airport	Examples of height restrictions
Heathrow	Heathrow airport applies restrictions on the height at which aircraft can join the ILS and does not permit joining below 2500ft in the day (0600 to 2330 local) and 3000ft or 10 nautical miles in the night
Auckland	Auckland airport applies a minimum altitude of 5,000ft over the high-density parts of the city.
Los Angeles (LAX)	LAX applies a minimum altitude of 2,000ft for helicopters over the city and restricts helicopter flights in the overnight period.

Table 15: Examples of height restrictions at selected airports

Departing aircraft

Twenty three of the 26 airports researched were found to apply noise abatement procedures to manage the noise from departing aircraft. The most commonly used procedures were Noise Abatement Departure Procedures 1 and 2 (NADP1/NADP2), or an equivalent.
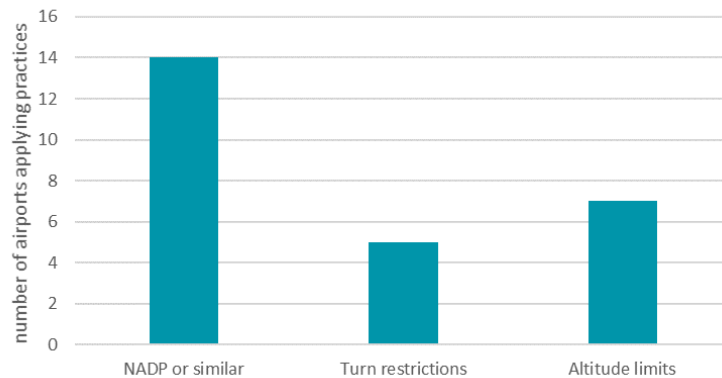
Figure 11: Summary of the procedures and practices used to manage the noise generated from departing aircraft

The following noise abatement procedures were identified for departing aircraft:

- **Noise Abatement Departure Procedures 1 and 2 (NADP1/NADP2):** NADP1 and NADP2 are guidance on departure procedures published by the International Civil Aviation Organisation (ICAO)[19]. The procedures are outlined below and shown graphically in the following figure:

---

[18] Arrivals code of practice: http://www.sustainableaviation.co.uk/wp-content/uploads/2015/09/Noise-from-Arriving-Aircraft-%E2%80%93-An-Industry-Code-of-Practice1.pdf
[19] ICAO Doc 8168 PANS-OPS Part 1, Chapter 3 Annex

— **NADP1** is intended to provide noise reduction for noise-sensitive areas near the airport (but provides more for areas more distant from the airport than NADP2).

— **NADP2** provides noise reduction to areas more distant from the airport (but provides more for areas near the airport than NADP1).
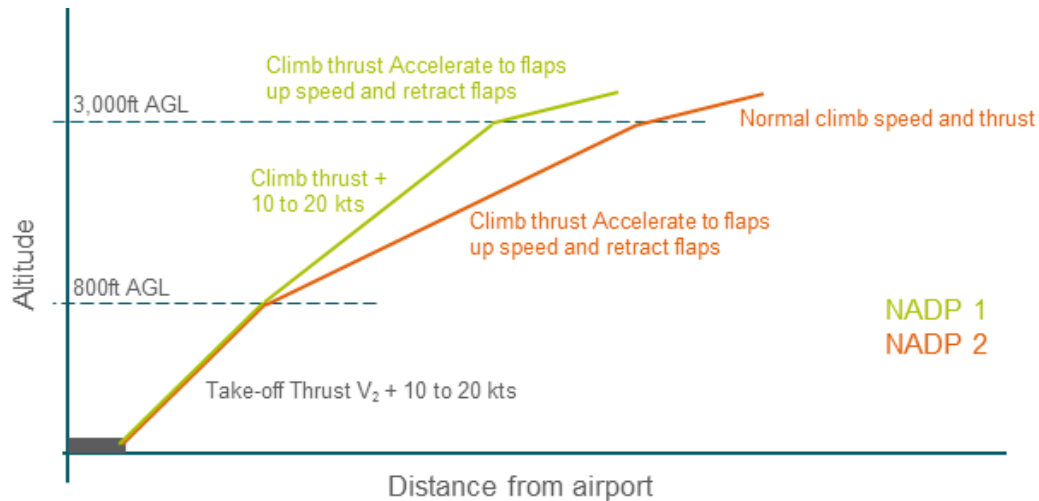
Figure 12: Comparison between NADP1 and NADP2.

Fourteen of the airports researched either prescribed the use of NADP or a similar procedure such as the equivalent FAA Advisory Circular. Of the fourteen airports, only Amsterdam Schiphol recommended the use of a single procedure (NADP2) but permitted the use of NADP1 if it was not possible to comply with NADP2. All other airports were non-prescriptive and simply required the use of NADP1, 2 or the procedure listed within FAA AC91-53A[20].

- **Departure routes - altitude restrictions:** Seven airports applied guidelines to ensure that departing aircraft did not exit their Standard Instrument Departure (SID) route before a specified altitude, which was typically around 3,000ft. This aimed to limit the noise exposure of departing aircraft to a specific area.

- **Departure routes - early turns:** Eight airports made reference to allowing aircraft to make 'early turns' after take-off. These were used to either allow slower aircraft, such as propeller driven aircraft to exit the main departure flow, or to manage departure noise, by turning aircraft off the extended runway centreline before overflying residential areas. Conversely five airports restricted early turns before a specific altitude or the end of the Standard Instrument Departure (SID). Again, this was intended to limit the noise exposure of departing aircraft to a specific area.

- **Continuous Climb Operations (CCO):** Continuous Climb Operations (CCO) is a procedure used to allow an aircraft to climb from take-off to cruise with no level segments. Environmental benefits are achieved through reduced fuel burn and potential aircraft noise mitigation through thrust and height optimisation. Research has shown that the air navigation service providers (ANSPs) in the UK and Denmark facilitate CCO. Trials have been undertaken at Paris Charles de Gaulle and Frankfurt are currently developing CCO procedures with the German ANSP, DFS.

---

[20] FAA Advisory Circular 91-53A Noise Abatement Departure Profile

- **Voluntary industry code of practice:** Similar to the arrivals code of practice in the UK, industry partners have developed a code of practice for departing aircraft[21]. The document defines options to reduce departure noise through the implementation of systems to reduce APU usage, implement reduced engine taxi and Continuous Climb Operations. Again, the document provides guidance to air traffic control, flight crews and airports on how to deliver improvements.

- **Departure noise restrictions:** Four of the airports researched used noise monitors and their noise and track keeping system to measure the noise generated by aircraft and applied financial penalties if the limits were breached.

Trials

Published practices on how airports engaged communities prior to, during and after airspace trials were investigated. Of the airports researched, only a few provided information on trials. This typically took the form of:

- **Information on trials:** Publishing information on upcoming trials and post-trial assessments on the noise pages of the airport's website.

- **Trial websites:** A dedicated website providing information on any ongoing trials and summary reports from completed trials.

- **Communication:** Sydney was found to have proactive community engagement initiatives as part of infrastructure works and airspace trials/consultation processes. This included the distribution of material to over 100,000 residences, community sessions and door to door visits.

7.3 Toronto Pearson today

Noise abatement procedures for arriving aircraft

Pilots are requested to minimise the use of reverse thrust. All approaches should remain at or above 3,000 feet (above sea level) until intercepting the extended runway centreline for final approach. While on final approach, arriving aircraft should remain on or above the 3 degree glideslope.

The GTAA/NAV CANADA Noise Mitigation Initiatives Engagement Plan includes (i) designing new approaches for use during designated night-time operations, and (ii) studying the potential to use new technology to reduce the need for low altitude levelling by arriving aircraft. Also, as part of this plan NAV CANADA is due to study if increasing published speeds on the 'downwind' leg of the approach may provide noise benefits in some parts of Toronto by negating the need for some large aircraft to deploy their flaps as early.

Noise abatement procedures for departing aircraft

Noise Abatement Departure Procedures 1 or 2 (NADP1 or NADP2) are required to be used for departing aircraft on all runways. Departing aircraft are expected to follow their departing routes until reaching 3,600 feet (above sea level). Early turns are only permitted for small/regional jets.

---

[21] Departures code of practice: http://www.sustainableaviation.co.uk/wp-content/uploads/2015/09/Departures-Code-of-Practice-June-2012.pdf

The GTAA/NAV CANADA Noise Mitigation Initiatives Engagement Plan will investigate if, during designated night-time periods, increasing the altitude achieved before aircraft turns are permitted may deliver noise benefits for those under the departure flight path.

Trial updates

Updates on ongoing trials are given at the GTAA community forum, CENAC, through a standing agenda item (noise statistics updates).

7.4 Potential new programmes and initiatives for GTAA to pursue

Objective
Reduce the noise generated by arriving and departing aircraft.

Ref	Potential new programmes and initiatives
NAP1	Establish an industry group to be the focal point for the operational and policy aspects of the programmes and initiatives proposed in this report.
NAP2	Investigate options for additional low power/low noise procedures such as Continuous Descent Approaches, Low Power Low Drag operations and a voluntary night-time ban on the use of reverse thrust.
NAP3	Investigate if Noise Abatement Departure Procedure 2 (NADP2) provides greater noise benefits to residential communities than NADP1.
NAP4	With other industry partners develop a voluntary industry code of practice for noise abatement procedures at Toronto Pearson.
NAP5	Develop a standard methodology for future trials influencing the noise environment around Toronto Pearson.

Table 16: Potential new programmes and initiatives for noise abatement procedures

The rationale for potential new programmes and initiatives is explained below:

- **Establishing an industry body on noise procedures and policy at Toronto Pearson:** Several initiatives and programmes have been proposed that will require interactions between GTAA, NAV CANADA, Toronto-based airlines and Transport Canada (both in this section and others). Rather than undertaking each action in isolation, it is proposed that a single industry body is formed to act as a focal point for the operational, policy and best practice aspects of the programmes and initiatives identified in this report. This should include nominating one person from each organisation to be responsible for oversight of noise related activities at Toronto Pearson.

- **Noise abatement procedures for arriving aircraft:** The review of best practice has identified some arrival noise abatement procedures with a proven noise benefit that could be investigated further by Toronto Pearson:

  - **Reverse thrust on landing:** Over a third of airports researched had some form of restriction on reverse thrust on landing, mainly at night. This could be achieved relatively quickly through a voluntary agreement with airlines.

  - **Low Power Low Drag (LPLD):** The point on the approach path when aircraft exit LPLD is typically governed by an airline's Standard Operating Procedures (SOPs). Therefore, investigating LPLD operations (both SOPs and adherence)

followed by the development of some best practices for Toronto Pearson could provide another small noise benefit.

— **Continuous Descent Approaches (CDAs):** CDAs are another procedure with a proven noise benefit and used in some form by seventeen of the twenty-six airports researched (noting that the CDAs at these airports typically involve segments of level flight). Based on this, it is proposed that options for implementing CDAs at Toronto Pearson are investigated. This activity is envisaged to take time to implement and will most likely need to be undertaken as a phased activity – for example initially implemented during the night when traffic levels are lower.

- **Departure noise abatement procedures:** Given the amount of land dedicated to industrial use around Toronto Pearson (Figure 13), there could be some merits in investigating if Noise Abatement Departure Procedure 2 (NADP2) provides greater noise benefits to residential communities than NADP1[22].

Figure 13: Industrial areas (pink) in the vicinity of Toronto Pearson

- **Voluntary industry code of practice:** To maximise the benefit of the various noise related procedures, it is proposed that a voluntary industry code of practice like the documents produced in the UK, is published by the main industry partners. The aim of the code of practice would be to promote, align and spread best practice amongst the main industry partners.

- **Standard methodology for future noise related trials:** Several of the programmes and initiatives identified by this report could result in trials that will influence the noise environment near Toronto Pearson. The development of a standard methodology for trials is proposed to ensure the value of each trial is maximised, the possibility of

---

[22] NADP1 and NADP2 are guidance on departure procedures published by the International Civil Aviation Organisation (ICAO). NADP1 is intended to provide noise reduction for noise-sensitive areas in close proximity to the airport (but provides more for areas more distant from the airport than NADP2). NADP2 provides noise reduction to areas more distant from the airport (but provides more for areas in close proximity to the airport than NADP1).

unintended consequences is reduced, all stakeholders are aware of the objectives and the benefits are clearly evaluated. Any methodology would not necessarily need to be substantive, but should include items such as pre-trial objectives, pre-trial evaluations, pre-trial notification to communities, pre-trial input from communities, updates during the trial, post-trial assessment and reporting, and a repository for all relevant trial material.

8 Fly Quiet programmes

8.1 Introduction

This area of research investigated 'Fly Quiet' programmes. A 'Fly Quiet programme is a **voluntary** initiative designed to encourage airlines to adopt newer (quieter) aircraft or fly existing aircraft in a manner which minimises their noise impact on the communities surrounding the airport. Typically, Fly Quiet programmes include combinations of the following:

- A set of metrics used to measure noise performance.

- Comparison of performance between different airlines.

- Public reporting of results.

- Public recognition of the best performing/most improved airlines.

8.2 Summary of best practice research

A summary of the research is presented below. More detail, including case studies, is provided in Annex C.

Existence of Fly Quiet programmes

Four of the 26 airports researched had a Fly Quiet programme. These are summarised below:

- **Vancouver:** The Vancouver Fly Quiet programme has two measures – adherence to published noise abatement procedures (NAPs) and measured noise levels. Each year the airline with no suspected violations of NAPs and the lowest average annual noise level for their aircraft category (propeller aircraft, narrow body jet aircraft and wide body jet aircraft), is publicly recognised at an awards ceremony.

- **Heathrow:** Heathrow compares the performance of 50 airlines against six metrics to further encourage airlines to use quieter aircraft and to fly them in the quietest way possible. The six metrics score the fleet operated by the airline to/from Heathrow, achievement against noise abatement procedures and compliance with night-time arrangements for arriving aircraft. Airlines are ranked in a quarterly league table according to their overall score across the six metrics.

- **San Francisco:** The San Francisco Fly Quiet programme was initiated by the community forum and aims to encourage airlines to operate as quietly as possible in the San Francisco Bay area. Similar to Heathrow, airlines are ranked in a quarterly league table according to their overall score across six metrics. The six metrics score the fleet operated by the airline to/from San Francisco, measured noise levels, night-time runway use and adherence/performance against three specific local noise abatement procedures. The programme also has annual awards to recognise the quietest overall airline, most improved airline and exceptional commitment to the programme.

- **Chicago O'Hare:** The Chicago O'Hare Fly Quiet programme focusses on night-time operations. The metrics measured are night-time runway use, deviation from planned night-time flight tracks, night-time complaints, night-time noise measurements and (all day) ground runs.

Fly Quiet metrics

The metrics used in Fly Quiet programmes depend on factors such as ease of measurement, importance to local communities and the airport's noise abatement procedures (NAPs). Some metrics measure noise directly using noise monitors, while others are 'proxy' metrics that give a strong indication of whether the aircraft is being flown in the quietest way possible. Metrics used in Fly Quiet programmes can be categorised as follows:

- **Strategic metrics:** These metrics measure how quiet an airline's fleet is (e.g. Chapter number certification).

- **Operational metrics:** These include measurements of actual aircraft noise and adherence to NAPs.

- **Night-time metrics:** Adherence with restrictions on aircraft operations at night (e.g. night-time flight tracks)
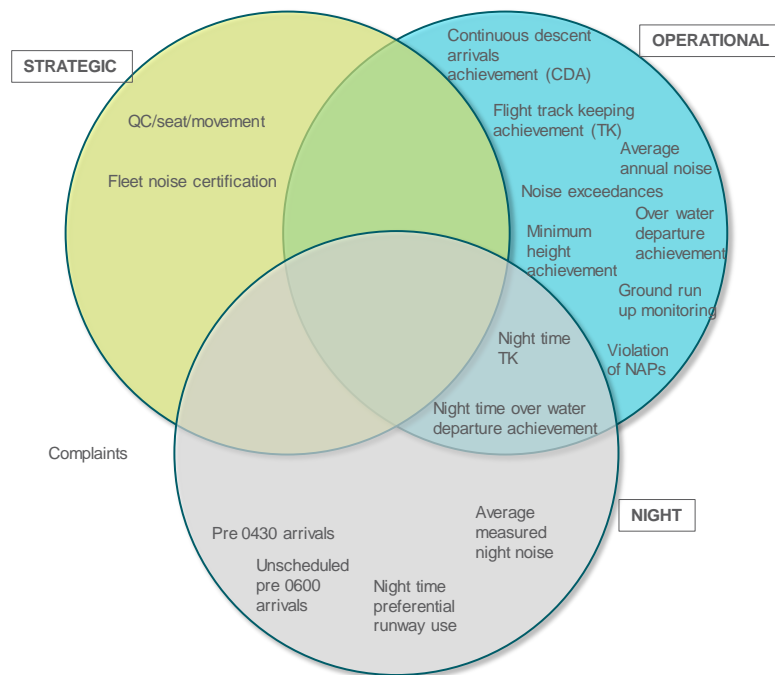
Figure 14: Metrics used in the Chicago, Heathrow, San Francisco and Vancouver Fly Quiet programmes

Reporting

A key element of Fly Quiet programmes is public reporting. Examples of Fly Quiet reporting are shown in Table 17, Figure 15, Figure 16 and Figure 17.

Element	Summary
Frequency	Chicago, Heathrow and San Francisco report quarterly on their Fly Quiet programmes.
League tables	Both Heathrow and San Francisco produce league tables comparing airline performance across the different metrics.
Expected levels of compliance	Heathrow, and to a certain extent Chicago, highlight if an airline is performing as expected against a given metric.
Working with airlines	Heathrow actively works with airlines who do not achieve the expected level of performance for individual metrics.
Awards	San Francisco and Vancouver hold annual award ceremonies to recognise the best performing and most improved airlines.

Table 17: Summary of Fly Quiet reporting

Figure 15: Extract from the Heathrow Fly Quiet Programme league table showing airline rankings and summarising achievement against each metric

Figure 16: Extract from the Chicago Fly Quiet report for average deviation from night-time runway tracks

Airline		Fleet Noise Quality	Noise Exceedance	Nighttime Runway Use	Departures Shoreline	Gap	Arrivals Foster City	Final Score	Airline Fly Quiet Rating
Virgin Atlantic	VIR	9.50	10.00	-	-	8.01	-	9.17	
China Eastern	CSN	9.50	9.96	10.00	-	6.97	-	9.11	
Lufthansa	DLH	9.08	9.90	-	10.00	6.14	-	8.78	
ANA	ANA	7.15	10.00	-	-	7.76	-	8.30	
NCA	NCA	9.25	9.10	10.00	-	6.03	5.22	7.92	
Air New Zealand	ANZ	6.71	9.93	-	-	6.17	-	7.60	
Air France	AFR	7.83	10.00	-	-	4.81	-	7.55	
Scandinavian Airlines	SAS	8.17	10.00	-	-	4.41	-	7.53	
Swiss	SWR	8.17	9.96	-	-	4.11	-	7.41	
Sun Country	SCX	5.82	9.95	5.00	9.38	5.31	8.57	7.34	
British Airways	BAW	7.91	9.90	-	-	4.02	-	7.28	
China Eastern	CES	6.20	9.97	-	-	5.50	-	7.22	
Compass	CPZ	10.00	9.92	3.33	9.17	5.64	5.00	7.18	
AIC	AIC	7.15	8.58	-	-	7.73	5.00	7.11	
KLM	KLM	7.77	9.98	-	2.00	8.41	-	7.04	
SkyWest	SKW	10.00	9.98	4.63	7.66	4.36	5.23	6.98	
Air Canada	ACA	5.45	9.82	3.81	8.06	6.42	7.99	6.92	
Air China	CCA	9.07	9.44	1.48	-	7.40	-	6.85	
Emirates	UAE	10.00	10.00	-	5.00	2.37	-	6.84	
Etihad	ETD	7.15	9.23	-	-	5.80	5.00	6.80	
Alaska	ASA	5.15	9.87	5.83	8.57	6.00	4.86	6.72	
Delta	DAL	6.41	9.91	4.22	6.01	5.24	7.27	6.51	
Southwest	SWA	5.73	9.89	3.72	8.36	4.34	6.82	6.48	
Turkish Airlines	THY	7.15	10.00	-	-	2.22	-	6.45	
jetBlue	JBU	4.79	9.88	5.67	6.27	3.71	8.10	6.40	
								6.40	SFO AVERAGE
Volaris	VOI	4.87	9.80	3.15	-	8.89	5.00	6.34	
Frontier	FFT	5.46	9.88	4.50	7.05	2.69	8.33	6.32	
Japan Airlines	JAL	7.15	9.40	1.33	-	6.98	-	6.21	

Airline Fly Quiet Summary Report - 4th Quarter 2016   October 1 to December 31, 2016

Figure 17: Extract from the San Francisco Fly Quiet league table showing airline rankings, scores for each metric and overall scores

8.3 Toronto Pearson today

Toronto Pearson does not have a Fly Quiet program

8.4 Potential new programmes and initiatives for GTAA to pursue

Objective

Establish a Fly Quiet programme as one way of encouraging airlines to adopt new quieter aircraft, or fly existing aircraft in a manner which minimises their noise impact on the communities surrounding the airport.

Ref	Potential new programmes and initiatives
FQ1	As a precursor to a Fly Quiet programme, establish a mature set of metrics that measure aircraft noise performance.
FQ2	Implement a GTAA 'Fly Quiet' programme to compare airline performance across a number of noise metrics.

Table 18: Potential new programmes and initiatives for a Fly Quiet programme

The rationale for potential new programmes and initiatives is explained below:

- **Establish a mature set of metrics as a precursor to a Fly Quiet programme:** Any metrics used in a future GTAA Fly Quiet programme will need to be accepted by airlines and communities. Failure to do so would risk one or both parties not engaging

in what has been to date a voluntary programme. Therefore, as a precursor to a Fly Quiet programme, GTAA should identify, with stakeholders, candidate metrics that measure aircraft noise performance and bring them to a suitable level of maturity (i.e. acceptable to airlines and communities, ability to measure 24/7, agreed method of calculation).

- **GTAA Fly Quiet programme:** A small number of airports researched have Fly Quiet programmes as one way to encourage the operation of aircraft in the quietest way possible and the use of the quietest fleet. It is proposed that GTAA establish its own Fly Quiet programme. A full-scale Fly Quiet programme, similar to those at Heathrow and San Francisco, will take time to develop and need considerable consultation with both airlines and communities. While this is taking place, GTAA could establish a programme like that operated at Vancouver.

9 Land use planning

9.1 Introduction

This area of research investigated how land use is managed near airports.

For this study, land use planning has only been investigated with respect to aviation noise. No reference has been made to other national or local land use planning activities, or rules associated with buildings/obstacles under the flight paths.

9.2 Summary of best practice research

Two main areas of best practice were identified – land use planning and noise mitigation/insulation programmes. A summary is included in this section, a detailed report of the research, including case studies, is provided in Annex C.

Land use planning and zoning

Twenty of the 26 airports researched published land use rules around their airport. The main trends identified are summarised below:

- **Source of land use policy:** Policy on land use near an airport is typically provided by the Federal Government for the entire country. These rules are often augmented by local authorities.

- **Typical rules:** Land use policy will typically define rules/restrictions on land use and development close to the airport. These are usually defined with reference to noise contours. Typical rules/restrictions are given in the table below:

Rules/restrictions	Comments
Restrict all development	Sometimes including mandatory purchase of buildings already inside the contour.
Restrict development of certain land uses	For example, residential developments or public buildings such as schools.
Allow the development subject to certain conditions	For example, (i) the use of noise insulation programmes or (ii) identification in a local land registry that a residential building is subject to aircraft noise.

Table 19: Examples of land use planning rules

- **Land use planning zones:** Land use policy often involves the use of phased restrictions on development. For example, noise contours are used to create 'zones', with each having more stringent restrictions the closer it is to the airport. Examples of zones, and their associated restrictions, are shown in Table 20. A schematic of the zones used at Amsterdam Schiphol are shown in Figure 18.

Airport/region	Zone 1	Zone 2	Zone 3
United States	70 dB CNEL, no new build, potential for compulsory purchase	65 to 70 dB CNEL, noise insulation area	65 dB CNEL, no new build of noise sensitive buildings
Canada / Toronto	NEF 30 and above, no new residential development		
Australia	Above ANEI 40, (70dB Ldn) mandatory purchase and conversion to parks	ANEI 30 to 40, residential sound insulation	ANEI 25 to 40, public building sound insulation
New Zealand	Above 65dBA Ldn, 100% funding for noise insulation programmes	Above 60dBA Ldn, 75% funding for noise insulation programmes	Above 57dBA, ground noise insulation programme
Amsterdam	Zone 1/2, Demolition for safety or high noise levels typically located around runway ends	Zone 3, No new build of housing or businesses. Potential areas for noise insulation Located under ILS	Zone 4, No new major housing sites or redevelopment allowed in the areas to the sides of the ILS and under departure turns.

Table 20: Examples of land use zoning around airports using noise contours
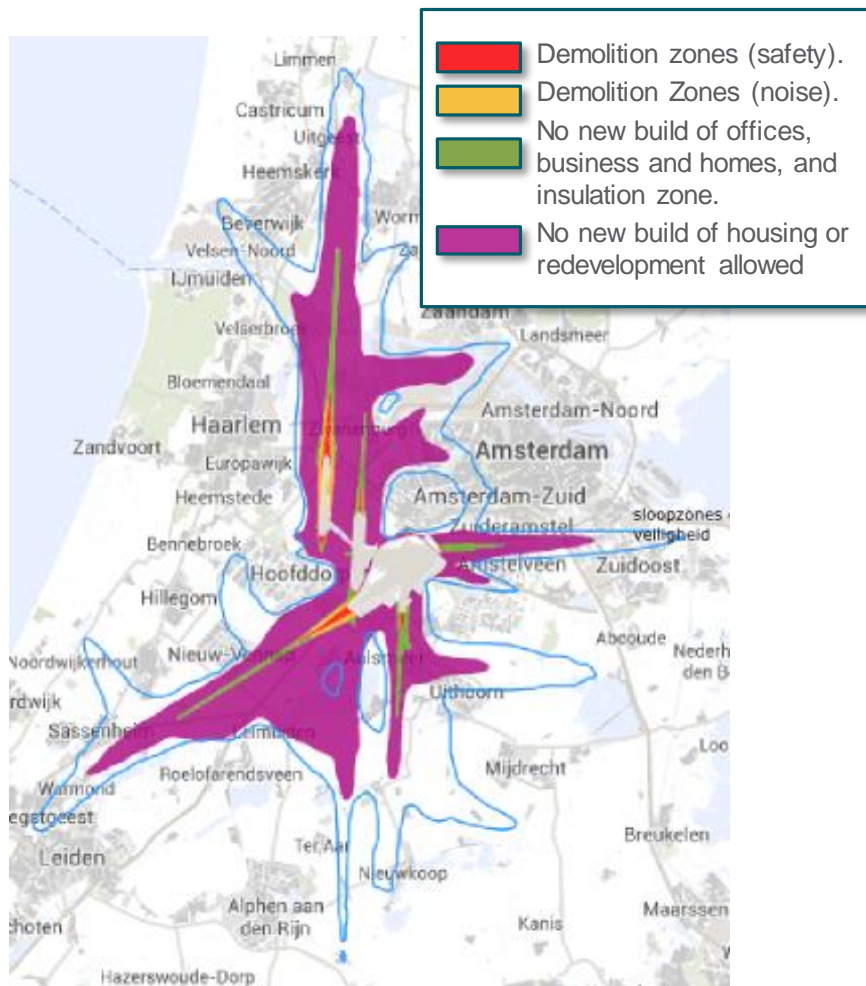
Figure 18: Example of land use zones at Amsterdam Schiphol

- **Common challenges and solutions:** There are often competing demands for land use between the airport and local authorities or the need for joint understanding/agreement on the aspirations of each party. In the United States this is addressed by a Part 150 Airport Noise Compatibility Planning study which seeks to review and align policy with the future development of the airport. Local citizens, public agencies and airport users are encouraged to engage in the study. Public workshops and hearings are used to engage with the stakeholders. The final report along with the noise maps are publicly available.

Noise insulation programmes

Sixteen airports were found to either offer noise insulation schemes or had done so in the past. Six of these undertook an 'active' noise insulation programme which involved engagement with communities rather than relying on applications from residents. Figure 19 summarises the number of buildings insulated and average spend per building for 12 airports.
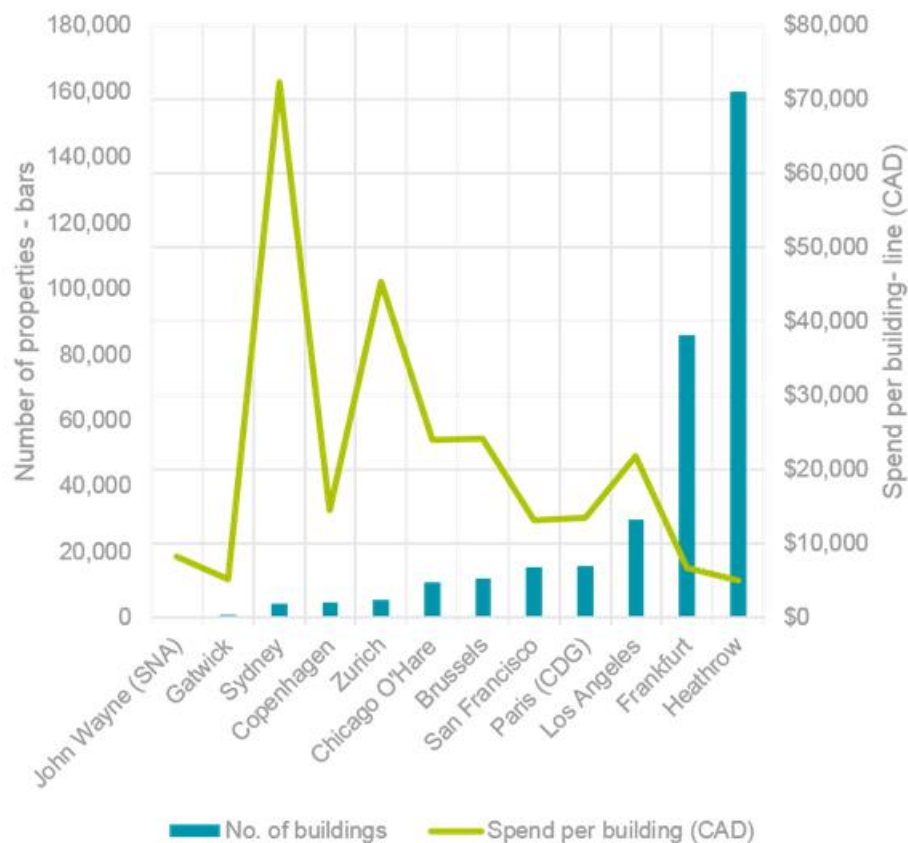
Figure 19: Examples of the number of properties insulated and average spend per property[23]

The different elements of noise insulation programmes are summarised below:

- **Eligibility for noise insulation:** Eligibility for insulation was based upon the location of the property within defined noise contours (see Table 20 for examples) and if it pre-dates the scheme. Additionally, in the United States, interior noise within an eligible property must be above 45dB DNL and any insulation installed must reduce

---

[23] The following noise insulation schemes are closed (figures in brackets denote the year of closure - John Wayne (2009), Sydney (2000), Brussels (2004) and Copenhagen (2016)). For these schemes the spend per building at the time of closure has been recalculated to 2017 values.

interior noise by at least 5dB. Airports such as Heathrow, Paris Charles de Gaulle and Zurich provide more than one insulation scheme, with each scheme having a different eligibility criteria. For example, Heathrow has day-time, night-time and quieter homes schemes.

- **Insulation provided:** The type of insulation provided varied from ventilation/double glazing in bedrooms only to insulation of roofs, doors and all windows. Again, some airports such as Heathrow and Paris Charles de Gaulle provided different levels of insulation depending on the scheme/zone a property fell within. At Chicago O'Hare a post works survey is carried out to make sure the works have reduced noise.

- **Funding of works:** Whether insulation is full or partly funded again varied by airport, the noise contours a property fell within and type of scheme (e.g. daytime/night-time). Funding of works ranged from 50% to 100% funding, or a fixed amount was provided towards the works. Some specific examples are shown in the table below.

Airport/region	Level of funding for noise insulation works
Auckland	Within the 65dBA Ldn contour the airport must provide 100% of the cost of insulation. Within the 60dBA Ldn contour the airport must provide 75% of the costs of insulation, with a 25% top-up available from a community fund to assist lower income families. The airport is required to fund noise insulation schemes at new schools built within the contour to a total value of 75% of the works.
Heathrow	The day noise scheme covers free loft insulation and ventilation, and 50% of the cost of double glazing. The night noise scheme covers free loft insulation and ventilation, and 50% of the cost of double glazing in bedrooms. The quieter homes initiative includes 1,200 homes closest to the airport and includes custom made noise solutions and is undertaken at no cost to the resident.

Table 21: Examples of funding for insulation noise insulation works

- **Impetus for initiating noise insulation schemes:** The reason for the introduction of a noise insulation programme was not usually published by airports. However, research has shown the impetus for schemes to be a combination of legislation, voluntary actions, airport development and availability of government funds. Examples are shown in Table 22.

Airport/region	Comments
United Kingdom	Airports are required to undertake insulation programmes under the UK Civil Aviation Act. Both Heathrow and Gatwick voluntarily established their programmes under this act and have since offered to extend the original programmes as part of expansion plans
Copenhagen, Sydney & Frankfurt	These airports undertook noise insulation schemes in response to expansion plans. Frankfurt initiated its scheme voluntarily.
United States	Airports undertaking a Part 150 airport noise compatibility study qualify for Federal grants for noise insulation programmes.

Table 22: Example reasons for initiating noise insulation programmes

- **Source of funds for noise insulation schemes:** The source of funds for noise insulation schemes was identified for 12 airports. With two exceptions funds came from some form of charge placed on airspace users and/or passengers. For the 6 airports in the United States Federal Grants were used to fund between 75% and 90% of the total cost of insulation schemes[24]. Four other airports funded their noise insulation schemes through noise charges levied on airlines and/or passengers (see quieter fleets section). The two remaining airports used government funds, but the exact source could not be identified.

- **Management of noise insulation schemes:** The insulation schemes are either managed by the airport directly or by a public body such as the local council or central government.

9.3 Toronto Pearson today

Land use planning and zoning

Like many of the airports researched, and in accordance with guidelines set by Transport Canada and outlined in *TP1247E Land Use in The Vicinity of Aerodromes*, Toronto Pearson has a defined noise contour within which noise sensitive land uses (e.g. residential properties) should not be located. Transport Canada's guidelines for development of compatible land uses in the areas surrounding airports use the Noise Exposure Forecast (NEF). It is Transport Canada's recommendation that areas within a 30 NEF contour or above should not be used for sensitive land use such as new residential development

Accordingly, Toronto Pearson has established an Airport Operating Area (AOA) which uses well-defined natural and manmade boundaries to approximate the 30 NEF contour on the ground (see Figure 20). The Region of Peel, with the cities of Brampton and Mississauga, and the City of Toronto have included the AOA in their Official Plans and have approved associated policies that limit incompatible land uses within these areas for new developments. For infill developments, GTAA has worked with local and regional planning authorities to establish a voluntary compatible future land use plan, including the mitigation of noise impacts through appropriate building design features as well as ensuring notice to buyers of potential impacts is given[25].

Noise insulation programmes

Transport Canada does not stipulate any recommendations for airports to provide noise insulation schemes. Instead (i) it recommends no residential development within the AOA (NEF 30 noise contour) and, (ii) places obligations on the responsible authority to ensure new properties have appropriate insulation where this recommendation is not followed.

---

[24] It is understood that these grants are funded from more broader taxes on airspace users (3% ($111 million USD) of the total value of this tax collection was spent on noise insulation programmes in 2016).
[25] This is in accordance with Transport Canada guidelines (http://www.tc.gc.ca/eng/civilaviation/publications/tp1247-menu-1418.htm).
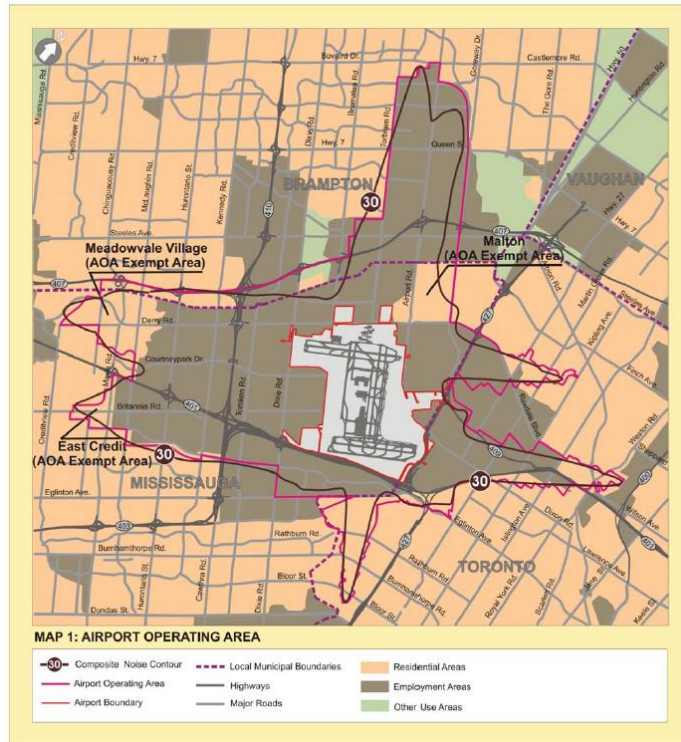
Figure 20: Toronto Pearson Airport Operating Area (AOA) – NEF 30 contour

9.4   Potential new programmes and initiatives for GTAA to pursue

> **Objective**
>
> *GTAA to examine the conditions under which it will undertake voluntary land use planning activities that go beyond the scope of the current regulatory environment stipulated by Transport Canada.*

Ref	Potential new programmes and initiatives
LU1	In addition to the current (Transport Canada) regulatory environment for land use planning, GTAA to consider the additional merits of working with local communities and regional/local authorities to agree to a voluntary compatible future land use plan.
LU2	GTAA to examine the conditions under which it may consider a voluntary noise insulation programme.

Table 23: Potential new programmes and initiatives for land use planning

For this study, land use planning has only been investigated with respect to aviation noise. No reference has been made to other national or local land use planning activities, or rules associated with buildings/obstacles under the flight paths.

The rationale for potential new programmes and initiatives is explained below:

- **Consider the merits of a voluntary compatible future land use plan:** In terms of aircraft noise, Transport Canada recommends that areas within a 30 NEF contour or above should not be used for sensitive land use such as new residential development. Toronto Pearson has established an Airport Operating Area (AOA) which uses well-defined natural and manmade boundaries to approximate the 30 NEF contour on the ground. Surrounding municipalities have included the AOA in their Official Plans and

have approved associated policies that limit incompatible land uses within these areas.

At the same time, local authorities can designate exemptions for residential development in the AOA, and Toronto Pearson has its own future development plans. Therefore, it is proposed that, in addition to existing regulatory requirements, GTAA examine the merits of working with local communities and regional/local authorities to establish a voluntary[26] compatible future land use plan along the lines of the Part 150 airport noise compatibility planning programmes undertaken in the United States.

- **Examine the conditions under which GTAA may consider a voluntary noise insulation programme:** The majority of airports researched currently have, or previously had, noise insulation schemes to mitigate the impacts of aviation noise on local communities close to the airport. Where information has been made available, the impetus for initiating these schemes has been identified as a combination of national legislation, voluntary actions, airport development and availability of government funds.

Within the current regulatory environment, Transport Canada does not stipulate any recommendations for airports to provide noise insulation schemes. However, as so many of the airports researched have these schemes, it is proposed that GTAA examine the conditions under which it may consider a voluntary noise insulation programme. For example, aligning with practices (noise insulation contours) at other major international airports, changes in flight paths that extend the NEF 30 contour beyond the existing AOA or a scheme to support future development. For the first point, this could involve benchmarking the existing AOA against rules applied at other major international airports, such as the FAAs 65 to 70 dB CNEL noise insulation area and the requirement to reduce the interior noise by at least 5dB if it is above 45dB.

---

[26] Any initiative would need to be voluntary as it would be outside of the current regulatory environment.

10   Noise Complaints

10.1   Introduction

This section investigates the process for managing complaints about aircraft noise. Complaints have been researched in three areas:

- Complaints process – how complaints are submitted.

- Complaints policy – how the complaints are handled.

- Complaints reporting - how complaints are reported upon and analysed.

10.2   Summary of best practice research

A summary of the findings of the research is presented below. More detail, including case studies, is provided in Annex C.

Complaints process

Sixteen of the 26 airports researched were found to accept noise complaints from the public. Most complaints are handled by the airport, but it is not unusual for complaints to be handled by other organisations such as local government, an airport committee, the regulator, air navigation service provider or an ombudsman. The method by which complaints were submitted and the type of information requested is summarised below:

- **Submission of complaints:** Airports provide different options for communities to submit complaints to account for different demographics. Online forms (17 airports), by phone (16 airports) and dedicated online tools (10 airports) were the most prevalent methods available, along with other traditional methods such as email and letter.

- **Information requested:** Half of the airports researched accepted complaints regarding specific aircraft, typically via online flight tracking tools such as the WebTrak system used at Toronto Pearson, or by requesting information in the online complaints form. When complaining about an individual aircraft, online tools allow the complainant to select the aircraft in question on a map and register a complaint. This also makes the investigation of complaints by an airport more efficient.

Complaints policy

Half of the airports researched provided some information on how complaints were handled – either as a standalone policy or as part of the information published on how to make a complaint. The amount of information provided varied between airport but included information such as the different ways to make a complaint, the conditions under which a response would be provided to the complainant, target response times and specific policies on communication with high frequency complainants.

Elements of the various complaint policies identified by the research are summarised in Table 24. Examples of such material from other airports is provided in Annex C.

Element	Summary
How to make a complaint	Explanation of how to make a complaint (e.g. online forms, by phone, online tracking tool) and the necessary details (e.g. phone numbers for the Noise Management Office).
Information required to make a thorough investigation	If a complaint was being made against a specific aircraft, the information required to make a thorough investigation.
Complaints that airport cannot respond to	For example, aircraft not using the airport.
Complaints handling and use of personal data	How complaints are registered and the receipt of the complaint is acknowledged. Also, statements regarding how any personal information will be treated confidentially are included.
Investigation of complaints	How the complaint is investigated. For example, San Francisco, Sydney[27] and Vancouver explain the airport's noise and tracking keeping system is used by staff to make their investigations. The Sydney complaints policy clearly states they types of investigations that can take place.
Responding to complaints	For example: • If a response is always provided, provided on request or only provided if appropriate. Some airports also specify target response times for complaints (see Table 26). • If written or verbal responses are provided. Additionally, San Francisco also provides responses to complaints via Community Round Table events (see the Community Outreach section). • The type of information typically provided by the airport in response to a complaint. For example, information explaining flight procedures and information derived from the airport's noise and track keeping system showing maps of flight paths near the complainant and details of the flight against which the complaint was made. • How the airport will address complaints from high frequency complainants. • How abusive complaints will be addressed. Further information on responding to complaints can be found in Table 25.
What happens to complaints	Information on if/how the complaints are reported upon publicly and used to improve the noise environment – for example (i) used to identify trends and (ii) reviewed by community forums.
Violation of regulations or procedures	Canadian airports highlight that if there has been a violation of Canadian Aviation Regulations or the published Noise Abatement Procedures, this will be passed to Transport Canada Civil Aviation Enforcement for further investigation.
Other	Airports that receive a high-volume of complaints tend to have more detailed policies. Examples include: • Resolving complaints: The Sydney policy states what criteria need to be met for a complaint to be considered resolved. • If the complainant is not satisfied with the response: Very little information was found on how a complaint can be escalated if the complainant is dissatisfied with the investigation. The exception is Sydney where the complaint can be escalated to the Australian Noise Ombudsman. • Time window to submit complaints: Complaints against Amsterdam Schiphol can only be accepted within 10 days of the event. • Submission of multiple complaints: At Heathrow, where complaints are made about multiple aircraft events within one email/complaint form, only one complaint will be recorded. • Provision of extensive data: Both Heathrow and Gatwick state that they will not undertake extensive data gathering exercises for individual complaints. • Visits to the airport: At Heathrow, if thought to be beneficial for the complainant, an invitation to visit the airport will be made.

Table 24: Elements of complaint policies identified by the research

Best practice is to respond to complaints and provide information to the complainant. Typical practices are as follows.

Type of complaint/ complainant	Example practices
First complaint	Airports will typically provide a response to the first complaint. At some airports this will be accompanied by information explaining the operation of the airport, noise activities and where to find further information.
Subsequent complaints	For subsequent complaints, typical practice is to continue providing information until no new information is available. For example, the Sydney complaints process states '*If you have contacted us previously and received a response, we may not respond further if there is not additional information that we can reasonably provide*'. If no further information is available, best practice at some airports is to inform the complainant accordingly.
High frequency complaints	Several airports receive a high proportion of their complaints from a small number of complainants (see Figure 21). Gatwick and Heathrow have specific entries on how the airport will respond to this group of complainants. For example, the Gatwick policy states '*Where we have repeatedly explained the policies and noise measures which affect a complainant's postcode area and previously supplied sufficient information to the extent that we are unable to further enhance understanding, we will notify the complainant of our intention only to register - rather than to respond to – all future complaints*'.
Abusive complaints	Heathrow and Gatwick state that they will not respond to any complaints made that are of an abusive or threatening nature or containing obscene language. It is also stated that any such complaints may be referred to the Police for investigation.

Table 25: Examples of how airports respond to complaints

Airport	Response time
San Francisco	1 day (for call backs)
Calgary, Frankfurt	3 days
Heathrow	5 days[28]
Amsterdam	7 days[29]
Sydney	21 days

Table 26: Example target response times stated in airport complaint policies

---

[27] Complaints made against Sydney Airport are managed by the Australian Air Traffic Control provider, Airservices.

[28] The Heathrow complaints policy states that 'If further investigation is required we will acknowledge the complaint within this timeframe and inform the complainant when we expect to be able to fully respond to their enquiry'.

[29] Amsterdam Schiphol airport's target response time was 7 days, however, if this timescale was unachievable, complainants would be notified.

Number of complaints and complainants at different airports in the study
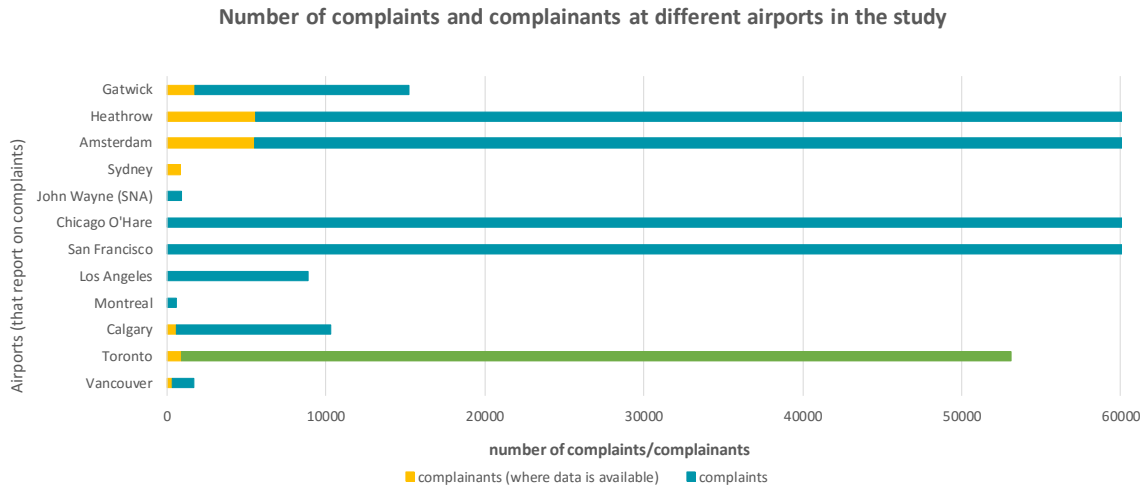
Figure 21: Number of complaints and complainants for selected airports per annum[30]

Complaints reporting

Most of the airports researched publicly report on noise complaints. The methods of reporting and level of additional detail provided vary significantly. Where reporting of noise complaints occurs, one or more of the examples shown in Table 27 are used:

Method	Summary
Traditional noise reports	Eleven airports reported on complaints either on a monthly, quarterly or annual basis. Complaints data reported included total complaints, reasons, geographic distribution, complainants and times of day.
Online reporting	Three airports reported complaints statistics on dedicated web pages or websites. Heathrow airport makes the number of complaints registered each day available.
Interactive online platforms	Gatwick has an interactive platform for complaints reporting. Complaints are presented on a map of the airport locale together with number of complaints received by postcode (ZIP code). Users can obtain more specific information about a particular postcode by selecting it (see below for more information).

Table 27: Typical methods of publicly reporting on noise complaints

Best practice was for airports to further segment complaints in order to identify common causes and patterns. Examples identified included:

- **Reporting on complaints and complainants**: For example, Vancouver airport reports separately on both complaints and complainants. This information is also segmented by district.

- **Segmentation of complaints and explanation of causes:** Sydney segments complaints into reasons such as aircraft height, runway choice etc (see Figure 22). It also provides a quarterly commentary of changes in complainants, the main issues raised and associated explanations.

---

[30] In addition, Chicago and San Francisco receive a high proportion of their complaints from a small number of complainants (e.g. in June 2016, San Francisco received 79,307 complaints from 437 Palo Alto residents).

- **User defined segmentation of complaints:** At Gatwick complaints can be investigated by postcode (ZIP code). Information available includes number of complainants, complaints per aircraft type/number of engines, complaints by hour and complaints by reason.
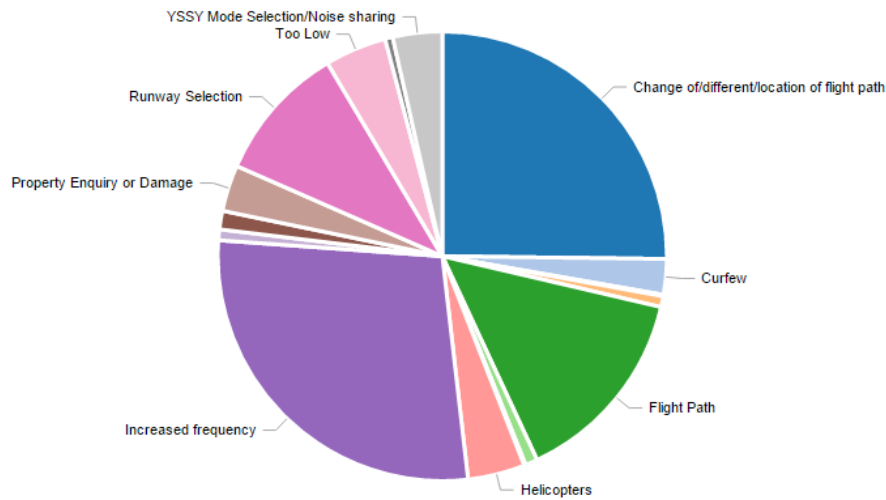
Figure 22: Segmentation of noise complaints at Sydney airport

10.3   Toronto Pearson today

Complaints process

Complaints can be submitted using the following methods:

Method	Summary
Online form	Complainants are asked to specify the date, time, aircraft type (jet, propeller etc), operation (arrival, departure etc) and event type (too loud, too late, too frequent etc). Complainants can also state how they wish to be contacted.
WebTrak (online flight tracking tool)	When an aircraft is selected on the WebTrak tool, users can choose to register a complaint. They are directed to the online form which has much of the required information pre-populated.
Phone	The phone service is available from 8am to 5pm, Monday to Friday.

Table 28: Methods of submitting complaints to Toronto Pearson

Complaints policy

Complaints are registered and analysed using the airport's flight tracking system records and reports from noise monitoring systems. Complaints are responded to on request and can only be registered if correlated to a specific aircraft.

Complaints reporting

Complaints are reported at the GTAA community forum, CENAC, through a standing agenda item (noise statistics updates). Complaints and complainants are tracked monthly and segmented by Federal Sortation Area, Federal electoral district, by runway and hours when the night-time preferential runway scheme is in operation.

10.4 Potential new programmes and initiatives for GTAA to pursue

Objective

Focus the complaints handling process on enabling tangible actions to address the causes of noise complaints from the community.

Ref	Potential new programmes and initiatives
NC1	Appoint points of contact in NAV CANADA and the main Toronto-based airlines to support the day-to-day investigation of complaints.
NC2	Publish an updated noise complaints policy.
NC3	Implement a quarterly review of complaints with the objective of understanding any patterns in complaints and identifying follow-up actions to address them.

Table 29: Potential new programmes and initiatives for noise complaints

The rationale for potential new programmes and initiatives is explained below:

- **Appointing NAV CANADA and airline representatives to support the day-to-day investigation of complaints:** The day-to-day investigation of complaints should be supported through closer working with operational staff in NAV CANADA and the main Toronto-based airlines. This will add greater understanding to complaint responses and will support GTAA responding to complaints quickly with full information regarding the event. Where there was a clear operational breach, GTAA could respond outlining the measures they would take with NAV CANADA and the airline concerned to prevent future occurrences. If there was a good operational reason for the noise event, e.g. a flight safety issue, or an emergency, this could be conveyed to the complainant. It will also provide a communication channel for awareness of common issues to be fed back to pilots and controllers.

- **Publish an updated noise complaints policy:** GTAA already has several elements of the complaints policies identified across the airports researched. These should be formalised and published in a complaints policy on the noise complaints page of the GTAA website. Using a combination of new material and material already published on the GTAA website, this should include (i) how to make a complaint, (ii) the information required for GTAA to make a thorough investigation of the complaint, (iii) complaints handling and use of personal data, (iv) how complaints are investigated, (v) how complaints will be responded to (including the type of information the airport will typically provide, what happens when no new information can be provided and how the airport responds to frequency complainants) and (vi) an explanation of how complaints are reported and used to investigate improvements to the noise environment.

Discussions with GTAA identified areas where staff could be used more efficiently in resolving complaints. For example, the additional time taken to classify and investigate multiple complaints submitted on a single complaint form. At the same time, some individuals collect and submit complaints on behalf of their community. Any new policy will need to balance (i) giving the community as much flexibility as possible in the way they register genuine complaints about aircraft noise, with (ii) the benefits of the deeper analysis of individual complaints that could be undertaken if GTAA staff could process complaints more efficiently through a more standardised complaints submission process.

- **Quarterly review of complaints:** Where practicable, there needs to be a visible link between noise complaints and tangible actions to improve the noise environment. The information requested by GTAA in its noise complaints forms (e.g. time, type of operation, type of aircraft, reason for complaint) already provides a considerable amount of detail for the analysis of complaints. In addition to the day-to-day review of individual complaints, it is proposed that GTAA have a structured process to review all complaints submitted each quarter. The objective will be to identify and understand any patterns in complaints, identify any practicable follow-up actions and explain these to the public. This could include reviews with communities, follow-up with airlines or further investigations. Summary material should be published on the noise complaints page of the GTAA website. A possible process for the above is summarised in Figure 23:
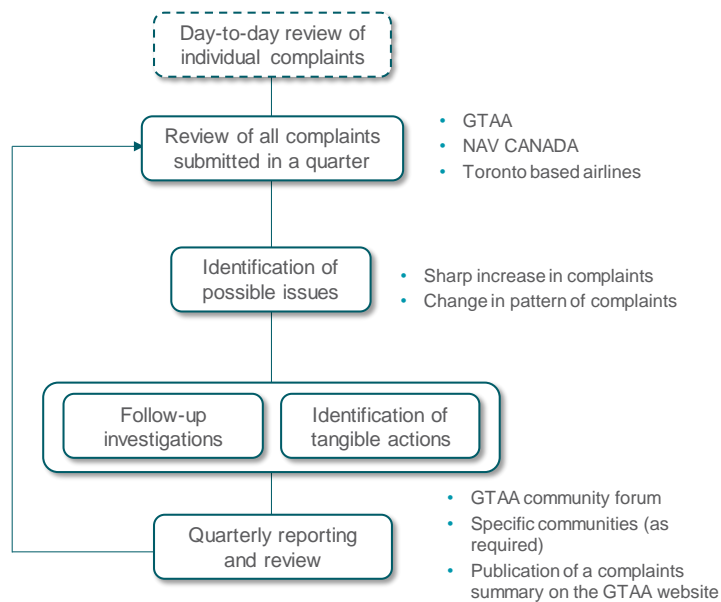
Figure 23: Proposed process for reviewing all complaints submitted in a quarter

11 Community outreach

11.1 Introduction

This area of research investigates activities undertaken by airports to engage with local communities on aircraft noise. In particular, it investigated structures and processes of community engagement committees similar to CENAC.

11.2 Summary of best practice research

A summary of the best practices identified are included in this section. More detail, including case studies, is included in Annex C.

Existence of community forums

Fourteen of the 26 airports researched publicly reported on having a dedicated community engagement forum. Of the remainder, 4 airports have undertaken ad-hoc community engagement activities. This includes the creation of panels to undertake consultations, studies and provide information.

Membership

A summary of membership practices at other community forums is given in Table 30.

Element	Summary
Chairmanship	Over half of the community forums identified were not chaired by the airport. Instead there was an independent chairperson, either an elected representative or an independent person.
Industry membership	All the forums included representatives from the airport, air traffic control provider and the regulator. There were also examples of members from relevant government departments or regional councils.
Community membership	The local community was represented either by elected officials (councillors or members of parliament), community representatives or a combination of both. If community members were involved they represented a local area. Information on the selection of community representatives could only be found for Gatwick where a consensus agreement was reached between the 14 local noise lobby groups to occupy 4 spaces on the Noise Management Board.
Number of members	The community forums researched typically had up to 20 members, although those at Frankfurt and Chicago have approximately 60 members. To manage this size of forum, the Frankfurt group also has a 3-person board of directors and a steering committee to decide the work of the forum.
Term of membership	Terms of references from 5 forums provided prescriptive durations of between 2 and 4 years before an individual required re-election/re-nomination. The Gatwick Noise Management Board also limits the duration of membership to a maximum of 2 terms. The majority of airports researched allowed the named organisations to select a primary and alternate representative.
Capabilities of members	None of the terms of reference researched applied criteria for the seniority of forum representatives but did provide guidelines on the ability of the individual to make decisions on behalf of the organisation they represented. The members of industry organisation ranged in seniority from senior managers to directors.

Table 30: Summary of membership practices at other community forums

Terms of Reference

A summary of terms of reference at other community forums is given in Table 31.

Element	Summary
Advisory status	All groups held an advisory status - they could make recommendations but not mandate enforcement or apply penalties.
Governance	Some of the community forums researched are not directly run by the airport. For example, the San Francisco Airport/Community Round Table is a voluntary committee, the Chicago O'Hare Noise Compatibility Commission (ONCC) is an inter-governmental agency and the Gatwick Noise Management Board has an independent Chairperson to work closely with both the community and industry, and as necessary, arbitrate between the two. Gatwick facilitates the Noise Management Board, with an independent secretariat and third party providing technical support. An additional independent consultant, paid by the airport, advises the community members.
Executive committee	The Frankfurt community forum has a 3-person board of directors and a steering committee to decide the work of the forum.
Dedicated workplan	Eight of the 14 airports with community forums maintained a dedicated workplan. This enabled the forum to have a more pro-active role in noise management. The remaining six focused on reviewing the work undertaken by the airport.
Working groups	Five of the 14 airports with community forums operated regular sub-groups to manage specific tasks. All groups held the power to create ad-hoc subgroups.
Participation of members of the public (i.e. non-forum members)	Eight of the airports with community forums have meetings that are open to the public in some form (i.e. non-forum members). Typically, this takes the form of a dedicated agenda item for public involvement. One example of full public participation was found and two other airports only allowed members of the public to observe the forum (with one of these having a dedicated public session once a year). Public involvement is often subject to a number of conditions including a time limit (typically 2-3 minutes per speaker), limits on issues that can be discussed (often items on the meeting agenda only) and rules about the use of abusive language. The other airports identified as having community forums were found not to be open to the public. For these forums, public concerns were raised via nominated community representatives.
Frequency	Meetings are typically held every 2 to 3 months with formal minutes published alongside documentation from the meeting, such as presentations or progress reports.
Meeting arrangements	The airport is typically responsible for the management, coordination and facilitation of meetings, and usually provides resource, be that financial or technical support.

Table 31: Summary of terms of reference at other community forums

Activities and successes

Examples of activities community forums at Chicago O'Hare, London Gatwick, Los Angeles (LAX), and San Francisco have undertaken are given below. It is noted that these forums all have some form of work programme:

- **Fly Quiet programmes:** The San Francisco and Chicago O'Hare community roundtables have supported the introduction of Fly Quiet noise management programmes. Both groups continue to monitor compliance with the programme.

- **A320 retrofit:** Forums at Chicago O'Hare, LAX and San Francisco jointly engaged with United Airlines to retrofit A320 family aircraft to reduce the 'whine' generated on approach by these aircraft.

- **Overseeing the implementation of an independent arrivals review:** The Gatwick Noise Management board (NMB) has the task of overseeing the implementation of 22 recommendations from a review of arriving aircraft. A year since the publication of the review, 11 recommendations have been completed.

- **Night-time operations:** Amongst others, the LAX community roundtable worked to increase the altitude of arriving aircraft between midnight and 0630.

Additional community outreach practices

- Sydney airport has a community committee and has previously undertaken direct and deliberate community engagement using the following methods: websites, phone calls, emails, adverts, FAQ sessions, community and stakeholder meetings, door to door visits and sent brochures to over 100,000 residences.

- The Chicago O'Hare Noise Compatibility Commission (ONCC) has a mobile community engagement vehicle which travels to community events, festivals, schools, and libraries throughout the year. The vehicle has video presentations and computer demonstrations that explain, among other things, the O'Hare Airport Noise Management System and noise profiles of different types of aircraft.

11.3   Toronto Pearson today

As part of its airport ground lease, the operator of Toronto Pearson is required to have a community engagement forum. As a result, GTAA formed the Community Environment and Noise Advisory Committee (CENAC) in 1996.

Membership

CENAC is chaired by the airport and comprises:

- **Citizens and/or elected officials:** This comprises 13 voting members representing 6 areas. Representatives are a combination of elected officials, residents and other appointments at the discretion of the local council.

- **Technical members:** Representatives from Transport Canada, the airlines, staff representatives, province of Ontario, GTAA and other technical support as required (e.g. an acoustician)

Terms of reference

CENAC has an advisory role and will make recommendations to the GTAA Chief Executive Officer on topics concerning noise and environmental impact. This includes advising on, but not limited to the following topics[31]:

- Aircraft operation procedures impacting aircraft noise in Toronto Pearson's Airport Operating Area (AOA).

- The examination of alternatives for noise mitigation.

- The enforcement of aircraft noise violations.

- Municipal land use within the GTAA AOA.

- The review of the GTAA's environmental programmes and adherence to ISO targets.

---

[31] CENAC Terms of Reference, April 2015.

- The examination of potential environmentally sensitive measures at Toronto Pearson.

GTAA coordinate, facilitate and produce documentation including reports and statistics to support CENAC public meetings which take place 4 to 5 times per annum. As required, CENAC can appoint ad-hoc sub-committees to deal with issues as they arise. A recent example was an ad-hoc sub-committee to determine the locations for future noise monitors. This included both GTAA staff and community members.

Meetings and activities

CENAC meets approximately 4 to 5 times per year. Each meeting has a closed committee meeting followed by an open public session. The meeting has a standing noise statistics update agenda item, which primarily covers noise complaints, enforcement investigations and trial updates. Updates are provided on several topics such as night flights, noise mitigation initiatives and runway rehabilitation.

CENAC accomplishments include influencing a cargo company to accelerate the adoption of quieter aircraft, the development of Toronto Pearson's first Noise Management Action Plan, supporting the 2013 Air Quality study and conducting a review of the noise monitoring terminal locations resulting in the addition of eight new noise monitors. Members represent the Committee at outreach sessions, including consultations associated with the current noise mitigation studies.

11.4 Potential new programmes and initiatives for GTAA to pursue

Objective
Enhance community engagement by focusing the work of CENAC on addressing community concerns about aircraft noise. In doing so, ensure the wider community (non-CENAC members) is involved in identifying and resolving the concerns.

Ref	Potential new programmes and initiatives
CENAC1	Enhance community engagement by focussing the work of CENAC on addressing community concerns about aircraft noise through an annual work programme.
CENAC2	Ensure the wider community (non-CENAC members) is involved in identifying and resolving the concerns to be addressed by the annual work programme.
CENAC3	Consider if increasing the independence of CENAC from GTAA would enhance community engagement.

Table 32: Potential new programmes and initiatives for the community forum

The overall aim of the above initiatives is to ensure that, while people will continue to be overflown and dislike aviation noise, CENAC is a truly representative body where all public concerns can be raised and turned into tangible actions to improve the noise environment:

- **Annual work programme focused on community concerns:** Many community forums have a dedicated work programme to enable them to be more active in noise matters. CENAC should develop its own noise work programme and directly link it to community concerns. A considerable amount of forum activity will be orientated around the work programme and understanding/resolving issues. As required, permanent or ad-hoc working groups could be established to deal with specific matters in the work programme such as identifying solutions to address

concentrations of noise complaints and monitoring the implementation of the recommendations from the NAV CANADA airspace study.

- **Wider community (non-member) involvement:** It should be ensured that the wider community (presently non-CENAC members) is involved in identifying and resolving the concerns to be addressed in by the annual work programme. This could be achieved, for example, by giving the community members of CENAC a wider role in engagement with their communities or by expanding the membership to increase the representativeness of participants. This could be structured around meetings in their local communities (i) pre-CENAC meetings to identify concerns, and (ii) post-CENAC meetings to report back on what action is being taken to help. To be truly successful in achieving this aim, CENAC and the community noise groups in the Toronto area (e.g. T.A.N.G.) will also need to be actively engaged with one another. It is also noted that some airports have established new forums when there has been a need to increase the level of involvement from communities or where the existing forum has not been perceived as effective or representative.

- **Increasing the independence of CENAC from GTAA:** Over half of the community forums identified by the research are not chaired by the airport, while others operate with a degree of independence from the airport. For example, the San Francisco Airport/Community Round Table is a voluntary committee and the Chicago O'Hare Noise Compatibility Commission (ONCC) is an inter-governmental agency. At Gatwick, the Noise Management Board has an independent Chairperson who works closely with both the community and industry, and as necessary, arbitrates between the two. Gatwick facilitates the Noise Management Board, with an independent secretariat and third party providing technical support. An additional independent consultant, paid by the airport, advises the community members. Accordingly, GTAA should consider if giving CENAC more independence would support one of the aims in the terms of reference of this study of enhancing community engagement. It is emphasised that in all the examples cited above, both the airport and other industry stakeholders maintain a strong involvement in the forum and a commitment to progress agreed actions.

An indicative structure for the forum, taking account of the proposals above, is shown in Figure 24. This includes working groups to deal with specific matters relating to the work programme and the suggestion for an executive of one community and one industry member to work closely with the Chairman.
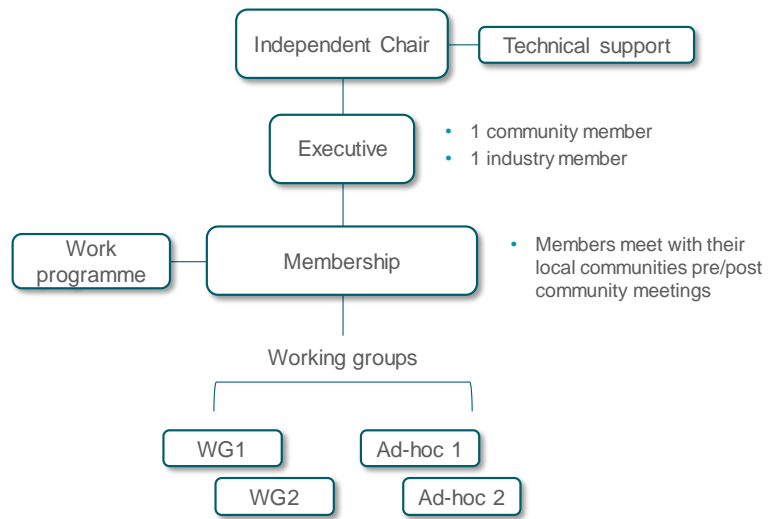
Figure 24: Indicative structure for the community forum

12 Independent noise ombudsman

12.1 Introduction

This area of research investigated the existence and responsibilities of noise ombudsmen - an independent body or person responsible for oversight and intervention in noise activities.

12.2 Summary of best practice research

A summary of the findings of the research is presented below. More detail, including case studies, is provided in Annex C.

Presence of a noise ombudsman

Three of the countries researched have an established noise ombudsman or mediation services - Australia, Belgium and the United States. In addition, an Independent Commission on Civil Aviation Noise (ICCAN) has been proposed in the United Kingdom following the Airports Commission review into future aviation capacity.

Roles and responsibilities of the noise ombudsman

Typical responsibilities of noise ombudsman include:

- **Complaints:** Handling of complaints or oversight of the complaints process.

- **Community:** Review of consultation processes and community concerns related to aircraft noise.

- **Airspace change:** More recently, proposals for ICCAN in the UK and proposed changes to the responsibilities of the ombudsman in the United States, has moved the emphasis of the role towards involvement in the airspace change process, in particular community engagement during this process.

- **Reviews:** Reviews of specific aspects of noise management.

Overview of different noise ombudsman

An overview of each noise ombudsman is given below:

- The **Australian Noise Ombudsman (ANO)** is funded by the government and has a public charter. The role of the ombudsman is to review complaints handling, monitor community consultation processes, monitor the presentation of noise data to the public and undertake targeted reviews of specific aspects of noise management. It can investigate both civil and military noise complaints and make recommendations to both Air Services Australia and the Chief of the Air Force. If recommendations are made, they are initially sent privately with a response required within 60 days. The recommendations are non-blinding, but are made public alongside a joint press statement between the ANO and the relevant party outlining the issues and the relevant response. Progress against agreed recommendations is tracked.

- The **Belgium Airport Mediation Service** is an independent mediator for handling, managing and responding to complaints. It is also responsible for collecting and disseminating information on aircraft trajectories and provides support and mediation.

- The **United States Federal Aviation Authority (FAA) Noise Ombudsman** was established in 1996 with a similar role to the Australian noise ombudsman. The ombudsman is part of the FAA rather than being an independent entity. The role is

being revised through the FAA Community Accountability act which is currently with the Senate. If passed it will put more emphasis on the ombudsman liaising with communities. The proposed revisions include (i) acting as a liaison between communities affected by aircraft noise and the FAA Administrator, (ii) monitoring the impact of the FAAs NEXTGEN (Next Generation Air Transportation System) programme on communities in the vicinity of airports and (iii) appointing 'community ombudsman' for each FAA region.

- The role of the **proposed UK Independent Commission on Civil Aviation Noise (ICCAN)** is currently being consulted upon by the Department for Transport. The role is proposed to include (i) involvement in airspace change, (ii) assisting communities in understanding proposed changes, (iii) reviewing plans and making recommendations on behalf of communities on airspace/noise changes and (iv) producing best practice guidelines for noise management and community engagement. It is understood that current proposals are for ICCAN to have no statutory powers and be a publicly funded independent part of the UK Civil Aviation Authority.

12.3   Toronto Pearson today

Like many other countries there is no noise ombudsman in Canada.

Transport Canada directs concerns/complaints about aircraft noise to the airport in question. Airports are expected to have a noise management programme to deal with aircraft noise and complaints from adjacent communities, as well as a noise management committee (community forum) similar to CENAC. At major airports, Transport Canada also provides a representative to the community forum.

There is an emphasis on the noise complaints process and community forum successfully resolving concerns about aircraft noise. When this does not occur, there is no third party with a statutory responsibility to arbitrate on the matter[32]. Instead individuals/communities raise the matter with Transport Canada, local politicians and/or to GTAA staff outside of the noise management office.

12.4   Potential new programmes and initiatives for GTAA to pursue

Objective
Consider the need for a designated independent third party to arbitrate where the community feels a noise issue has not been resolved satisfactorily.

Ref	Potential new programmes and initiatives
INO1	GTAA to consider, in addition to the proposals made in this report, the need for a designated third party to arbitrate in matters where the community feels a noise issue has not been resolved satisfactorily.

Table 33: Potential new programmes and initiatives for an independent noise ombudsman

The current regulatory environment does not include a formally designated third party to arbitrate in instances where communities feel a noise complaint/issue has not been resolved satisfactorily. Ideally, the proposals made in Section 11 above would ensure that

---

[32] By comparison, the Canada Transportation Act authorises the Canadian Transportation Agency to resolve complaints regarding noise and vibration caused by the construction and operation of railways under its jurisdiction as well as public passenger service providers.

all complaints that the community does not believe have been addressed correctly or completely by the GTAA process, would be addressed directly in the community forum. Transport Canada, community and industry participation in that potentially independent forum would help ensure that a reasoned collective decision can be taken on the merit of that complaint, and it could either result in a new noise work programme action, or else be rejected on the basis of a broad agreement.

Nevertheless, it is proposed that GTAA consider, in addition to the proposals made in this report (on the complaints process, CENAC and the process for trials, plus the joint NAV CANADA/Canadian Airports Council voluntary airspace change communications and consultation protocol), if there is a current/future need for a formally designated independent third party to arbitrate between communities and the aviation industry when noise issues cannot be resolved locally. It is noted that it would not be in the control of GTAA to implement such a body. It would require discussion with Transport Canada, and possibly new rules/legislation.

13 Noise reporting and metrics

13.1 Introduction

This area of research investigated how airports report on aircraft noise from noise monitors. It concentrates on how noise information is presented to the public.

13.2 Summary of best practice research

A summary of the research is presented below. More detail, including case studies, is provided in Annex C.

Measurement of aircraft noise

Twenty-two of the 26 airports researched place noise monitors in the vicinity of an airport, either under flight paths or in noise sensitive areas, to make measurements of aircraft noise.

Reporting the measurement of aircraft noise

Four main ways of reporting measurements of aircraft noise were identified by the research – online platforms, reporting of noise monitor data, bespoke noise reports for a given community and noise contours:

- **Online platforms:** Twelve of the airports researched had online platforms with all (except one) providing live and historical noise data. In general, these presented flight tracking data and the location of noise monitors. As aircraft passed a given monitor, some form of colour coding was used to visualise the change in noise levels – typically louder events were presented as being towards the red end of a colour scale, and quieter events towards the green end (see example of for Copenhagen airport below).

Figure 25: Copenhagen's WebTrak system showing a noise event (in red) as registered by a noise monitor

In addition to live data, online platforms are now starting to summarise noise data in a given timeframe. For example, Gatwick's Casper system presents a series of charts (see Figure 26). These can be manipulated by the user to show a specific timeframe and/or noise monitor. Sydney airport uses a simple website to report quarterly on noise monitor data. For a given monitor/community the site provides the hourly

number of noise events above 70dBA, number of noise events at different dBA levels and average noise generated by aircraft types.
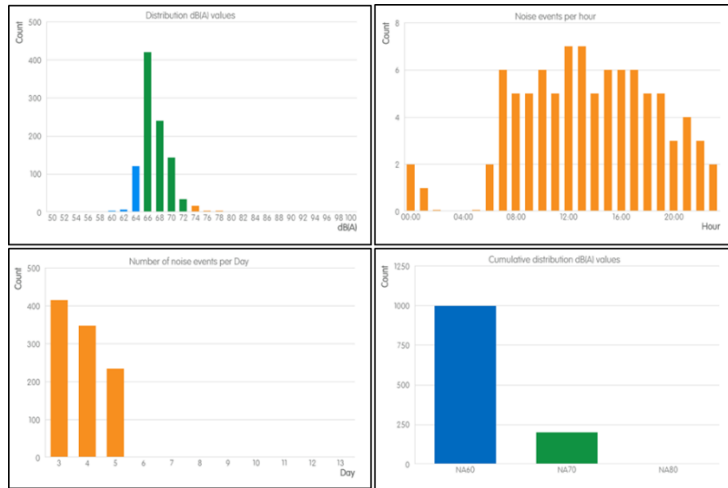
Figure 26: Graphs of noise monitor data from Gatwick's Casper system

- **Traditional noise reports:** Thirteen airports produced traditional 'print friendly' noise reports. These were produced either monthly or annually and typically provided information on noise monitor data only. They focussed on information such as the number of single noise events, average and maximum noise levels, and noise contours. The level of detail in these noise reports varied significantly. For example, Vancouver airport presented charts on night operations, runway use, run-ups, noise concerns and noise monitoring data, all with accompanying explanations. This was particularly useful as it allowed the reader to draw meaningful conclusions from the information presented. Other airports published a series of automatically generated charts per noise monitor.
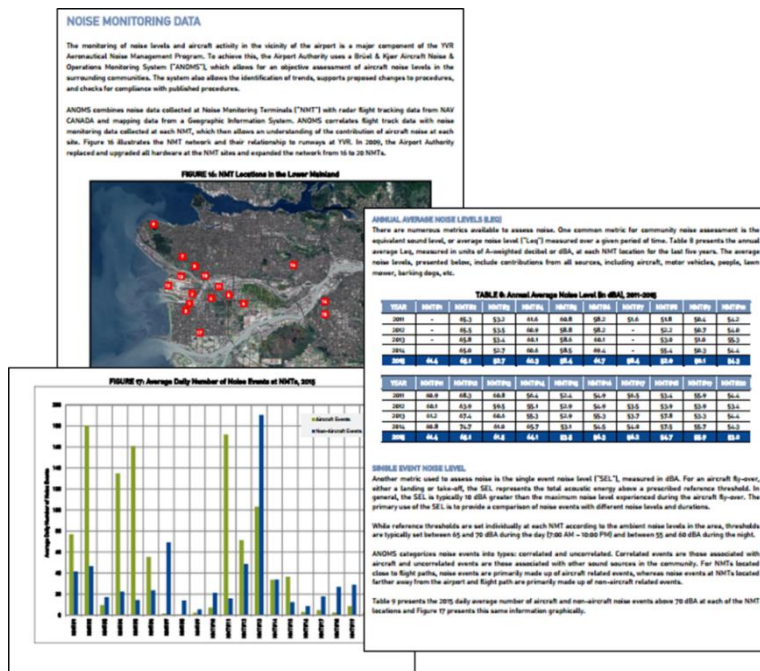
Figure 27: Extract of the noise monitoring data section of Vancouver airport's 2015 noise report[33]

---

[33] Data on average annual noise levels and average number of noise events is presented

- **Bespoke noise reports:** Chicago O'Hare, Heathrow and Sydney place temporary monitors in local communities and produce bespoke noise reports for that area. These report on both aircraft tracks and noise levels. For noise, background noise levels, aircraft noise levels and maximum aircraft noise levels are typically reported upon. Examples from Chicago O'Hare are shown below.

Hourly Noise Level Report
Chicago O'Hare International Airport
Period: October 28, 2015 to November 10, 2015
Site: 2051 - 5420 N. Lowell Avenue
Metric: Aircraft Leq

Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DNL
Oct 28	46	0	0	0	0	41	55	57	56	54	53	54	59	58	59	59	59	59	60	61	56	50	52	52	58
Oct 29	52	47	43	47	54	57		61	59	59	59	57	58	60	59	60	58	60	59	58	54	49	49	51	60
Oct 30	45	37	43	42	51	51	50	59	58	56	60	57	58	59	59	59	58	58	60	59	55	52	53	52	59
Oct 31	46	43	47	43	48	46	45	40	40	50	0	41	49	0	47	56	56	43	56	58	59	57	55	55	57
Nov 1	46	46	44	52	52	55	53	57	58	57	59	58	58	57	57	58	57	60	58	57	54	56	51	46	59
Nov 2	45	48	45	41	46	50	58	58	55	55	58	57	58	58	59	57	59	58	58	57	51	45	44		59
Nov 3	35	0	47	39	42	51	57	59	57	51	58	57	58	56	57	56	59	58	58	56	45	50	50		58
Nov 4	0	0	38	36	40	51	52	53	51	51	58	57	56	59	58	57	57	59	58	57	58	54	46	41	56
Nov 5	36	39	38	39	44																				
Nov 6	44	39	41	41	52																				
Nov 7	38	0	40	0	42																				
Nov 8	46	46	0	0	54																				
Nov 9	43	46	43	44	0																				
Nov 10	42	0	41	50	52																				
Energy Average	45	43	43	45	50																				

Note: ## is aircraft events above 65 dB daytime (...)

Aircraft Noise Events Graph Report (Lmax)
Chicago O'Hare International Airport
Period: October 28, 2015 to November 10, 2015
Site: 2051 - 5420 N. Lowell Avenue

Total Number of Measured Aircraft Noise Events

(Chart: Number of Events vs dBA Max Noise Levels, x-axis 10, 31, 42, 53, 64, 75, 86, 97, 108; y-axis 0 to 700)

Figure 28: Extract from one of Chicago O'Hare's bespoke noise reports[34]

- **Noise contours:** Some airports also produce noise contours, presenting both historical and forecast future noise levels (note – noise contours are often produced by modelling rather than noise monitor data). These are produced for a variety of reasons – statutory obligations, future planning, assessing the impact of new aircraft types/operational changes and noise insulation schemes. Similar to noise monitor data, noise contours usually use traditional noise metrics based upon noise exposure over a given period of time. The exception is Sydney which includes contours based upon the number of events above 70dBA (see Figure 29).

---

[34] Data shows the hourly noise levels for the 2-week monitoring period and the total number of measured aircraft noise events.

Figure 29: Sydney airport N70 contours for an average day in 1998

Noise metrics

A variety of noise metrics were identified by the research. These are used to report on single events (e.g. the overflight of an aircraft) and noise exposure (e.g. noise exposure over a given period of time). The main trends and common issues are summarised below. *It is noted that the intention of this section is not to critique the use of specific noise metrics.*

- **Traditional noise metrics:** The majority of airports report noise using traditional acoustic measures such as decibels. A variety of metrics are used to report on aircraft noise. Some are internationally recognised such a Leq (equivalent sound level of aircraft noise), while others are national metrics such as the Australian Noise Exposure Index (ANEI), often based on variations of internationally recognised metrics. Traditional noise metrics are often regarded as difficult to understand by the general public as they are logarithmic and can be difficult to equate to an individual's perception of a noise event.

- **Number above metrics:** Sydney airport reports on the number of aircraft events (measurements) above 70 decibels (dBA), referred to as the N_{70} metric. The advantage of this metric is that it is simple to understand and gives an indication of how noise would change if traffic increased or decreased. For example, if the number of flights doubled, the number of events above 70dBA would double – this of course relies on all things being equal and does not account for changes in traffic mix. A weakness of this metric is that it treats all events above 70dBA the same. Conversely it is argued that this does not matter as long as the 70dBA threshold reflects the point at which aircraft noise becomes an annoyance[35].

- **Challenges:** As per above, establishing a suitable metric to report on aircraft noise is challenging. Useful insight into this challenge is provided in a survey of noise attitudes

---

[35] Reference: UK CAA Environmental Research and Consultancy Department
ERCD REPORT 0904, Metrics for Aircraft Noise, 2009.

published by the UK CAA. One of its aims was to examine whether LAeq was still an appropriate measure of annoyance to aircraft noise around major airports. The study found that, compared to other noise indicators, the traditional LAeq metric correlated best with annoyance with aircraft noise, but the public struggled to understand the metric. It therefore summarised that '*there is, therefore merit in considering greater use of Nx [number above] metrics as supplemental indicators to help portray noise exposure, but recognising that evidence-based decisions should continue to use LAeq*'[36].

13.3   Toronto Pearson today

Reporting measurement of aircraft noise

Toronto Pearson has a WebTrak online tool to present live noise monitor data to users from each of the 17 noise monitors in the vicinity of the airport. The Leq dB measurements are displayed at each site and are complimented by a colour scale. The scale ranges from 45dB (green) to 90dB (red). The airport has been working with CENAC to assess locations for additional temporary noise monitoring terminals.
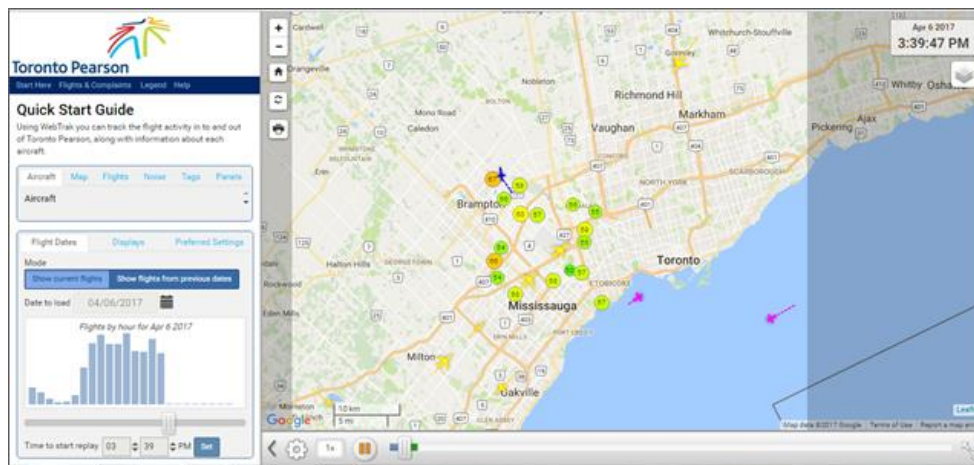

Figure 30: Noise monitor data presented on Toronto Pearson airport's WebTrak system

Toronto Pearson uses the Noise Exposure Forecast (NEF) metric for noise contours. This contour is recommended by Transport Canada and is used to define the Airport Operating Area (see the land use planning section).

---

[36] UK CAA survey of noise attitudes 2014: Aircraft, CAP 1506, 2017.

13.4　Potential new programmes and initiatives for GTAA to pursue

Objective

Focus the use of noise monitor data on gathering information on community concerns about aircraft noise.

Ref	Potential new programmes and initiatives
NM1	Ensure that reporting on noise monitor data is understandable to local communities and is focussed on identifying potential issues and tangible solutions.

Table 34: Potential new programmes and initiatives for noise metrics and reports

The rationale for potential new programmes and initiatives is explained below:

- **General:** It is common practice to report on data from noise monitors. The challenge is to present this data in a way that is understandable to communities, leads to the identification of any issues and, as appropriate, the need for further action. The GTAA has recently undertaken a review of locations for temporary noise monitoring terminals. These should be deployed when data is genuinely needed to support the understanding of issues. Similar to the handling of noise complaints, it should be ensured that the reporting on noise monitor data is understandable to local communities and is focussed on identifying potential issues and tangible solutions. This includes agreeing with communities what outputs and metrics are meaningful to them, and a standard methodology for analysing noise monitor data

- **Understandable outputs:** Community requirements for the reporting of noise monitor data should be identified through the GTAA community forum, CENAC. For example, maximum noise levels, noisiest aircraft types, noise by time of day, changes in noise levels, number of measurements above a certain noise level.

- **Understandable noise metrics:** Similar to the UK CAA survey of noise attitudes 2014 report, it is proposed that a supplementary metric is used alongside traditional metrics, such as Leq which is reported on the Toronto Pearson WebTrak system. The supplementary metric could be the N_{70} metric, or similar, used at Sydney to report the number of aircraft noise events above 70 decibels.

- **Standard methodology for analysing noise monitor data:** To aid the identification of potential issues, GTAA should establish a standard method for analysis noise data. An example process is shown in Figure 31.
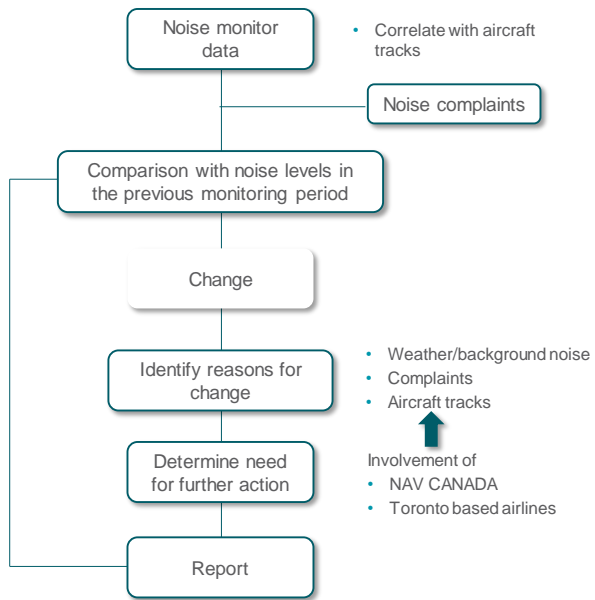
Figure 31: Example process for analysing data from noise monitors

14 Summary & grouping of potential new programmes and initiatives

14.1 Introduction

This section summarises the potential new programmes and initiatives identified in sections 3 to 13, and groups them into a manageable set of activities. All full list can be found in Annex B.

14.2 Identification of potential new programmes and initiatives for GTAA to pursue

> The potential new programmes and initiatives presented in this report have primarily been developed on the basis of best practices in noise management at other comparator airports, the existing regulatory environment and operations at Toronto Pearson, and our best judgement as to which practices could provide a meaningful benefit to local communities and/or GTAA.
>
> An assessment of the financial costs and resources associated with any potential new programmes or initiatives was not in the scope of this study.

14.3 Summary of potential new programmes and initiatives for GTAA to pursue

The potential new programmes and initiatives identified for GTAA to pursue are summarised below:

- **Quieter fleet initiatives:** Most of the airports researched have measures to encourage airlines to use the quietest aircraft types in their fleet. It is proposed that GTAA work with airlines to encourage the use of the quietest fleet possible for a given operation (e.g. long-haul, short-haul, regional) through a combination of voluntary initiatives, operating restrictions and, as appropriate, financial mechanisms. Specifically, this should include, depending on the current/future fleet mix, more stringent restrictions on the noisiest aircraft types at night (for example Chapter 3 aircraft) and a programme to retrofit A320 family aircraft with wake vortex generators to reduce the noise generated by this type on approach.

  A number of airports in Europe use financial mechanisms, in particular a noise charge added to the landing/take-off fee, to incentivise airlines to use the quietest aircraft types possible. The implementation of these mechanisms could take considerable time and consultation with airlines. Therefore, at this stage, it is proposed that GTAA establish a programme to determine how financial mechanisms could be used to incentivise the quietest aircraft types should they be required in the future.

- **Night flight restrictions:** Over half of the airports researched have a defined night period where a more stringent set of operating rules is applied compared to the day-time. The intention of such restrictions is to reflect the need for a quieter airport operation during those hours where residents in affected local communities could be expected to be sleeping. Toronto Pearson has such a period; however, compared to other airports, it starts later, and with few exceptions, is shorter in duration. Therefore, it is proposed that the current night period is extended. Given that the current night-flight regime at Toronto Pearson regulated by Transport Canada, in the first instance it is proposed that GTAA work with industry and community stakeholders to agree to a separate set of rules in the hours adjacent to the night period.

Another practice is to manage the night flights in terms of number of take-offs/landings *and* overall aircraft noise. Toronto Pearson has an annual night-flight budget, albeit with a unique practice amongst other airports in this study with night-time movement limits of increasing in line with annual passenger growth. Assuming the continuation of this practice, it is proposed that GTAA implement a programme to ensure that the total amount of noise from aircraft at night does not increase – for example through a night quota scheme and/or night-time noise contours.

- **Runway schemes:** Many of the airports researched operate runway schemes for noise purposes. Each scheme is broadly intended to provide some form of predictability of when communities will be overflown, focus aircraft on the least populated/unpopulated areas and/or share noise amongst those living under the flight paths This practice is most common at night when traffic levels are lower and the runways can be operated flexibly. The GTAA operates a night-time preferential runway scheme from midnight to 0630 each day. The scheme was designed to impact the fewest residential neighbourhoods. As part of their Noise Mitigation Initiatives Engagement Plan, GTAA and NAV CANADA are reviewing the existing night-time preferential runway scheme and exploring opportunities for a summer time weekend runway alternation scheme. These ideas are still under review and no decisions have been made. Any permanent changes to how the runways may be used would need to go through full public consultation before being implemented.

  Research shows that it is not possible to provide 100 percent conformance with any runway scheme. For both the current night-time preferential runway scheme, and any future schemes, it is therefore important that GTAA set stakeholder expectations by identifying expected levels of conformance. Achievement against these and reasons for non-conformance, should be reported regularly.

- **Ground and gate operations:** It is understood that there are currently limited complaints about ground noise at Toronto Pearson. Therefore, initiatives have been proposed to align Toronto Pearson with typical best practice at other airports without being too onerous. These are to start night-time restrictions for ground running earlier and monitor compliance, and introduce time restrictions on the use of auxiliary power units (APUs) while parked at stands equipped with ground power units (GPU) and preconditioned air (PCA).

- **Noise Abatement Procedures:** Airports operate noise abatement procedures to manage the noise generated from aircraft during the approach and departure phases of flight. Research identified some arrival noise abatement procedures with a proven noise benefit that could be investigated further by Toronto Pearson – (i) a voluntary agreement with airlines not to apply reverse thrust at night, (ii) Low Power Low Drag (LPLD) procedures which reduce noise by safely delaying the extension of flaps and undercarriage, and (iii) investigating options for Continuous Descent Approaches (CDA) which reduce noise by limiting the amount of time an aircraft remains in level flight while on approach. As CDAs can be difficult to implement, both in busy traffic and in terms of achieving limited amounts of level flight, in the first instance it is expected that they would be implemented at night.

Given the amount of land dedicated to industrial use around Toronto Pearson, there could be some merits in investigating if Noise Abatement Departure Procedure 2 (NADP2) provides greater noise benefits to residential communities than NADP1[37].

In addition to procedures, GTAA should ensure co-ordinated activity by all industry partners on noise activities at Toronto Pearson. This includes (i) forming a single industry body to be the focal point of the operational, policy and best practice aspects of all the programmes and initiatives identified in this report (including nominating one person from each industry stakeholder organisation to be responsible for oversight of noise related activities at Toronto Pearson), (ii) aligning and spreading best practice through a document similar to the voluntary industry code of practice developed in the UK and (iii) developing a standard methodology for future noise related trials.

- **Fly Quiet programmes:** A small number of airports have Fly Quiet programmes. These are voluntary initiatives that publicly compare airline performance against a number of noise related metrics. It is proposed that GTAA establish its own Fly Quiet programme as one way of encouraging airlines to adopt new quieter aircraft, or fly existing aircraft in a manner which minimises their noise impact on the communities surrounding the airport. As a precursor to Fly Quiet, GTAA will need to establish a mature set of candidate metrics that are accepted by airline and community stakeholders. This will take time so, in the interim, GTAA could establish a Fly Quiet programme like that operated at Vancouver.

- **Land use planning:** Like many of the airports researched, and in accordance with guidelines set by Transport Canada and outlined in TP1247E Land Use in The Vicinity of Aerodromes, Toronto Pearson has a defined noise contour within which noise sensitive land uses (e.g. residential properties) should not be located. Transport Canada's guidelines for development of compatible land uses in the areas surrounding airports use the Noise Exposure Forecast (NEF). It is Transport Canada's recommendation that areas within a 30 NEF contour or above should not be used for sensitive land use such as new residential development. Accordingly, Toronto Pearson has established an Airport Operating Area (AOA) which uses well-defined natural and manmade boundaries to approximate the 30 NEF contour on the ground. The Region of Peel, with the cities of Brampton and Mississauga, and the City of Toronto have included the AOA in their Official Plans and have approved associated policies that limit incompatible land uses within these areas for new developments. For infill developments, GTAA has worked with local and regional planning authorities to establish a voluntary compatible future land use plan, including the mitigation of noise impacts through appropriate building design features as well as ensuring notice to buyers of potential impacts is given. Additional schemes[38], similar to the Part 150[39] airport noise compatibility planning programmes undertaken in the United States, could be contemplated.

---

[37] NADP1 and NADP2 are guidance on departure procedures published by the International Civil Aviation Organisation (ICAO). NADP1 is intended to provide noise reduction for noise-sensitive areas in close proximity to the airport (but provides more for areas more distant from the airport than NADP2). NADP2 provides noise reduction to areas more distant from the airport (but provides more for areas in close proximity to the airport than NADP1).

[38] Any initiative would need to be voluntary as it would be outside of the current regulatory environment.

[39] The Federal Aviation Administration Part 150 (Airport Noise Compatibility study is a voluntary program under which airport operators can conduct an analysis of noise exposure associated with airport operations, identify land uses that are incompatible with specified noise levels, and recommend a program of alternatives for mitigating these impacts or eliminating incompatible land uses.

The majority of airports researched currently have, or previously had, schemes to insulate noise sensitive buildings (e.g. residential properties) close to the airport. These schemes were initiated by national legislation, voluntary actions, airport development and availability of government funding. Based upon Transport Canada rules, GTAA is under no obligation to provide noise insulation to buildings within the AOA, this responsibility is placed on developers. However, as so many of the airports researched have these schemes, it is proposed that GTAA examine the conditions under which it may consider a voluntary noise insulation programme. This could include aligning with practices at other major international airports, changes in flight paths that extend the NEF 30 noise contour beyond the existing AOA or a scheme to support future development.

- **Noise Complaints:** Like most of the airports researched, Toronto Pearson has a process for handling noise complaints. It is proposed that GTAA focus this on enabling tangible actions to improve the noise environment. The day-to-day investigation of complaints and any subsequent follow-up actions should be supported through closer working with operational staff in NAV CANADA and the main Toronto based airlines.

It is also proposed that, using a combination of new material and material already published on the GTAA website, GTAA produce a formal policy. This should include (i) how to make a complaint, (ii) the information required for GTAA to make a thorough investigation of the complaint, (iii) complaints handling and use of personal data, (iv) how complaints are investigated, (v) how complaints will be responded to (including the type of information the airport will typically provide, what happens when no new information can be provided and how the airport responds to frequency complainants) and (vi) an explanation of how complaints are reported and used to investigate improvements to the noise environment. Any new policy will need to balance giving the community as much flexibility as possible in the way they register genuine complaints about aircraft noise, with the benefits of the deeper analysis of individual complaints that could be undertaken if GTAA staff could process complaints more efficiently through a more standardised complaints submission process.

In addition to the day-to-day review of individual complaints, it is proposed that GTAA undertake a quarterly review of complaints. The objective will be to identify and understand any patterns in complaints, identify any practicable follow-up actions and explain these to the public. A possible process is shown in Figure 32.
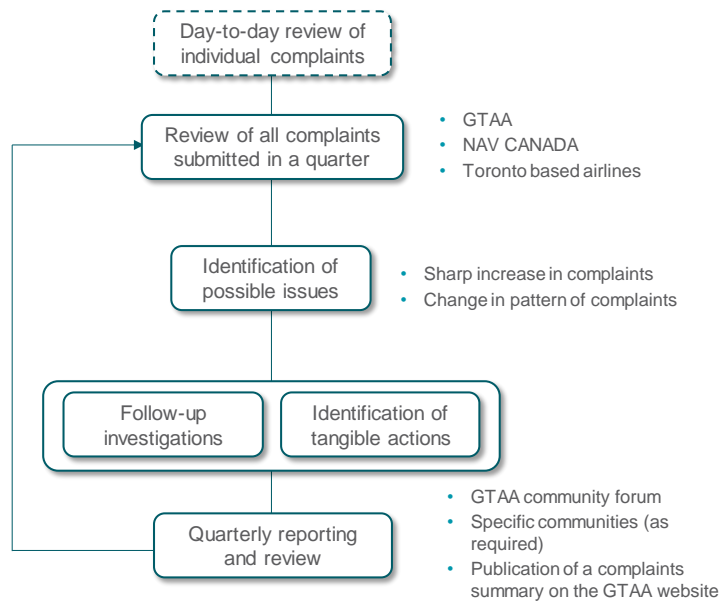
Day-to-day review of
individual complaints

Review of all complaints
submitted in a quarter
- GTAA
- NAV CANADA
- Toronto based airlines

Identification of
possible issues
- Sharp increase in complaints
- Change in pattern of complaints

Follow-up
investigations

Identification of
tangible actions

Quarterly reporting
and review
- GTAA community forum
- Specific communities (as
  required)
- Publication of a complaints
  summary on the GTAA website

Figure 32: Proposed process for reviewing all complaints submitted in a quarter

- **Community outreach:** Like many other airports, Toronto Pearson has a community forum: the Community Environment and Noise Advisory Committee (CENAC). The overall aim of the initiatives proposed for this area is to ensure that, while people will continue to be overflown and dislike aviation noise, CENAC is a truly representative body where all public concerns can be raised and turned into tangible actions to improve the noise environment. This will include CENAC developing its own noise work programme directly linked to community concerns. A considerable amount of forum activity will be orientated around the work plan and understanding/resolving issues.

It should be ensured that the wider community (presently non-CENAC members) is involved in identifying and resolving the concerns to be addressed in by the annual work programme. This could be achieved, for example, by giving the community members of CENAC a wider role in engagement with their communities or by expanding the membership to increase the representativeness of participants. This could be structured around meetings in their local communities (i) pre-CENAC meetings to identify concerns, and (ii) post-CENAC meetings to report back on what action is being taken to help. To be truly successful in achieving this aim, CENAC and the community noise groups in the Toronto area (e.g. T.A.N.G.) will also need to be actively engaged with one another. It is also noted that some airports have established new community forums when there has been a need to increase the level of involvement from communities or where the existing forum has not been perceived as effective or representative.

Over half of the community forums identified by the research are not chaired by the airport, while others operate with a degree of independence from the airport. For example, the San Francisco Airport/Community Round Table is a voluntary committee, and the Chicago O'Hare Noise Compatibility Commission (ONCC) is an inter-governmental agency. At Gatwick, the Noise Management Board has an independent Chairperson who works closely with both the community and industry, and as necessary, arbitrates between the two. Gatwick facilitates the Noise Management Board, with an independent secretariat and third party providing technical support. An

additional independent consultant, paid by the airport, advises the community members. Accordingly, GTAA should consider if giving CENAC more independence would support one of the aims in the terms of reference of this study of enhancing community engagement. It is emphasised that in all the examples cited above, both the airport and other industry stakeholders maintain a strong involvement in the forum and a commitment to progress agreed actions.

An indicative structure for the forum, taking account of the proposals above is shown in Figure 33. This includes working groups to deal with specific matters relating to the work programme and the suggestion for an executive of one community and one industry member to work closely with the Chairman.
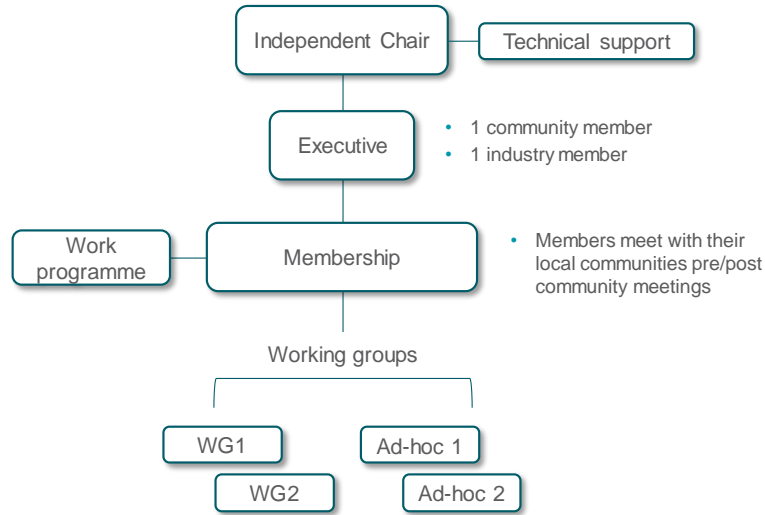

Figure 33: Indicative structure for the community forum

- **Independent noise ombudsman:** A small number of countries researched have a noise ombudsman, an independent body or person responsible for oversight and intervention in noise activities. In the current regulatory environment, Transport Canada places an emphasis on an airports noise complaints process and community forum successfully resolving concerns about aircraft noise. When this does not occur, there is no third party with a statutory responsibility to arbitrate on the matter[40]. Instead individuals/communities raise the matter with Transport Canada, local politicians and/or to GTAA staff outside of the noise management office.

  Ideally, the proposals made for CENAC earlier would ensure that all complaints that the community does not believe have been addressed correctly or completely by the GTAA process, would be addressed directly in the community forum. Transport Canada, community and industry participation in that potentially independent forum would help ensure that a reasoned collective decision can be taken on the merit of that complaint, and it could either result in a new noise work programme action, or else be rejected on the basis of a broad agreement. Nevertheless, it is therefore proposed that GTAA consider if, in addition to the proposals made in this report (and the joint NAV CANADA/Canadian Airports Council voluntary airspace change communications and consultation protocol), there is a current/future need for a formally designated independent third party to arbitrate between communities and the

---

[40] By comparison, the Canada Transportation Act authorises the Canadian Transportation Agency to resolve complaints regarding noise and vibration caused by the construction and operation of railways under its jurisdiction as well as public passenger service providers.

aviation industry when noise issues cannot be resolved locally. It is noted that it would not be in the control of GTAA to implement such a body. It would require discussion with Transport Canada and possibly new rules/legislation.

- **Noise reporting and metrics:** It is common practice to report on data from noise monitors. The challenge is to present this data in a way that is understandable to communities, leads to the identification of any issues and, as appropriate, the need for further action. GTAA has recently undertaken the review of locations for temporary noise monitoring terminals. These should be deployed when data is genuinely needed to support the understanding of issues.

Similar to the handling of noise complaints, it should be ensured that the reporting on noise monitor data is understandable to local communities and is focussed on identifying potential issues and tangible solutions. This included agreeing with communities what outputs and metrics are meaningful to them, and a standard methodology for analysing noise monitor data (see Figure 34).

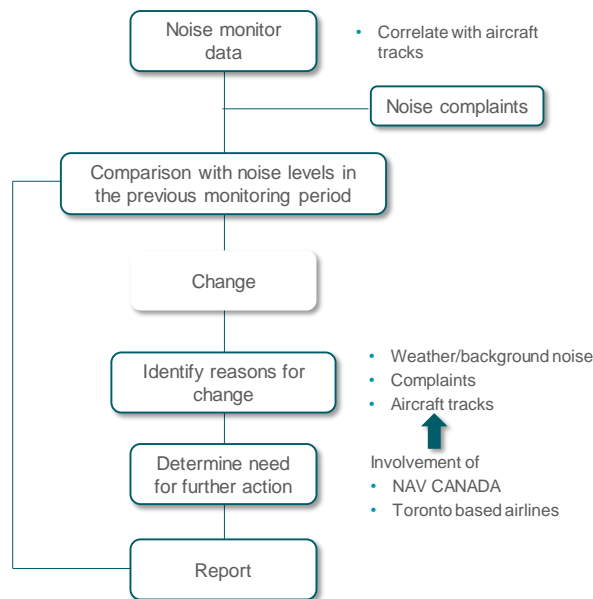**Figure 34: Example process for analysing data from noise monitors**

14.4 Grouping of potential new programmes and initiatives for GTAA to pursue

The programmes and initiatives summarised above have been grouped into a manageable set of activities. The groupings are summarised in Figure 35.
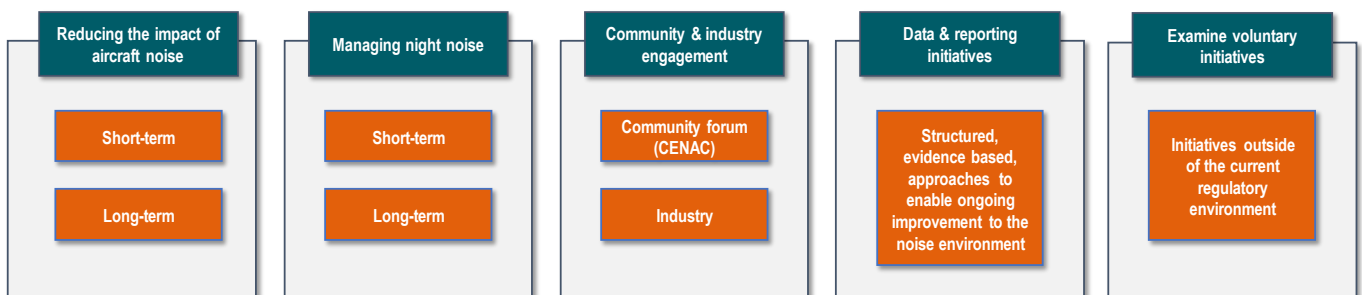

Figure 35: Grouping of potential new programmes and initiatives for GTAA to pursue – overview

The individual proposals that fall into each of these groupings are shown in Figure 36 (see the following pages). A summary of each grouping in Figure 36 is as follows:

- **Reducing the impact of aircraft noise:** This group of activities aims to directly reduce the impact of aircraft noise – either by reducing the amount of noise generated by an aircraft, or providing some form of predictable break from aircraft noise through runway schemes. Short-term activities are either already underway or envisaged to be achievable/have significant progress made in the next 1-2 years. These are intended to provide 'quick wins' to improve the noise environment. Long-term proposals are more complex to implement, potentially requiring considerable investigation, new technology, consultations, trials and changes to existing operational procedures.

- **Managing night noise:** The objectives of these activities are to ensure that the total amount of noise from aircraft at night does not increase and to extend the time during which night noise impacts are managed. Again, the short-term activities are intended to produce some small 'quick wins' in the next 1-2 years. The long-term activities are the main programmes/initiatives aimed at managing night-noise at Toronto Pearson. These will require considerable consultation with communities, investigations and changes to existing procedures.

- **Community & industry engagement:** The main objective of these activities is to enhance community engagement, focus the work of CENAC on addressing community concerns about aircraft noise and involve the wider community (e.g. non-CENAC members) in understanding/resolving these concerns. Engagement with industry partners is another objective to ensure co-ordinated activity by all industry partners on noise activities at Toronto Pearson.

- **Data & reporting initiatives:** These activities are aimed at putting structured, evidence based, approaches in place to address issues and enable ongoing improvement to the noise environment around Toronto Pearson. They include using operational data, noise complaints and measurements of aircraft noise to enable tangible improvements in the noise environment.

- **Examine voluntary initiatives:** The objective of this grouping is to examine the need for voluntary initiatives outside of the current regulatory environment to leverage improvements in the noise environment. If taken forward, these activities will require considerable consultation with airlines, Transport Canada and local authorities. Therefore, the intention is to launch these programmes in the short-term so the concepts, and the understanding amongst the relevant stakeholders, are mature enough to progress these activities quickly should they be required in the future.

Reducing the impact of aircraft noise

Short-term

- Investigate summer time weekend runway alternation schemes (PR1/PR3)
- Retrofit A320 family aircraft with vortex generators (QF2)
- Investigate lower power low drag operations (NAP2)
- Auxiliary power unit restrictions (GG2)

Long-term

- Investigate opportunities to use the runways to provide noise relief during off-peak periods on weekdays (PR2)
- Investigate continuous descent approach operations (NAP2)
- Investigate if departure procedure NADP2 has benefits of NADP1 for residential communities (NAP3)

Managing night noise

Short-term

- Investigate night-time preferential runway schemes (PR1/PR3)
- Voluntary night-time ban on use of reverse thrust (NAP2)
- More stringent restrictions on the noisiest aircraft types at night (QF1)
- Earlier start time for ground-run restrictions (GG1)

Long-term

- Extend the period during which night-time noise is managed (NF1)
- No increase in total night-time noise (NF2)

Community & industry engagement

Community forum (CENAC)

- Annual work programme aligned to community concerns (CENAC1)
- Ensure wider community involvement (CENAC2)
- Consider increasing the independence of CENAC from GTAA (CENAC3)

Industry

- Industry forum with oversight of operational & policy activities related to noise (NAP1)
- Day-to-day complaints investigation supported by NAV CANADA/main Toronto airlines (NC1)
- Voluntary industry code of practice (NAP4)
- Standard trials methodology (NAP5)

Data & reporting initiatives

- Formal complaints policy (NC2)
- Quarterly review of noise complaints (NC3)
- Focus reporting on aircraft noise on tangible actions (NM1)
- Fly Quiet programme (MR1, MR2)
- Report compliance with preferential runway schemes (PR3)
- Benchmarking noise insulation schemes used at other airports (LUP2)

Examine voluntary initiatives

- Programme to determine how financial mechanisms could be used to incentivise quieter fleets if required in the future (QF3)
- Consider the merits of a voluntary land-use compatibility plan with communities and local authorities (LU1)
- Examine the conditions under which a voluntary noise insulation scheme would be considered (LU2)
- Consider the need for a designated third party to arbitrate where a noise issue has not been resolved satisfactorily (NO1).

Figure 36: Grouping of potential new programmes and initiatives for GTAA to pursue

A   Questions investigated by the best practice research

Quieter fleet initiatives

Objective: Identify incentive programmes used at other airports to encourage airlines to adopt/expedite the purchase of quieter fleets and/or pursue known airframe noise issues such as those that occur with some A320 family aircraft.

Areas of investigation:

- A320 family: Are/how are other airports incentivising the retrofit of A320 family aircraft with vortex generators?
- Incentives: What incentive programmes are used at other airports to encourage airlines to adopt/expedite the purchase of quieter fleets?
- Restrictions: Are/what types of restrictions are placed on the noisiest aircraft types/chapters?

Night flight restrictions

Objective: Identify practices in night-time operating restrictions at other airports.

Areas of investigation:

- Duration: What are the durations of the night-time at comparator airports?
- Types of scheme: What types of night-flight schemes are in place at the comparator airports?
- Where possible, identify (i) any penalties for non-conformance with night-flight restrictions, (ii) management of aircraft not scheduled to operate in the night period, but running later/early into the night period and (iii) annual number of night flights at comparator airports.

Runway schemes

Objective: Identify runway schemes at other airports that are used for the purpose of providing periods of respite/relief from aircraft noise.

Areas of investigation:

- Day-time: What types of runway schemes are used during the daytime? What is their purpose/rationale?
- Night-time: As per above but for night-time.
- Reporting: Is adherence reported to the public / how is this reported?

Ground & gate operations

Objective: Identify practices in noise operating restrictions for aircraft on the ground/at the gate at other airports.

Areas of investigation:

- Engine run-up restrictions: How many of the comparator airports have engine run-up restrictions? How do these compare to Toronto in terms of stringency (e.g. time of day/duration), location (i.e. having specific locations on the airfield (including ground-run pens)) and reporting?

- APU usage: How many of the comparator airports have restrictions on the amount of time APUs can be used on stand (on arrival and pre-departure)?

- Other practices: Where possible, identify any other practices (for example, reduced engine taxi, night-time taxi-routings, monitoring systems).

Noise abatement procedures

Objective: Identify noise abatement procedures applied at other airports.

Areas of investigation:

- Arrivals: What are the types of arrival noise abatement procedures used at other airports? For example, CDAs (including when used), minimum height requirements, steeper approaches, use of PBN to avoid populations.

- Departures: What are the types of departure noise abatement procedures used at other airports? For example, CCOs (including when used), minimum height requirements, use of NADP1 or 2, maximum lateral deviations from the route centrelines, use of PBN to avoid populations.

- Other procedures: For example the use of early turns.

- Trials: Where possible, identify any best practices in communicating trials. For example, goals, monitoring/reporting and implementation.

Fly Quiet programmes

Objective: Determine the benefits and impacts of Fly Quiet scoring and reward programmes in place at other airports. *Note - as few airports have Fly Quiet programmes we propose to also look more broadly at the type of metrics airports report upon.*

Areas of investigation:

- Metrics: What types of metrics are typically monitored and reported upon (publicly) by airports?

- Reporting: How are such metrics reported to the public (e.g. website, reports (monthly/quarterly/annual), Fly Quiet programmes, comparison of airline performance)?

- Fly Quiet programmes: For airports with Fly Quiet programmes, identify the details of the programme (e.g. metrics, how the metrics are collected (e.g. ANOMS), how reported/frequency, feedback to airlines, incentives/penalties).

- Violations: Identify how violations with NAPs/restrictions are addressed (e.g. penalties/fines).

Land use planning

Objective: Identify how other airports deal with pressures for residential developments in areas deemed 'incompatible' due to noise exposure.

Areas of investigation:

- Defining the AOA: How do other airports define the equivalent of the Toronto Airport Operating Area (AOA)? For example, an area within a defined noise contour.
- Rules within the AOA: What rules apply for development in these areas?
- Noise insulation schemes: What criteria/mitigations are used for noise insulation schemes? Where possible, identify what criteria/mitigations are used for noise insulation schemes within the equivalent of the AOA.
- Complaints within the AOA: Where possible, identify how complaints from within the AOA about aircraft noise are treated? *Note – this question will also be investigated under 'complaints'.*

Noise complaints

Objective: Review the noise complaints process/policy at other airports.

Key questions to answer:

- Complaints process: What are the main elements of the complaints process at other leading airports worldwide?
- Complaints policy: What are the main elements of the complaints policy at other airports? Investigate how high frequency complainants are engaged.
- Complaints reporting: What reports/media are used to report on the numbers/locations of complaints?
- Responsibility: How far (and high) from the airport are complaints handled? This is of interest to GTAA.
- Complaints within the AOA (taken from the land-use planning section): Where possible, identify how complaints from within the AOA about aircraft noise are treated?

Community outreach

Objective: Identify the best practices, structures and processes of committees similar to CENAC.

Key questions to answer:

- Existence: Identify existence of committees like CENAC that exist at other airports.
- Governance/membership: Responsible body (e.g. APT, regulator, government), Chairmanship and typical membership groups (e.g. main aviation stakeholders, local councils, local resident groups (elected official vs resident representatives).
- Terms of reference: Broadly identify the remit of the group and working arrangements.
- Activities/successes: Where possible, broadly identify the types of activities that take place/successes in improving the noise environment around the airport.
- Identify community outreach activities at other airports and compare to Toronto.

Independent noise ombudsman

Objective: Explore the role of the independent noise ombudsman around the world.
Areas of investigation:
• What are the responsibilities of the noise ombudsman?
• Which countries have a noise ombudsman? *Currently thought to be Australia and the United States, as well as the Independent Aviation Noise Authority proposed by the UK Airports Commission.*

Noise reporting and metrics

Objective: Identify best practices in noise metrics and reporting to reflect the current noise environment.
Areas of investigation:
• Metrics/measures: What noise metrics/measures do airports use to present noise monitor data to the community? Judge how meaningful these are to the general public.
• Reporting: How is noise monitoring data reported to the community? Judge how meaningful these are to the general public.

B   Summary of potential programmes and initiatives

The potential programmes and initiatives identified in sections 3 to 13 are listed below.

Quieter fleet initiatives

Objective
Encourage airlines to use the quietest fleet possible for a given operation (e.g. long-haul, short-haul, regional) through a combination of voluntary initiatives, operating restrictions and, as appropriate, financial mechanisms.

Ref	Potential new programmes and initiatives
QF1	Investigate more stringent restrictions on the noisiest aircraft types at night.
QF2	Establish a programme to retrofit A320 family aircraft operating to/from Toronto Pearson with vortex generators.
QF3	Establish a programme to determine how financial mechanisms could be used to incentivise the use of the quietest aircraft types, should they be required in the future.

Night flight restrictions

Objective
Extend the time over which night noise impacts are managed and ensure that the total amount of noise from aircraft at night does not increase.

Ref	Potential new programmes and initiatives
NF1	Extend the period during which night noise impacts on communities are managed.
NF2	Implement a programme to ensure that the total amount of noise from aircraft does not increase in the night-period/adjacent hours.

Runway schemes

Objective
Continue to investigate opportunities to use the runways at Toronto Pearson to equitably share, or provide relief from, aircraft noise.

Ref	Potential new programmes and initiatives
PR1	Continue to investigate night-time preferential runway schemes and summer time weekend runway alternation schemes aimed at sharing noise.
PR2	Identify opportunities to use the runways to provide relief from aircraft noise during off-peak periods on weekdays.
PR3	For current (and any future) runway schemes operated at Toronto Pearson, define expected levels of conformance, and implement a mechanism for regularly reporting adherence/reasons for non-adherence.

Ground and gate operations

Objective
Align ground run and APU procedures at Toronto Pearson with typical practices applied at other airports.

Ref	Potential new programmes and initiatives
GG1	Apply the night-time restrictions for ground running earlier.
GG2	Implement APU restrictions on stands equipped with GPU/PCA.

Noise Abatement Procedures

Objective
Reduce the noise generated by arriving and departing aircraft.

Ref	Potential new programmes and initiatives
NAP3	Establish an industry group to be the focal point for the operational and policy aspects of the proposed programmes and initiatives identified in this report.
NAP1	Investigate options for additional low power/low noise procedures such as Continuous Descent Approaches, Low Power Low Drag operations and a voluntary night-time ban on the use of reverse thrust to improve the noise environment around Toronto Pearson.
NAP2	Investigate if Noise Abatement Departure Procedure 2 (NADP2) provides greater noise benefits to residential communities than NADP1.
NAP4	With other industry partners develop a voluntary industry code of practice for noise abatement procedures at Toronto Pearson.
NAP5	Develop a standard methodology for future trials influencing the noise environment around Toronto Pearson.

Fly Quiet programmes

Objective
Establish a Fly Quiet programme as one way of encouraging airlines to adopt new quieter aircraft, or fly existing aircraft in a manner which minimises their noise impact on the communities surrounding the airport.

Ref	Potential new programmes and initiatives
FQ1	As a precursor to a Fly Quiet programme, establish a mature set of metrics that measure aircraft noise performance.
FQ2	Implement a GTAA 'Fly Quiet' programme to compare airline performance across a number of noise metrics.

Land use planning

<table>
<tr><td colspan="2" align="center">**Objective**</td></tr>
<tr><td colspan="2">*GTAA to examine the conditions under which it will undertake voluntary land use planning activities that go beyond the scope of the current regulatory environment stipulated by Transport Canada.*</td></tr>
</table>

Ref	Potential new programmes and initiatives
LU1	In addition to the current (Transport Canada) regulatory environment for land use planning, GTAA to consider the additional merits of working with local communities and regional/local authorities to agree to a voluntary compatible future land use plan.
LU2	GTAA to examine the conditions under which it may consider a voluntary noise insulation programme.

Noise Complaints

<table>
<tr><td colspan="2" align="center">**Objective**</td></tr>
<tr><td colspan="2">*Focus the complaints handling process on enabling tangible actions to address the causes of noise complaints from the community.*</td></tr>
</table>

Ref	Potential new programmes and initiatives
NC1	Appoint points of contact in NAV CANADA and the main Toronto based airlines to support the day-to-day investigation of complaints.
NC2	Publish an updated noise complaints policy.
NC3	Implement a quarterly review of complaints with the objective of understanding any patterns in complaints and identifying follow-up actions to address them.

Community outreach

<table>
<tr><td colspan="2" align="center">**Objective**</td></tr>
<tr><td colspan="2">*Enhance community engagement by focusing the work of CENAC on addressing community concerns about aircraft noise. In doing so, ensure the wider community (non-CENAC members) is involved in identifying and resolving the concerns.*</td></tr>
</table>

Ref	Potential new programmes and initiatives
CENAC1	Enhance community engagement by focussing the work of CENAC on addressing community concerns about aircraft noise through an annual work programme.
CENAC2	Ensure the wider community (non-CENAC members) is involved in identifying and resolving the concerns to be addressed by the annual work programme.
CENAC3	Consider if increasing the independence of CENAC from GTAA would enhance community engagement.

Independent noise ombudsman

Objective
Consider the need for a designated independent third party to arbitrate where the community feels a noise issue has not been resolved satisfactorily.

Ref	Potential new programmes and initiatives
INO1	GTAA to consider, in addition to the proposals made in this report, the need for a designated third party to arbitrate where the community feels a noise issue has not been resolved satisfactorily.

Noise reporting and metrics

Objective
Focus the use of noise monitor data on gathering information on community concerns about aircraft noise.

Ref	Potential new programmes and initiatives
NM1	Ensure that reporting on noise monitor data is understandable to local communities and is focussed on identifying potential issues and tangible solutions.