Billy Bishop
Toronto City
Centre Airport

PORTER AIRLINES PROPOSAL REVIEW

INTERIM RESULTS AND FINDINGS
ADDENDUM

29 AUGUST 2013

Contents

1 Introduction

This document is an addendum to the Porter Airlines Proposal, Preliminary Findings and Interim report issued on 25 June 2013. The purpose of this document is to highlight additional information for considerations by the City of Toronto in light of initial comments and questions received. Where appropriate, it also clarifies or corrects statements from the interim report.

This report contains additional considerations in regards to:

- Aircraft Noise
- Operational Considerations
- Other Considerations

Upon approval of the material within this addendum, this report will be consolidated with the previously issued interim report and reissued as a final deliverable.

2 Aircraft Noise

2.1. Describing and Measuring Aircraft Noise

Aircraft sound can be measured accurately using a range of metrics depending on the objective sought. Attempting to correlate these metrics with impacts on the community is complex as aircraft noise as experienced by an individual is highly subjective. Unbearable noise for one person might not be of any concern at all to another.[1] Human perception of noise depends generally on three factors: frequency, level and duration. The chart below illustrates the audible range of a typical human ear based on frequency (0-20,000 Hz) and sound pressure level (SPL, 0-130 dB). The duration of a noise event will also be a significant contributing factor to annoyance.

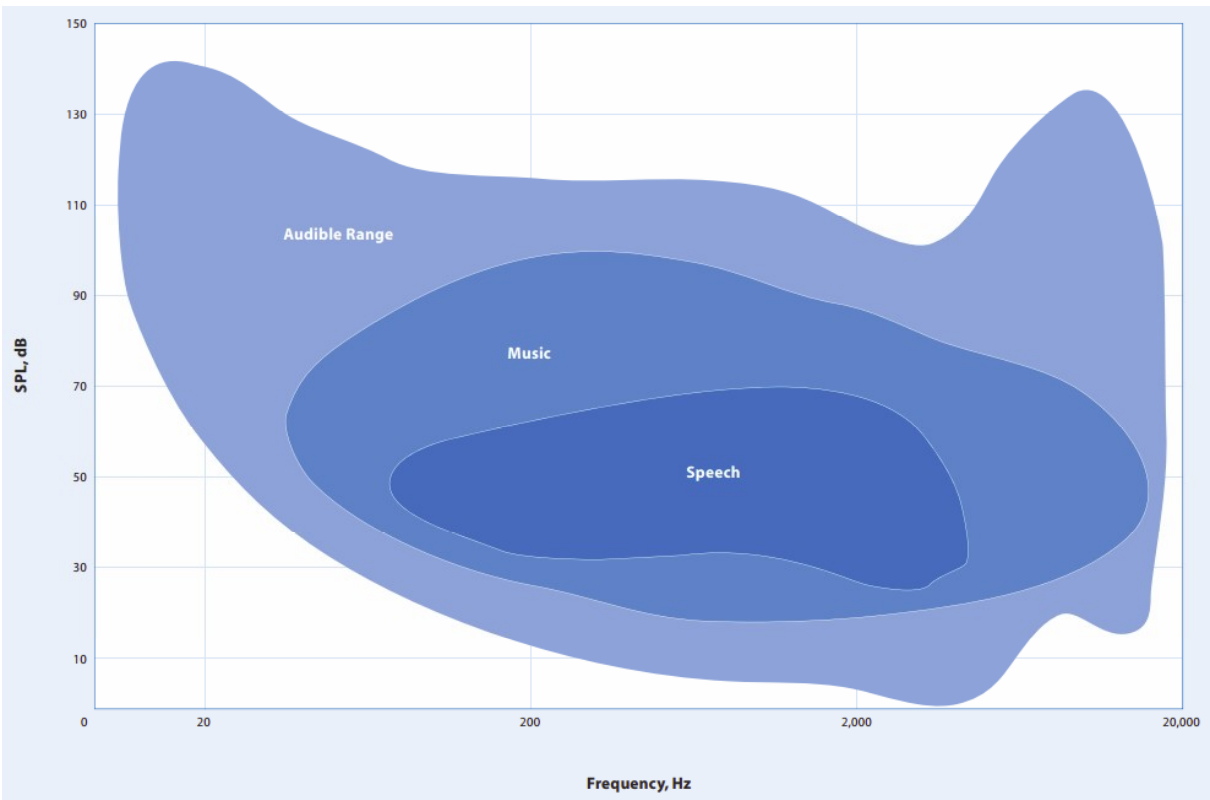

FIGURE 2.1 HEARING RANGE – FREQUENCY AND LEVEL [2]

The human ear does not perceive sound the same way across all frequencies. Low-pitch noise is less perceptible to the human ear but may lead to secondary effects such as window rattling and vibrations. High-pitch noise is generally more annoying as it includes squealing and screeching noise. To take account of the variation of this perception, various methods of frequency weighting have been developed. The A-Weighted scale (dBA) is the most commonly used scale because it weighs down the impact of low and high frequency noises. The C-Weighted scale (dBC) is also used but its purpose is to also account for non-audible impacts of noise such as impulsive sounds creating vibration. The following chart illustrates the weighting used for these two scales.

[1] The Truth About Aircraft Noise, Australian Noise Ombudsman
[2] Oakland International Airport Master Plan Update (2006)

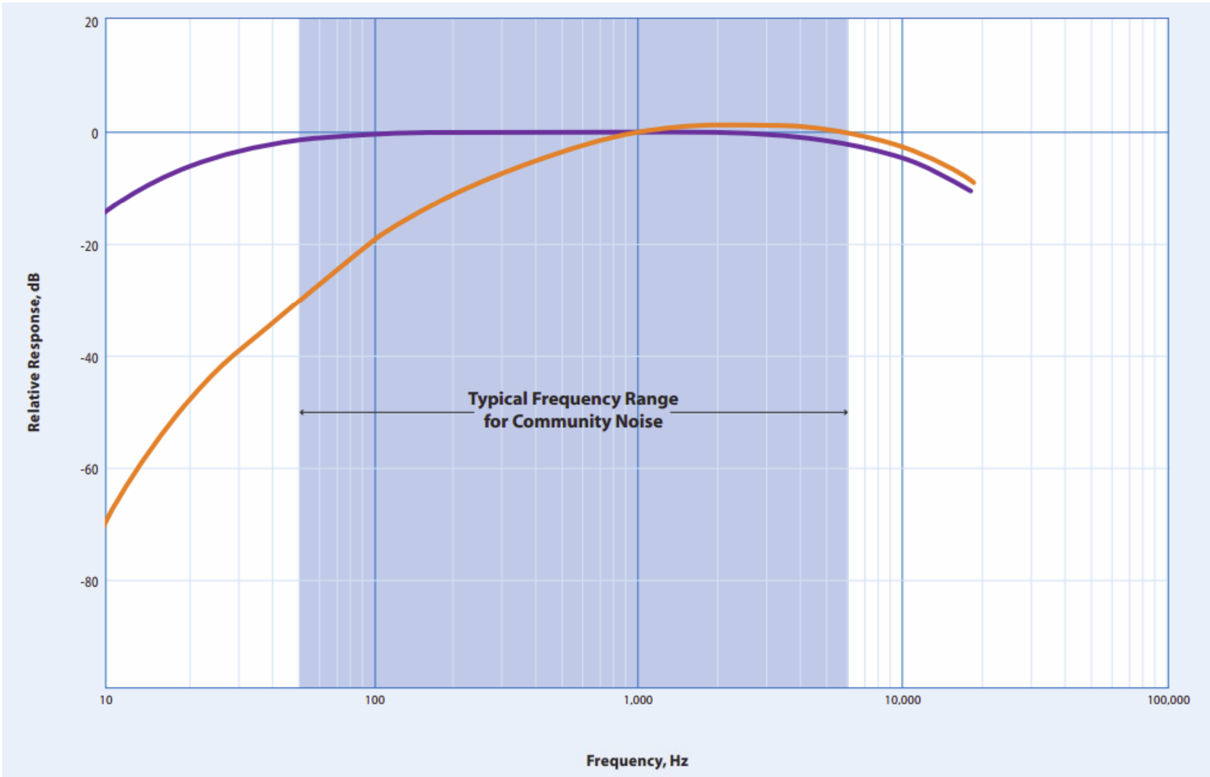

FIGURE 2.2 FREQUENCY WEIGHTING – A-SCALE (ORANGE) AND C-SCALE (PURPLE)[3]

When discussing noise, several metrics are used. There are three broad types of noise metrics:

- Those that express noise **cumulatively** as a function of total energy experienced over a set period of time,
- Those that express the noise levels experienced during a **discreet** aircraft operation, and
- Those that are a **hybrid** of the other two. [4]

Cumulative Noise Metrics

All cumulative noise metrics are expressions of the total amount of acoustic energy that is present. Most express an average of the noise energy that occurs during a selected period of time. Based on the needs of the government/ jurisdiction where each is applied, they often are adjusted to weigh more heavily on periods of the day that are considered to be noise-sensitive.

Noise Exposure Forecasts (NEF)

In Canada, the NEF metric is used to evaluate noise exposure as a means to encourage appropriate land use planning. It is a single number metric which cumulates all events across a busy day as determined by a methodology outlined by Transport Canada.[5] The noise levels are sourced from a database contained in the Transport Canada NEF-CALC software.

Equivalent Sound Level (Leq)

This metric represent a steady-state noise level over a specified time period. It is effectively a sum over that time period and is, thus, a measure of the cumulative impact of noise. Leq can be measured for any time period, but is typically measured for 15 minutes, 1 hour, or 24 hours. It is used where sound levels vary over time as a mean to assess the impact of cumulative noise exposure.

[3] Oakland International Airport Master Plan Update (2006)
[4] Airport Cooperative Research Program (ACRP) Report 15: Aircraft Noise: A Toolkit for Managing Community Expectations (2010)
[5] TRANSPORT CANADA, Aviation Group, « NEF micro computer system user manual », June 1990, TP 6907

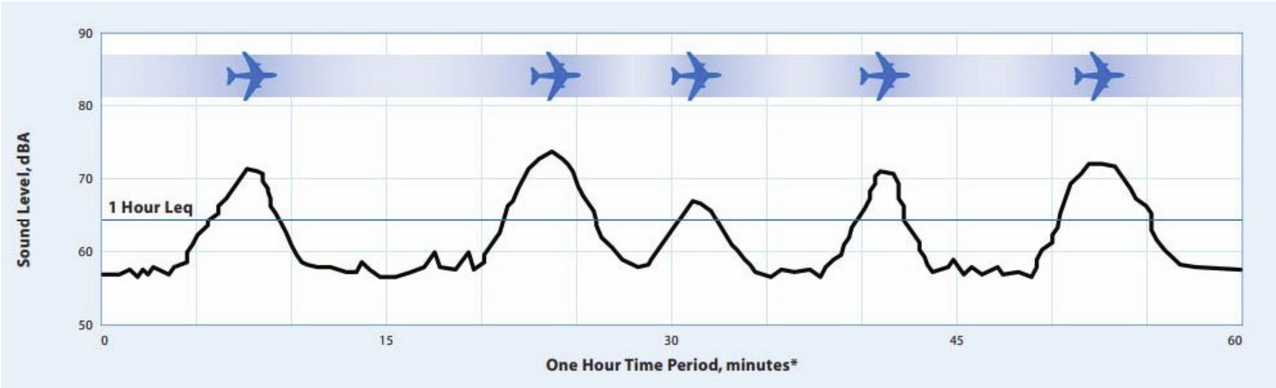

FIGURE 2.3 EQUIVALENT NOISE LEVEL (LEQ) - EXAMPLE[6]

Single Event Noise Metrics

Cumulative aircraft noise contours often are challenged by airport neighbors as not representing what can be heard and measured every time an aircraft flies near their home. Long duration measurements and computer technology may indicate the contour patterns are appropriate for community planning, but they fail to capture the discrete nature of the single events that people actually identify and complain about.

As louder Chapter 2 aircraft[7] were removed from the commercial operating fleet during the 1990s, cumulative noise contours shrank significantly from earlier sizes. Although the contour reduction could be attributed largely to the reduction of noise from individual aircraft, the number of actual operations has generally increased. As a consequence of this change, the public has become more vocal in demanding that the number and noise levels of single events be assessed within environmental evaluations. Several metrics are available to respond to this demand.

The following are examples of single event noise metrics:

Sound Exposure Level (SEL)

The SEL is a mathematical expression of the noise energy present during an event or a period of time, normalized to a single second.

It provides the noise analyst the ability to directly compare the acoustic energy generated by two separate events while clearly accounting for both their peak noise levels and durations. For example, the same operation may be considered along an existing and proposed flight track. The SEL of each operation would be compared to provide insight into the prospective effects of changing location on the underlying population. Further, the SEL is the preferred metric for the evaluation of sleep disturbance, making it critical to the evaluation of noise abatement measures that are directed towards night operations.

Maximum Sound Level (Lmax)

The maximum sound level corresponds to a single maximum value recorded during a given noise event. Although it can easily be measured, it does not correlate well with public perception as it does not include the notion of duration or a spectrum of the sound.

[6] Oakland International Airport Master Plan Update (2006)

[7] ICAO Annex 16 Volume 1:Environmental Protection – Aircraft Noise

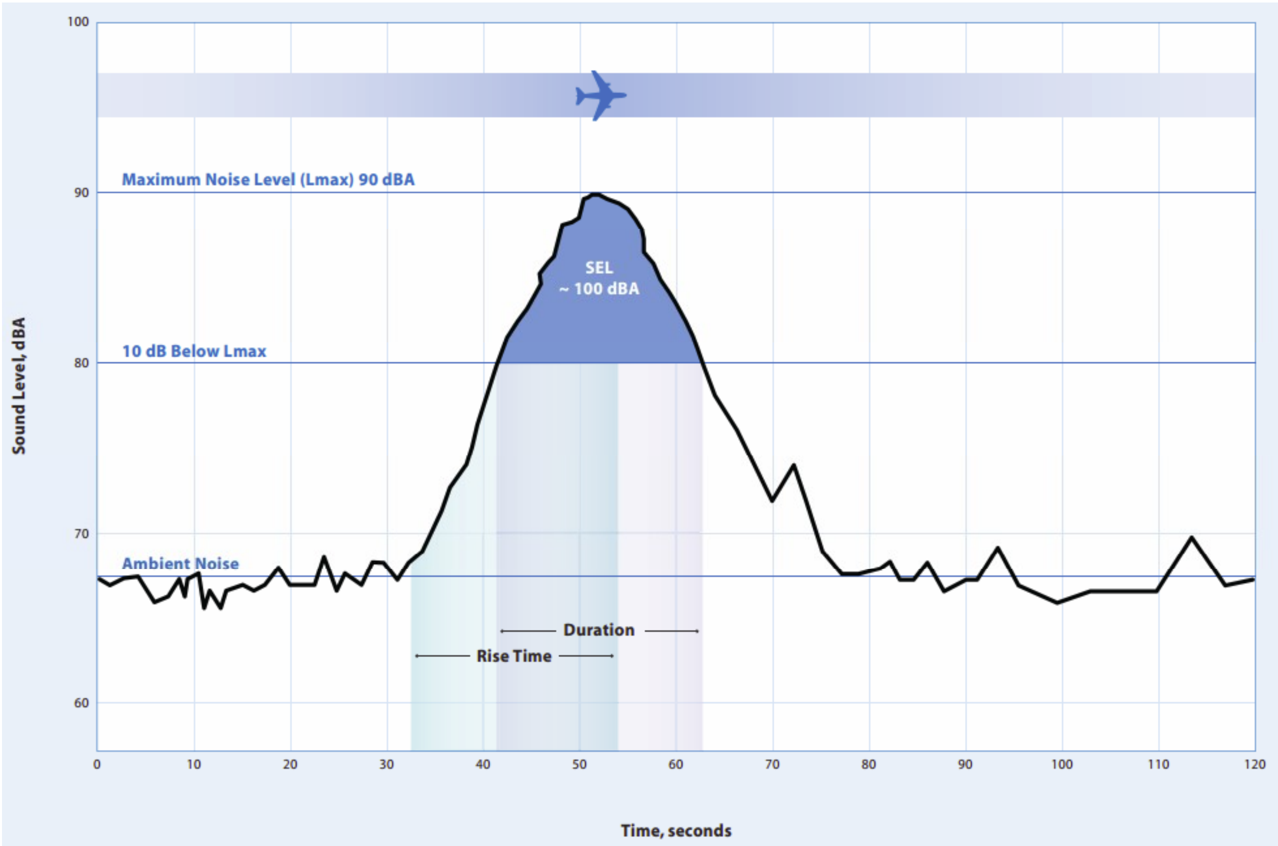

FIGURE 2.4 SOUND EXPOSURE LEVEL (SEL) AND MAXIMUM NOISE LEVEL (LMAX) - EXAMPLE [8]

Effective Perceived Noise Level (EPNdB)

This metric is a measure of human annoyance to aircraft noise which has special spectral characteristics and persistence of sounds. It accounts for human response to spectral shape, intensity, tonal content and duration of noise from an aircraft. It is used by national regulatory bodies to certify noise levels of aircraft models entering the market.

Hybrid Noise Metrics

Also called alternative noise metrics, tools have been developed to enable a more responsive approach to public interests and be easily understood by non-experts. These metrics are typically formed from combinations of simpler single event metrics.

NA (Number of Events Above)

The NA contours relate to the quantity of events above a certain noise threshold. N70 (70 dbA) is often used of daytime assessment while N60 (60 dBA) is used for night-time assessments. This metric has increasingly become popular over time because of its transparency and how it captures an increased paradigm shift in the source of aircraft noise annoyance. While noise impacts were historically driven by event loudness, the improvements in engine and airframe technology were offset by increased aircraft operations. While cumulative noise exposure contours may show no changes or improvements, NA contours will have captured the actual quantity of noise events reaching a perceptible noise level.

BBTCA Considerations

Several of the discussed noise metrics have been used under a range of circumstances in relation to the BBTCA, notably the EPNDB, NEF and Leq.

Because the Bombardier CS100 is in a testing phase, the EPNdB is the most reliable comparable metric. However it should be noted that this metric is based on testing conditions that may not be experienced at the

[8] Oakland International Airport Master Plan Update (2006)

BBTCA due to varying operational procedures. It is therefore appropriate to confirm compliance to the levels set in the Tripartite Agreement using this metric, but it should not be interpreted as a confirmation that the perception of noise by the community will be identical for two aircraft with the same or similar certification noise levels.

There is no single metric that can compare two different noise events or cumulative sound exposure accurately because of the inherent differences in perception between people. As such, the most appropriate and transparent course of action involves the use of several metrics, including quantifiable non-auditory metrics such as the number of events.

The Toronto City Airport Noise Management Study (Jacobs, 2010) used a combination of periods of 1 second and 20 minutes for attended monitoring stations, as well as 10 minutes and 1 hour for unattended stations. This metric is especially appropriate when monitoring successive sounds originating from a range of sources.

2.2. Effect of Weather on Sound

Noise propagates across the air from the transmitter to the receptor. As it travels towards the receptor, sound energy is dispersed but is also absorbed. The extent of atmospheric absorption varies widely based on weather conditions such as temperature, wind and humidity.

For example, sound will travel farther in hot and humid conditions than in cold and dry conditions. Wind direction and speed will also have a significant bearing on noise levels reaching the receptor.

Sound frequency will also be a consideration with high frequencies being more absorbed by the air than low frequencies.

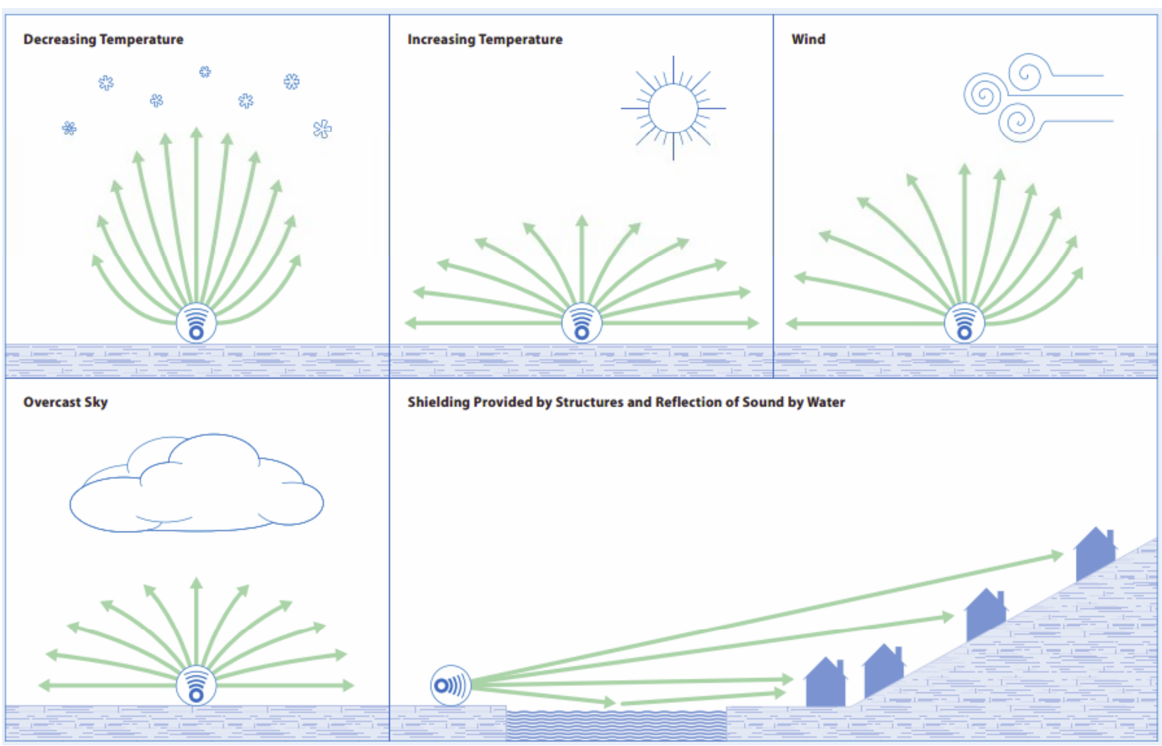

FIGURE 2.5 EFFECT OF WEATHER ON SOUND[9]

Sound Dispersion Over Water

An aspect that is more specific to the BBTCA is the effect associated with sound reflecting across a water surface. Research shows that this effect has an even more profound effect than weather occurrences. The perception that sounds are noisier when travelling over water can be explained by two physical principles: Refraction and Reflection.

[9] Oakland International Airport Master Plan Update (2006)

Refraction involves a bending of the sound wave that strikes a material in which it travels slower. Since the temperature of the water in a bay is usually cooler than the normal air temperature, the air just above the water level is cooled by the water. The temperature varies according to the distance from the surface of the water. This gradient of speeds results in a lens effect due to refraction of sound, which tends to focus and thus increase its apparent loudness.
Furthermore, water acts as a hard acoustical surface that enhances the **reflection** of the sound resulting in increased annoyance compared to a situation where sound would be absorbed by a soft ground surface such as a grassy field. If the water is smooth or calm, the sound waves skim the surface of the water and are reflected toward the observer, adding to the amplification. However, if the water is choppy, the sound is randomly reflected and makes no contribution to the amplitude of the sound.

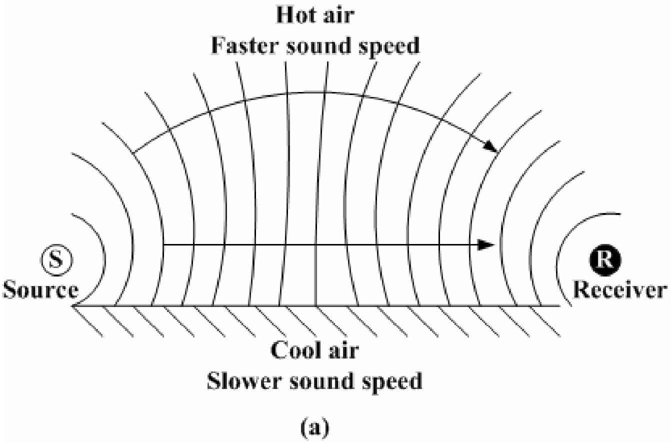

FIGURE 2.6 NOISE REFRACTION

These findings are difficult to specifically discuss in the context of the BBTCA, within the urban context where expressways, roadways, high rise buildings and other hard surfaces contribute to the complexity of noise propagation in the vicinity of the airport.

2.3. Transparent Disclosure of Aircraft Noise

As the material covered in this section indicates, noise is highly subjective and perception can be affected by a range of environmental, man-made and individual factors. Because of this complex environment, the best option remains the use of transparent tools to disclose aircraft noise. Transparent means delivering the message in an everyday language and in such a way that can be verified by the layperson. Transparency can also mean empowering individuals by providing them with the appropriate information in order to allow them to make their own view on acceptability of current and future aircraft noise.[10]

One of the most broadly accepted tools worldwide for disclosure of aircraft noise is a real-time web-based application providing information on aircraft movements and associated noise events. WebTrak is such a tool and has been implemented successfully at the Vancouver International Airport (http://webtrak.bksv.com/yvr)[11]

WebTrak

WebTrak is a web-based tool that allows the user to view "real-time" and historical flight and noise data collected by the Airport Authority's Aircraft Noise Monitoring & Flight Tracking System. Such a system provides a high degree of transparency and offers an interactive mean to manage noise complaints. Toronto-Pearson is projecting a roll-out of WebTrak in 2013 and this will cover the Greater Toronto Area, including traffic to other airports such as the Billy Bishop Toronto City Airport. It is our understanding that the BBTCA has access to the same monitoring platform as the GTAA which would allow implementation of a web-based tool such as WebTrak.

[10] Expanding Ways to Describe and Assess Aircraft Noise, Infrastructure Australia, 2000
[11] http://www.wired.com/autopia/2009/05/aircraft-noise-tracking-website-is-music-to-residents-ears/

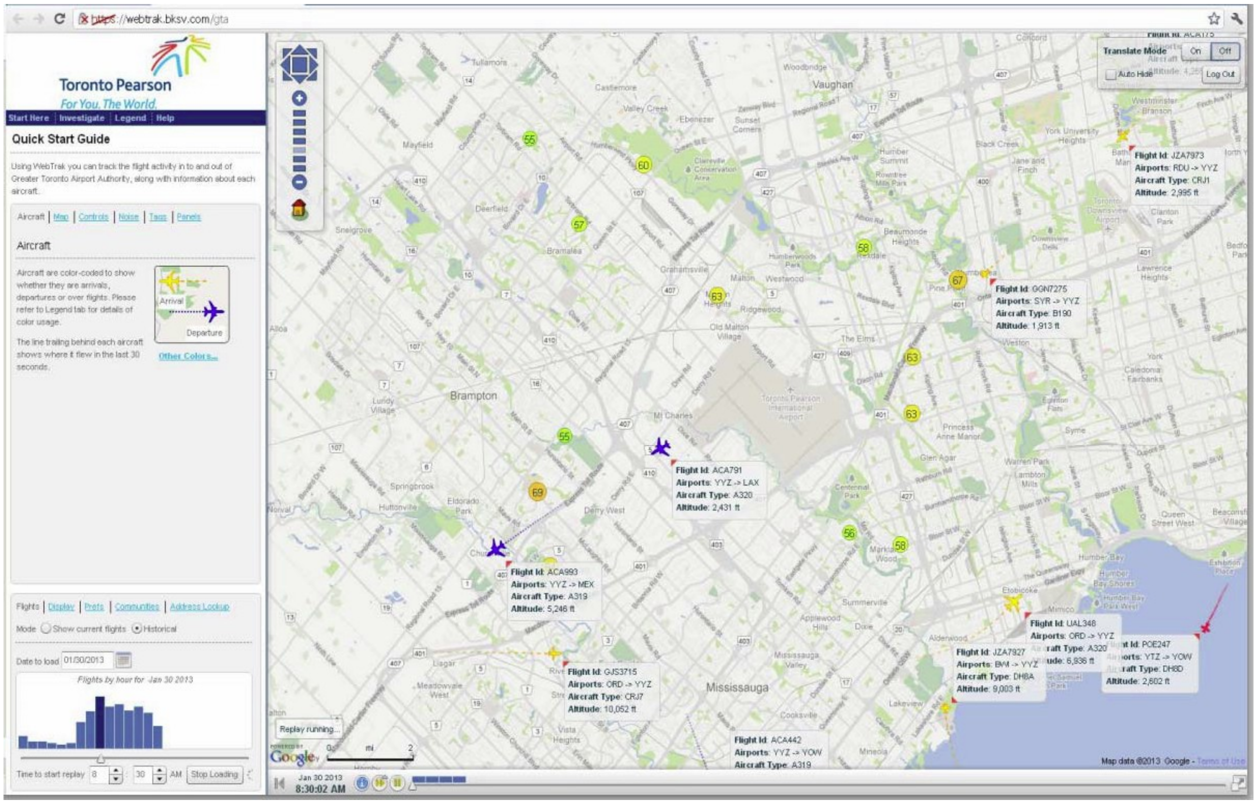

FIGURE 2.6 TORONTO-PEARSON WEBTRAK - DEMO[12]

12 http://www.torontopearson.com/uploadedFiles/Pearson/Content/Your_Airport/Noise_Management/2013-02-06_WebTrakPresentation.pdf

3 Operational Considerations

3.1. Steep Approach Landings

Steep approach landings are used at a range of airports worldwide, though more often in urban settings, as a mean to clear man-made or natural obstacles as well as to reduce noise impacts in the vicinity of the airport by allowing aircraft to maintain a higher altitude during the approach phase of the flight. Operations by commercial aircraft of these steeper approach paths must be approved by the regulator.

In Canada, these guidelines are set in Advisory Circular 525-011[13]. This document provides information on the requirements for the approval of steep approach landing capability of Transport Category aeroplanes using an approach path angle greater than or equal to 4.5 degrees (7.9 %). Currently, Runway 08 ILS approaches are performed at 3.5 degrees while Runway 28 ILS approaches are performed at 4.8 degrees which is considered steep.

Modelling of the noise impact of steeper approaches was undertaken generically using the Integrated Noise Model (INM), a U.S. Federal Aviation Administration software used broadly around the world to assess the impacts of aircraft noise using a range of metrics. The following figures illustrate the sound exposure level (SEL) of a Dash8-Q400 landing on Runway 08 at a 3 degree slope compared with a landing at a 3.5 degree slope as well as a landing on Runway 26 at a 3 degree slope compared with a landing at a 4.8 degree slope. Results assume a straight approach and comparable aircraft performance specifications for both slopes. It highlights the sizeable reduction in noise contours along the flight path of the aircraft although the model only highlights comparable impacts at ground or water level.

FIGURE 2.8 NOISE MODELLING – STEEP APPROACH IMPACTS – RUNWAY 08

[13] Approval of Steep Approach Landing Capability of Transport Category Aeroplanes, AC 525-011, Transport Canada, 2004

FIGURE 2.8 NOISE MODELLING – STEEP APPROACH IMPACTS – RUNWAY 26

3.2. Engine Run-Ups

As part of the regular inspection and maintenance of aircraft, aircraft engines require testing at high power levels to ensure their proper operation and the safety of operations. While necessary, engine run-up operations can be a disturbance to surrounding communities, especially when conducted at night. Furthermore, while these operations are a common occurrence at airports, they are not required by Transport Canada to be included in the assessment of noise contours, which means that run-up operations are not a contributing factor that is assessed for compliance to the limits set in the Tripartite Agreement.

In a 2010 Noise Management Study, it was recommended to the "TPA to assess the potential of implementing noise control barriers at or near any proposed aircraft engine run-up areas or pad." An environmental assessment screening report was produced in 2011 which subsequently led to the construction of a single 6m high by 82m long acoustic barrier near Runway 15. This is anticipated to reduce noise by 10 dBA up to five storeys high. An additional noise barrier East of the terminal building and an engine run-up enclosure was also included in the environmental assessment screening report. These have not been built yet.[14]

The first engine run-up enclosure in Canada was commissioned in 2012 at the Vancouver International Airport. At 67m wide by 80m long and varying in height between 11 and 15m, this enclosure was built at a cost of approximately $12 million and was expected to be utilized primarily by smaller planes in the southern precinct of the airport as this area is located closer to nearby communities. The project was featured on the discovery Channel in February 2012.[15]

Noise reductions were calculated to be on average 15 dB although some residential areas did experience more significant reduction than others. It remains important to manage expectations when commissioning such a facility especially in the context of the BBTCA where many high-rises are located in close proximity to the airport and apartments on upper-floors are less likely to see the benefits of such an installation.

[14] Noise Barriers and Engine Groud Run-Up Enclosure Environmental Screening Report, CPA EA Regs, October 2011
[15] http://watch.discoverychannel.ca/#clip615146

3.3. Turboprop Aircraft Fleet Development

The focus of the Porter Airlines proposal is on the introduction of jet aircraft at the Billy Bishop Toronto City Airport. However, it is also important to note foreseeable developments in Turboprop aircraft technology over the coming years.

When the modern regional jet entered the market in the 1990s with the Bombardier CRJ, followed by the Embraer ERJ, it was believed that this would adversely affect the turboprop aircraft market. However, increasing fuel costs and improvements to the best-selling turboprop aircraft (Bombardier's Dash8-Q400 and ATR's 72-600) have led to a renewed interest for this aircraft type, especially on short sectors of up to 500nm (approximately 1,000 km). In this category the turboprop offers a similar gate to gate operating time at a lower cost compared to regional jets.

The regional jet market is now focussed on aircraft operating on longer sectors where turboprop aircraft are not competitive or physically able to achieve the performance sought with seat configurations ranging from 70 to over 100 seats.

With the turboprop aircraft serving increasingly larger markets over short sectors, ATR and Bombardier have been considering a stretched version of their respective turboprop aircraft which would take them up to 90 seats. Although Bombardier is currently dismissing any plans ATR remains opened to the idea and is considering a brand new aircraft as opposed to a stretched version of the ATR72. Hence, although a larger turboprop is unlikely to be entering service in the foreseeable future, such an aircraft would likely be able to operate from Toronto City Centre Airport. Some incremental improvements to airport infrastructure may be required, especially to cater for an increase of over 25% in seats.

4 Other Considerations

4.1. Environmental Assessment

The Federal Government's National Airports Policy (NAP) provides a framework that clearly defines the Federal Government's role with respect to airports as owner, landlord, and regulator, and the Canadian Airport Authorities' role as operator and manager. This relationship provides the mechanism by which Airport Authorities are exempt from the Canadian Environmental Assessment Act (CEAA).

An Environmental Assessment (EA) examines the effects of a project on the biological, physical, social, and economic environment. It identifies potential adverse effects and mitigation measures that may be implemented to avoid or reduce identified effects and it considers the significance of any residual effects that may remain after the application of mitigation. Assessments of cumulative effects consider the effects of a project in combination with other projects that are underway or are reasonably foreseeable. An EA is normally carried out during the planning stages of a project before decisions are made to which environmental matters may contribute.

The process for the scoping of and the requirement for an EA in relation to the proposed development work at BBTCA is the responsibility of the Toronto Port Authority (TPA). The TPA is not an airport authority and as such the TPA's responsibilities for environmental assessment need to be confirmed by the TPA, the City of Toronto and Transport Canada.

Federal Legislation and Regulation

Canadian Environmental Assessment Act, S.C. 1992, c.37

CEAA (1992) establishes a process to assess the environmental effects of projects requiring federal actions or decisions, and requires that the environmental effects of projects be considered early in their planning stages. At present, CEAA does not apply to Airport Authorities though some airports have decided to conduct self-directed EA that mirror the CEAA process.

Canadian Environmental Protection Act, 1999, c.33

The goal of the Canadian Environmental Protection Act (CEPA) is to contribute to sustainable development through pollution prevention and the protection of the environment, and human life and health, from the risks associated with toxic substances. CEPA is the legislation under which the National Ambient Air Quality Objectives are issued.

With respect to the BBTCA, CEPA will provide guidance on hazardous substances, contaminated soils and on managing aircraft de-icing fluids.

Additional environmental legislative and regulatory requirements will be required to be addressed should the proposals at BBTCA be approved to proceed. The environmental report by CH2MHill provides more information on this matter.

4.2. General Aviation

General Aviation activities were found to be generally unaffected by the Porter Airlines proposal. This does not mean that GA activity is changing at the BBTCA. Recent discussions between COPA and HTA Consultants indicated a desire on the part of the COPA group to see a Master Plan for BBTCA in the near future to address the changes at the airport and to provide the GA users with a long term vision. The TPA confirmed that the Master Plan process will not proceed until there has been a resolution to the proposal by Porter Airlines.

The review within this report focuses on the impact to GA from the Porter proposal itself and does not address the broader trends or long term planning requirements of the GA community.

The most recent review of the commercial aircraft movements slot allocation assumed over 380 general aviation movements on a busy day. The runway extension proposal does not limit the range of GA aircraft that can operate at BBTCA. Additional spatial constraints may occur on aprons as a result of the categorization of 08-26 as category 3 runway. This will increase the clearances laterally from the runway and from the space required for parking the CS100 or similar aircraft. The proposed runway lengthening of Runway 08-26 from 1,216m to 1,569m will not directly affect general aviation operations. The integrity of the two (2) cross-runways are maintained which will enable small aircraft operators to retain access to runways providing optimal crosswind coverage.

On the aprons, plans to increase the footprint of the passenger terminal building could over time add constraints on general aviation airside activities though this is subject to review and approval of the final aircraft parking plans, pushback and ramp operations proposed by Porter Airlines.

Under a scenario where all jet operations are compliant with the Tripartite Agreement noise levels and allowed to operate at BBTCA, it is possible that small general aviation jet aircraft such as Very Light Jets (VLJ) could operate from the existing runway. The impacts of such a change have not been specifically assessed and would depend on the demand for very light jet services, availability of parking and the provision of services dedicated to VLJs.

5 Addendum and References

This section highlights other changes made to the Interim report as well as new references.

5.1. Addendum

The following changes were made to the interim report. All these changes as well as the new material will be integrated into the final version of our review of the Porter Airlines Proposal.

Boeing 737max

Our interim report mentioned that the Boeing 737max would also use the Geared Turbofan technology. This is incorrect. The B737max will be equipped with the CFM LEAP-X engine, a very high bypass ratio engine relying on enhanced components technology to achieve similar performance levels as the Pratt&Whitney Geared Turbofan. The A320neo also offers the LEAP-X engine as an option which has been retained by several airlines, notably Air Asia with 264 orders. Some purchasers such as leasing companies have bought both engine variants.

On 29 August, WestJet confirmed the purchase of 65 B737max aircraft, including 25 B737max7s, the smallest model currently offered for this aircraft.

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