BILLY BISHOP TORONTO CITY AIRPORT

PORTER AIRLINES PROPOSAL REVIEW

INTERIM RESULTS/FINDINGS

26 JUNE 2013

AIRBIZ

TABLE OF CONTENTS

01. EXECUTIVE SUMMARY

Porter Airlines Inc. (referred to as Porter Airlines) announced on April 10, 2013 the conditional purchase of 12 Bombardier CS100 (referred to as CS100) as well as an option for an additional 18 aircraft subject to the amendment of two key provisions of the 1983 Tripartite Agreement:

1. The lift of the current prohibition of jet aircraft operations at the airport
2. An authorization to lengthen the runway by 168m at both ends of the airfield [1]

A request to formally review the Porter Airlines proposal was considered by the Executive Committee of the City of Toronto on April 23, 2013 and formally adopted with amendments by the City Council on May 7, 2013. [2]

Airbiz Aviation Strategies was commissioned by the City of Toronto on May 22, 2013, to assist City staff with technical analysis of the request by Porter Airlines to permit jet-powered aircraft at Billy Bishop Toronto City Airport (BBTCA). Airbiz is an independent international specialist aviation consultancy servicing airport owners, operators, investors, airlines, government agencies and other aviation stakeholders. [3]

The review was conducted primarily based on a review of material associated with the Porter Airlines proposal as well as consultations with stakeholders associated with this proposal. The information was reviewed against industry regulations, international best practices and international case studies. The executive summary provides a synopsis of each of the critical areas of consideration and is followed by a description of the interim findings based upon the review conducted.

[1] Porter Airlines Press Release, 10 April 2013
[2] Letter from Robert J. Deluce, President and CEO, Porter Airlines Request from Porter Airlines for Exemption to Commercial Jet Ban at Billy Bishop Toronto City Airport, 22 April 2013
[3] http://www.airbiz.aero

AIRCRAFT

The Bombardier CS100 performance was reviewed based on preliminary information as the aircraft is in the testing phase. Several comparable aircraft were also identified including aircraft that are scheduled to enter service by the end of the decade (2020) with engines using the same technology as the CS100.

The runway length requirement provided by Bombardier, and supported by Porter Airlines within their proposal, allows the CS100 to undertake unrestricted operations except under limited conditions where a combination of a high load factor, high temperature and long range destination is involved.

In consultation with Porter Airlines, Bombardier has provided a guarantee to Porter Airlines that they would meet or better the Tripartite Agreements allowable cumulative noise level of 259.5 EPNDB. With the Tripartite Agreement levels being marginally higher than what is advertised in Bombardier's preliminary material, it is expected that Bombardier will meet the guaranteed cumulative noise levels once testing and compliance exercises are completed in early 2014. In regards to air quality, a preliminary review of literature confirms that the CS100 will meet the most current international emissions standards (CAEP/6).

CAPACITY ASSESSMENT

A key determinant of BBTCA's capacity is the existing slot cap on scheduled movements. The slot cap is in place in order to ensure the airports overall compliance to the terms of the Tripartite Agreement. Since the Tripartite Agreement does not specify the number of slots, this number is imposed by the Toronto Port Authority based on operational conditions, the fleet mix in operation, the noise modelling tool and the noise assumptions used by Transport Canada. For the purposes of this study, a base assumption, agreed to with the City of Toronto staff and based on advice from the Toronto Port Authority that no changes are being considered, is that the 202 slot cap will remain as a known constraint. Future studies may undertake additional noise modelling as more information becomes available on the noise levels of the CS100 or other jet aircraft compliant to the Tripartite Agreement (Potentially the MRJ, A320neo, B737max and the re-engined version of the E190).

The proposed extension of runway 08-26 will not increase aircraft movement capacity, but provides the opportunity for larger jet aircraft to operate at BBTCA. These aircraft with more seating capacity can increase the busy hour passenger demand and will require increased capacity of terminal and groundside facilities. Furthermore, the Dash8-Q400 will now be able to operate at Maximum Take-Off Weight under most conditions, allowing for a combination of higher passenger payloads and longer range for this aircraft.

As runway extension is not associated with a parallel taxiway modification, aircraft requiring the full length of Runway 08-26 on take-off will effectively need to backtrack on the runway to the runway end, which will reduce the hourly capacity of the runway to an extent that will be dependent on the timing of operations requiring the full runway-length.

Under existing operations and assuming an 85% load factor, an estimate of the annual airport capacity is approximately 3.8 million passengers. Of those passengers, it is assumed that 25% are transferring, which results in about 1million annual transferring passengers and about 2.8 million annual passengers who will interface with groundside facilities at BBTCA.

The existing hourly capacity is estimated at approximately 870 passengers per hour based on the current layout of 10 Q400 aircraft gates. Taking into account an average transfer rate of 25% the demand on groundside would be approximately 650 passengers per hour, each way.

When considering the introduction of the CS100 on 25% of the slots and assuming an 85% load factor, this leads to an incremental increase in capacity of 500,000 passengers to 4.3 million per year which corresponds to a low growth scenario per the assumptions used in the HLT Advisory Report[4]. Assuming that the introduction of the CS100 would lead to an increased utilization of available slots during the weekend, the annual capacity of the airport could grow to 4.6 million and 4.8 million passengers under a medium and high growth scenario respectively per HLT Advisory assumptions. During the busy periods, the ability to operate up to 4 CS100 concurrently could increase capacity to approximately 1,240 passengers per hour in each direction (910 passengers O/D[5]), an increase of approximately 50%. This scenario would result in the need to upgrade terminal facilities to enhance the total processing rate of key facilities. The ability to expand existing passenger terminal facilities to the north and south in incremental phases appears to have a nominal impact on the adjacent areas. Further expansion capacity also appears to exist within the current footprint of the terminal building. Additional planning is required to determine the exact extent of the impact of the increased passenger demand on the current facility and apron. On groundside, the busy hour demand associated with CS100 operations would have exceeded the capacity of the ferry terminal without the use of the pedestrian tunnel, which now becomes essential in eliminating the ferry service capacity constraint.

[4] Economic Impact Considerations of an Expanded Billy Bishop Toronto City Airport
[5] Origin/Destination passengers – Passengers that Toronto City Centre is the point of departure or arrival.

INFRASTRUCTURE

Review of the runway specifications was found to be compatible with the type operations sought from the CS100 as well as comparable aircraft types. However, a change of runway category to Code 3 will impact the runway strip width, required taxiway separation and height restrictions for aircraft parked at the passenger terminal building. This will restrict operations on Taxiway Delta and prevent the CS100 from parking on the south side of the passenger terminal building.

The runway length required to enable commercial operations varies significantly based on a range of factors. Because of the variability of payloads and environmental conditions, it is complex and costly to plan for all potential operational occurrences of an aircraft operation. The preliminary information available for the Bombardier CS100 confirms the ability of this aircraft to operate within the parameters of the proposed runway extension under standard conditions and subject to the final declared distances.

Obstacles Limitation Surfaces (OLS) define the limits to which objects may project into the airspace. BBTCA currently operates with exemptions from Transport Canada in regards to the OLS approach surfaces. For runway 08, the exemption allows the approach surface at 4.8%. For runway 26, the exemption allows the approach surface at 6.38%. Transport Canada has not discussed the implications of a change to Code 3 operations on these existing exemptions. The proposed layout as set-out in the Porter Airlines proposal retains the approach surfaces at their existing locations which are appropriate, and would ensure the integrity of the Marine Exclusion Zone (MEZ) subject to the existing approach exemptions being confirmed by Transport Canada. For take-off operations, declared distances (e.g. TORA, TODA) should be confirmed with Transport Canada to ensure that appropriate clearances from obstacles are also provided.

In 2010, Transport Canada tabled NPA 2010-012 with the objective to harmonize Canadian Standards (TP312) in regards to Runway End Safety Areas (RESA) with international standards (ICAO Annex 14) which will make the 90m RESA mandatory for runways 1,200m or longer. The use of a portion of the RESA provides additional length for take-off operations which is recommended procedure within most regulatory jurisdictions. There appears to be no Jet blast impacts associated to the use of the RESA for take-off roll purposes though this is subject to a more detailed assessment upon certification of the CS100. A jet blast analysis would be recommended for all new aircraft types under consideration for use at the BBTCA to ensure the compatibility of aircraft operations with marine operations

The widening of the runway strip will impact clearances, for certain aircraft, to Taxiway D making it unusable during Runway 08/26 operations. This has the potential to decrease the overall runway

utilization, especially during peak hours of operation. More detailed analysis can be conducted as formal airline schedules are developed in response to the Porter Airlines proposal.

The apron used for aircraft parking will be affected by the present proposal. A change of the runway code from 2 to 3 will lead to a wider runway strip requirement and therefore the OLS transitional surface will shift towards the apron preventing the CS100 from being parked at the gates on the south side of the passenger terminal building. Additional study on the transitional surfaces will be warranted as specific aircraft parking plans are developed and the GA parking areas reviewed for impact that those plans may have on them.

On the western and eastern end of the passenger terminal building, the CS100 will require a realignment of the gates to allow for appropriate wingtip clearances to be maintained. Furthermore, the operation of the CS100 aircraft during busy periods will require the passenger terminal building to be expanded to meet the anticipated increase in demand levels as the terminal traffic grows.

The impact of CS100 and similar aircraft operations on the existing pavement are currently unknown. A detailed study on required pavement upgrades is recommended for the existing runway, taxiway and aprons once additional information is available from the aircraft manufacturer.

NOISE IMPACTS

Bombardier have provided a guarantee to Porter Airlines that it will, as a minimum, meet the cumulative EPNDB levels (259.5) set in the Tripartite Agreement. However, formal confirmation of the CS100 compliance to the Tripartite Agreement also requires the certification of the noise levels at each measurement points (Approach, Lateral and Flyover) which will not be completed until May 2014 (based on advice received from Porter Airlines).

Other comparable existing and future aircraft were reviewed. It was found that existing narrowbody jets operating in Canada are unable to meet the noise limits set within the Tripartite Agreement. However, future aircraft planned for entry in service before the end of the decade such as the Mitsubishi MRJ and re-engined models of the A320, B737 and E190 may meet the Tripartite Agreement noise limits upon certification. A complete lifting of the ban on jet aircraft may also allow smaller general aviation jet aircraft to operate at BBTCA. Some very light jets (VLJ) such as the Eclipse 500, Cessna 510 and Embraer Phenom 100 would be able to operate at BBTCA without lengthening of Runway 08-26.

Recent noise studies have also confirmed compliance to the NEF noise exposure forecasts contained in the Tripartite Agreement. The cap of 202 movements on commercial operations is imposed by the

Toronto Port Authority as a mean to ensure that this condition set in the Tripartite Agreement is not breached. At present it is not possible to reliably assess the impact of the CS100 aircraft on compliance to the contours Schedule A of the Tripartite Agreement. Until an assessment can be made based on the revised commercial fleet and operational patterns, the current cap of 202 movements is assumed to remain an adequate interpretation of the Tripartite Agreement noise exposure compliance levels, especially as the CS100 is expected to operate at noise levels similar to the Dash8-Q400.

GENERAL AVIATION

General Aviation activities were found to be generally unaffected by the Porter Airlines proposal. The most recent review of the commercial aircraft movements slot allocation assumed over 380 general aviation movements on a busy day by a range of aircraft which is not affected by this runway extension proposal. Additional spatial constraints may occur on aprons as a result of the categorization of runway 08-26 as category 3, which will increase the clearances laterally from the runway and from the additional space required for parking the CS100 or similar aircraft. Expansion of the passenger terminal building, if required, may also lead to an expansion of the footprint of the passenger terminal building.

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 subject to the review and approval of the final aircraft parking plans, a review of pushback and ramp operations proposed by Porter Airlines.

Under a scenario where all jet operations compliant with the Tripartite Agreement noise levels are allowed to operate at BBTCA, a lift of the ban on jet operations would immediately allow small general aviation jet aircraft such as Very Light Jets (e.g. Cessna Mustang 510, Embraer Phenom 100 and Eclipse 500) to operate from the existing runway.

INTERNATIONAL CASE STUDIES

Several urban airports comparable in size and traffic to BBTCA, including those along waterfront areas, were benchmarked to identify operational specifications. These include key infrastructure, operational restrictions and urban interface considerations. The airports reviewed in Bromma (Sweden), London City (United Kingdom) and Belfast City (United Kingdom/Northern Ireland) were found to allow jets, but to be operating under strict operational constraints including hours of use and limits on aircraft movements.

Initiatives aimed at integrating these airports to their respective urban public transit system were also identified.

COST ESTIMATES

The preliminary cost estimate relates solely to the propose runway 08-26 extension at both extremities and is defined as approximately $80 million dollars. The potential impacts have been identified throughout this review that may result in additional costs and they are excluded from the estimates within this document. The exclusions include, but are not limited to, upgrades of existing facilities such as runways, taxiways, apron and the passenger terminal building to accommodate jet aircraft.

Further work on the conditions of existing infrastructure such as runways, taxiways, aprons and the passenger terminal building are expected to lead to additional costs which will be addressed by others at a later date. Financial feasibility of this proposed expansion has yet to be addressed as additional costs that may be indirectly associated to the runway extension have not been fully identified.

AIRSPACE CONSIDERATIONS

The CS100 aircraft proposed by Porter is approach category “C” aircraft. These categories are based upon the normal approach speed of the aircraft. Category C aircraft Glidepath angles (GPAs) for either Instrument Landing System (ILS) or Global Navigation System (GNSS) vertical guidance approaches are limited to a normal maximum angle of 3.6°.

An exemption is currently granted on the ILS/DME RWY 26 permitting a Glidepath angle (GPA) of 4.8°. This approach is currently in the Restricted Canada Air Pilot (R-CAP) and authorized for only approach Category A and B aircraft. In order for Porter’s aircraft to use a 4.8° GPA approach the exemption must be extended to include Category C aircraft.

The glidepath for the ILS/DME RWY 08 approach is proposed to increase from 3.5° to 3.9°. A new TP308 exemption would be required to authorize this steeper GPA. The resulting approach if approved would need to be moved from the Canada Air Pilot (CAP) and published instead in the Restricted Canada Air Pilot (R-CAP). This would mean that private IFR aircraft, or aircraft without the required OPS SPEC, would not be authorized to fly this approach. No publicly available ILS would be at BBTCA as a result.

Applications for approval of non-standard instrument approach procedures (IAPs) must be submitted to Chief Air Navigation Services (ANS) Operations Oversight at Transport, Ottawa. Transport Canada is normally quite hesitant to grant exemptions to the design criteria without significant supporting justification as to why such an exemption is “in the public interest” and how an “equivalent level of

safety" can be maintained despite the deviation from criteria. Transport Canada's willingness to consider these specific approach parameters should be ascertained before committing significant resources.

There were no speed restrictions on any of the airport's SIDs, STARS, approaches, or departures other than the 'C' Category approach issues already discussed. Therefore except for possible increases in wake turbulence separation, no significant adverse airspace or ATC issues are considered likely to occur.

The Toronto-Pearson and Billy-Bishop Airports are co-dependent with regards to the ability to operate aircraft in the general Toronto Terminal Airspace. However that is not affected by the proposed lengthening of the runways.

The approach's protected airspace would only be expended minimally on those missed approach sections already identified which would not have any effect on the total terminal's capacity.

Since the Runway 08/26 capacity is not increased by the lengthening, this proposal will not increase demand on the Toronto Terminal Airspace. Further review of airspace area capacity and operational procedures of both YYZ and BBTCA is required to define areas of co-management.

KEY INTERIM FINDINGS

The key interim findings are listed in the table below and are provided as a reference to where the primary points of concern are at this stage of the study:

Chapter	Topic	Key Interim Findings
04 Design Aircraft		
	Smaller Jet Aircraft	Current smaller General Aviation jet aircraft will meet the noise requirements within the Tripartite Agreement
	Commercial Jet Aircraft	Current commercial jet aircraft will not meet the noise requirements within the Tripartite Agreement
		Future commercial aircraft similar to the CS100 are expected to be able to meet the noise requirements within the Tripartite Agreement
	CS100	CS100 performance standards are predicated on information from Bombardier
		The CS100 will not be certified by Transport Canada until May 2014 (based on current information)
05 Capacity Assessment		
	Slot Cap	Is assumed to remain at 202 movements within the Tripartite Agreement
	Runway	The proposed runway extension does not increase runway capacity
		Backtracking by aircraft due to restrictions on Taxiway D will restrict runway operations during certain busy hours
	Terminal	The low passenger forecast is defined at 4.3M passengers/annum
		The medium and high passenger forecast are defined at 4.6M and 4.8M passengers/annum
		The current 10 apron stands are not proposed to be added to within this proposal
		Peak hour passenger movements are expected to be 1240 each way, an increase of 50% from the current volumes

Chapter	Topic	Key Interim Findings
06 Infrastructure Requirements		
	Runway Coding	Runway 08-26 is expected to be revised from a Code 2 runway to a Code 3 runway under this proposal
		The runway is proposed to be extended from 1,216m long to 1,569m long
		Further OLS and AZR review is required to finalize interim requirements defined within this study
		Existing and required pavement ratings for the runway, taxiway and apron require further review
	Proposed Runway Extension	The proposed runway extension appears meet the requirements for the CS100 or similar jet aircraft to operate at BBTCA
	Runway End Safety Areas	These are likely to become a requirement at Canadian airports in the near future. It is unclear at this stage if RESAs will be required at BBTCA regardless of the proposed runway extension. It is clear that if the runway is extended that the RESAs will be required
	Taxiways	Taxiway D is restricted under certain operations within the proposed changes, this will likely reduce the overall runway utilization at busy hours
	Apron	The apron will require alteration to accommodate the operation of up to 4 CS100 aircraft
		CS100 aircraft will only be able to park at the West and East apron areas
	Terminal	The terminal will require expansion in a number of areas to accommodate increased passenger demand
		The expansion is expected to along the western and eastern faces of the current terminal building
07 Noise Considerations		
	Aircraft Noise	The CS100 is expected to operate at or below the requirements within the Tripartite Agreement
		Final noise assessment of the CS100 cannot be conducted until more information is available from the manufacturer
		Future jet aircraft, similar to the CS100, are expected to operate at or below the requirements within the Tripartite Agreement
		Current small jet aircraft operate at or below the requirements within the Tripartite Agreement

Chapter	Topic	Key Interim Findings
08 General Aviation		
	GA Operations	GA operations are not expected to negatively affected by the introduction of the CS100
		Some procedural changes on runway operation and use will be required and certain restrictions may apply to GA activities
		Apron changes could require changes to the parking of GA aircraft
		The nature of GA operations could change if the jet ban is lifted and small jet aircraft start to utilize the airport
		The two cross runways remain available for GA activity
09 Case Studies		
	General Findings	Comparable airports operate a variety of restrictions from operating procedures through to hours of operation
10 Cost Estimate and Financial Feasibility		
	Runway Extension	Estimated at $80M
	Runway Pavement Rating	Not addressed in this study
	Apron Parking Revisions	Not addressed in this study
	Terminal Expansion	Not addressed in this study
	Financial Feasibility	Not addressed in the interim findings
11 Airspace Considerations		
	CS100	Category 'C' approach designation
		Approach procedures will require revision
		Air navigation systems will require upgrading
		Transport Canada review and approval of the proposal is required
	Airspace Management	No significant ATC issues are anticipated
		Review of airspace area capacity and operational procedures of both YYZ and BBTCA is required to define areas of co-management (i.e. missed approach procedures or irregular operations)

Table 1.1 Interim Findings

02. SCOPE AND METHODOLOGY

This section outlines the scope of work and methodology used for this study and agreed with the City of Toronto. The Purpose of this Study is to provide technical background information to the City of Toronto in order to assist them in their review of Porter Airlines' request to lift the restriction on jet operations.

SCOPE OF WORK

This study addresses the approved scope of work set out below:

1. To determine the airport ultimate capacity of the BBTCA (YTZ) through the examination of the airside and terminal components and terms and conditions of the Tripartite Agreement and also taking into account Bombardier CS-100 or similar aircraft operating from the airport and the current noise regulations contained within the Tripartite Agreement.

2. Examination of the Bombardier CS-100 aircraft, its performance capabilities, noise profile, requirements for operation at BBTCA (YTZ), air quality impacts, and identification of comparable current or upcoming jet aircraft with similar performance profiles.

3. Examination of BBTCA (YTZ) airport infrastructure required to support an increase in aeronautical and non-aeronautical operations, compatibility with current Noise Exposure Forecast (NEF) Contour Standards, safety, and changes to take-off and landing approach surfaces, protected airspace and marine exclusion zones.

4. Examination of potential noise and environmental issues due to the expansion of the airport to permit jet aircraft such as Bombardier CS-100 or similar aircraft.

5. Examination of the impact of the proposed Runway End Safety (RESA) standards on BBTCA (YTZ), the configuration, required extension into Lake Ontario and the Inner Harbour and marine exclusion zone, and inclusion of runway requirements for Bombardier CS-100 or similar aircraft.

6. Examination of the impact on General Aviation operating at BBTCA (YTZ) due to the introduction of CS-100 and other jet aircraft to the airport lands if Bombardier CS-100 or other jet aircraft were introduced.

7. Identification and examination of potential conflicts between the airspace of an expanded BBTCA (YTZ) with jet aircraft operations and the protected airspace and terminal control area around Pearson International Airport (YYZ) as defined by Nav Canada. Coordination of discussions with NAV Canada and the creation of a framework for resolving the questions related to airspace.

8. Examination of the order of magnitude cost for expansion of the BBTCA (YTZ) airport facilities and resulting airline cost per enplaned passenger and comment on the financial feasibility of the expansion of all operations at BBTCA (YTZ).

9. Examination of other waterfront airports located within urban areas, benefits and drawbacks, and operating limitations placed on them.

10. Any other issues that the City may have identified during the course of the review.

METHODOLOGY

This review was conducted primarily based on a review of material associated with the Porter Airlines proposal as well as meetings with main proponents associated with this proposal. No broader consultations were conducted during the development of this initial findings report. The information was reviewed against industry regulations and best practices, as well as through international case studies.

REVIEWED MATERIAL

A list of the material reviewed is included in Chapter 13. The following project specific items were reviewed during the preparation of this report:

- CS100 Update Presentation, Porter Airlines Inc.
- Flight Paths Presentation, Porter Airlines Inc.
- Runway Presentation, Porter Airlines Inc.
- Aircraft Noise Assessment of Allowing CS100 Flights at Billy Bishop Toronto City Airport, Tetra Tech AMT, May 28 2013
- Porter Airlines Runway 08-26 Extension Study Billy Bishop Toronto City Centre Airport, May 24, 2013, LPS AVIA Consulting

- TP 308 Impact Study Toronto Billy Bishop Toronto City Airport, May 2013, Air Navigation Data

Inclusive of:

  - Map 1: Runway 08-26 Extension, Air Navigation Data
  - Maps 2 & 3: Runway 08-26 Obstacle Assessment, Air Navigation Data

No material specific to this project was provided by Transport Canada or aircraft manufacturers but generic material and references were found in the public domain to support this report.

MEETINGS

The following meetings were held over the course of this study.

- 28 May 2013, City of Toronto, HLTA
- 28 May 2013: Porter Airlines, Toronto Port Authority and Genivar

Consultations with Transport Canada were email via email with a generic response provided on 11 June 2013 since no formal proposal had been presented to the airport.

Follow-up conference calls were conducted to clarify aspects of the proposal or to obtain additional information.

03. BACKGROUND

The Billy Bishop Toronto City Airport (BBTCA) was opened in 1939. In 1983, the City of Toronto, Toronto Harbour Commission (now the Toronto Port Authority) and the Government of Canada (Minister of Transport) entered into a tripartite agreement for the lease of the airport lands for a term of 50 years. The "Tripartite Agreement" governs the operation of the airport by the Toronto Port Authority and includes restrictions such as:

- A ban on jet aircraft
- A ban on expansion of existing runways and construction of new runways.
- A Night curfew (11:00pm to 6:45am)

Porter Airlines started commercial operations in 2006 at BBTCA with a fleet consisting exclusively of Bombardier Dash8-Q400 aircraft flying to regional ports generally within 500 nautical miles (925 km) of Toronto. Air Canada restarted operations from BBTCA in 2011 following the award of 30 slots under a newly introduced slot management scheme. The airport handled over 1.9 million schedule commercial (regular public transport (RPT)) passengers in 2012 in addition to general aviation operations.[6]

In 2010, following requests from other airlines, the Toronto Port Authority completed a capacity study to assess the number of aircraft movements that could be handled within the noise limits set in the Tripartite Agreement. Based on a scenario which included general aviation operations and considerations of night movements, it was determined that the airport could accommodate 202 daily slots for scheduled commercial aircraft arrivals and departures based on a specific operational scenario. Airbiz Aviation Strategies peer reviewed the report and methodology used and concurred with the findings of the capacity study.

EXISTING FACILITIES

BBTCA consists of three runways at different orientations (two east-west, one north-south) hence providing optimal wind coverage to general aviation traffic. The following image shows the main existing facilities.

[6] Toronto Port Authority 2012 Year-End Results

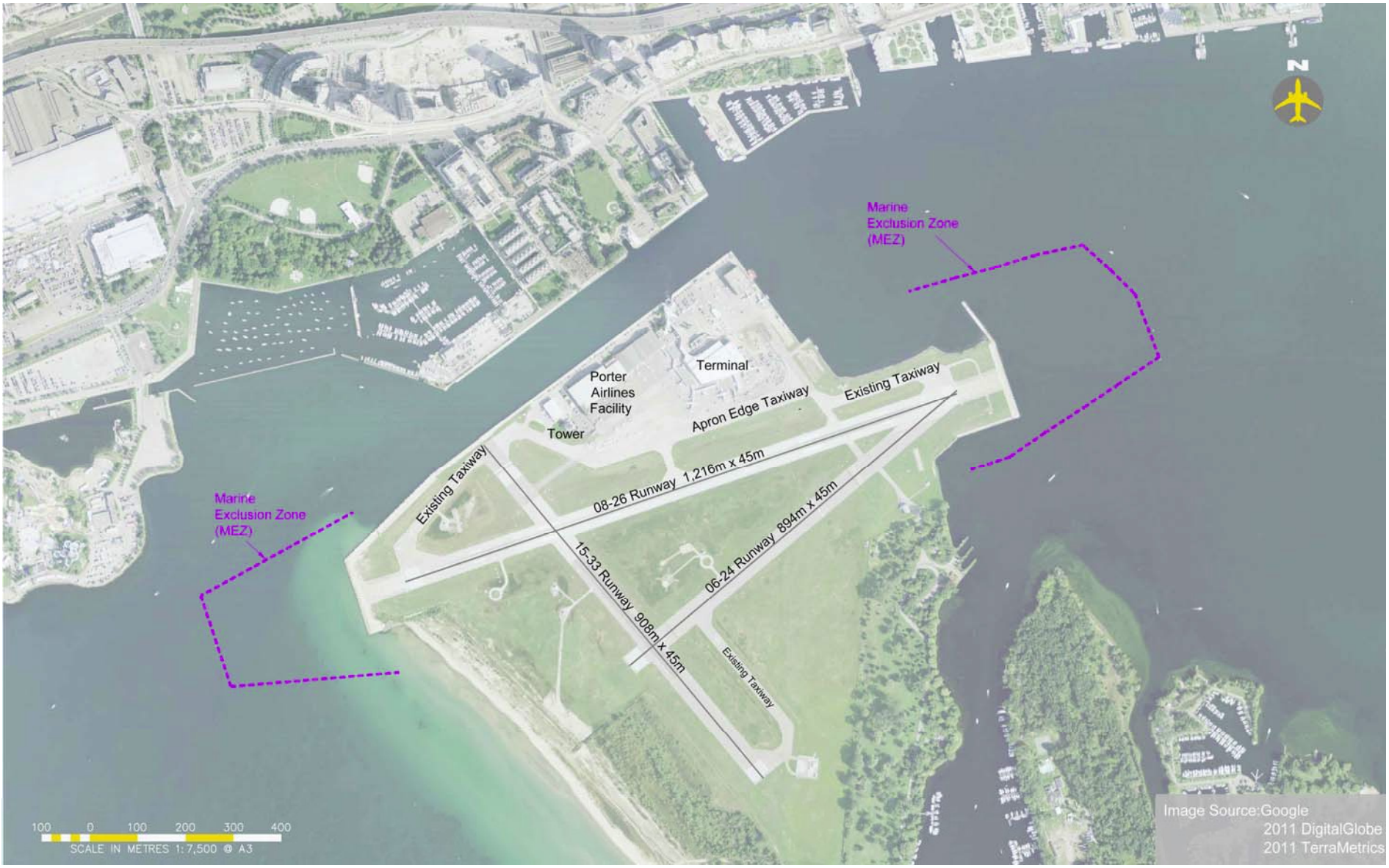


Fig 3.1 Billy Bishop Toronto City Centre Airport – Existing Facilities

HISTORICAL MOVEMENTS

Porter Airlines and Air Canada operate to a range of regional domestic and transborder destinations, generally to and from destinations within 500 Nautical miles of the BBTCA due to current restrictions on the size and type of aircraft that may be operated.[7]

The following chart shows the historical passenger movements at BBTCA by commercial airlines.

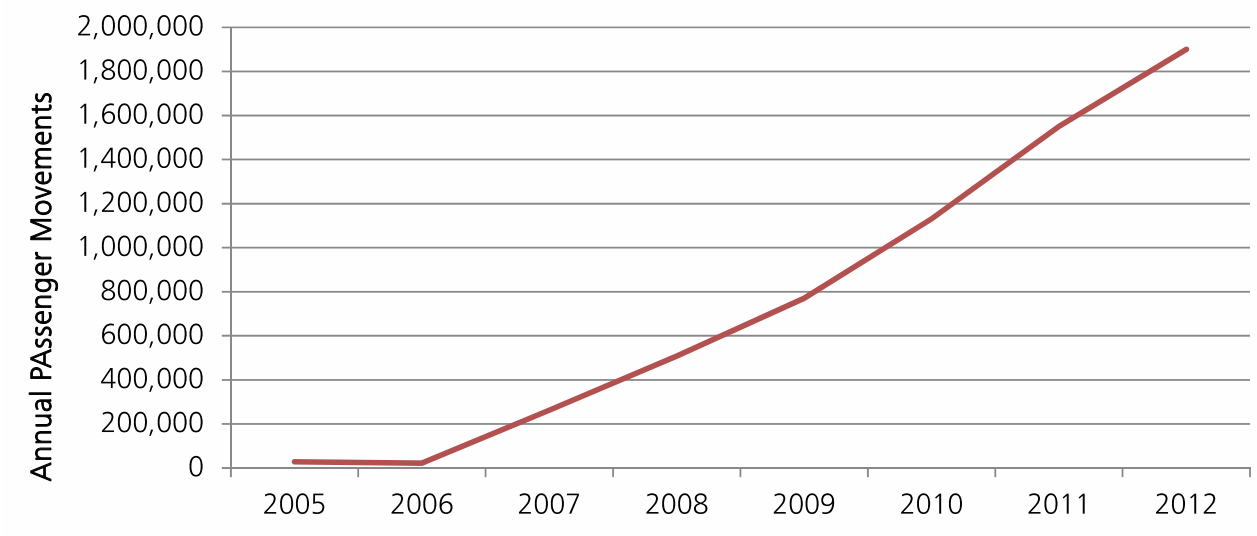
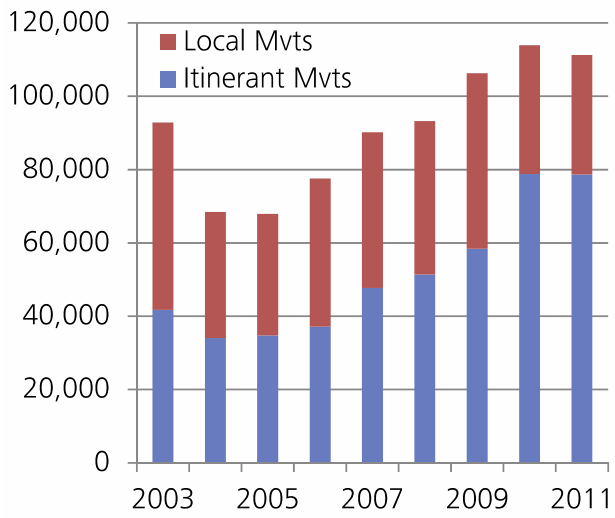


Fig 3.2 Historical Passenger Movements

The historical passenger movements show steady growth since Porter Airlines started operations in 2006. Traffic had previously peaked at 400,000 passengers in 1987 after City Express' relocation from Peterborough to the Toronto City Airport. Following the introduction of services by Air Ontario and the failure of City Express, traffic steadily declined to under 100,000 passengers per year until Porter Airlines entered the market.

[7] Request from Porter Airlines for Exemption to Commercial Jet Ban at Billy Bishop Toronto City Airport

Among itinerant movements (flights operating from one airport to another), the following graph shows the progressive growth in Turboprop aircraft operations, primarily driven by the expansion of operations by Porter Airlines and the reinstatement of operations by Air Canada in 2011. Local movements are those flights that remain in the vicinity of the airport.



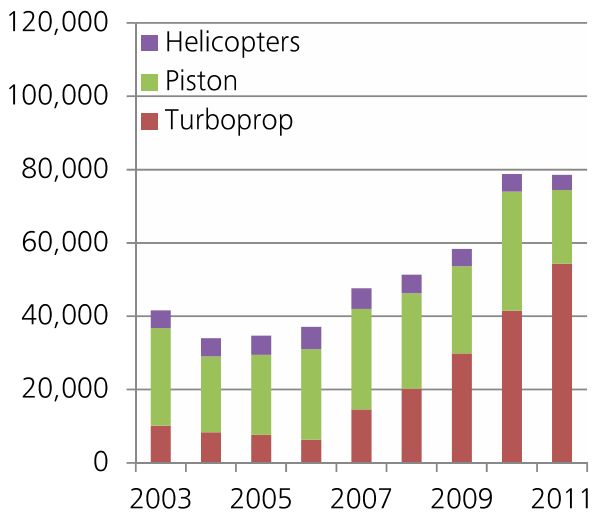


Fig 3.3 Historical Aircraft Movements – Local vs Itinerant **Fig 3.4 Historical Itinerant Aircraft Movements – By Aircraft Type**

Operations at BBTCA are predominantly driven by the business market. A review of a typical schedule for May 2013 highlights the profile of seats available across a weekday and on weekends. Daily profiles on weekday highlights the typical business peaks early morning and in later afternoon based on a rolling busy hour.

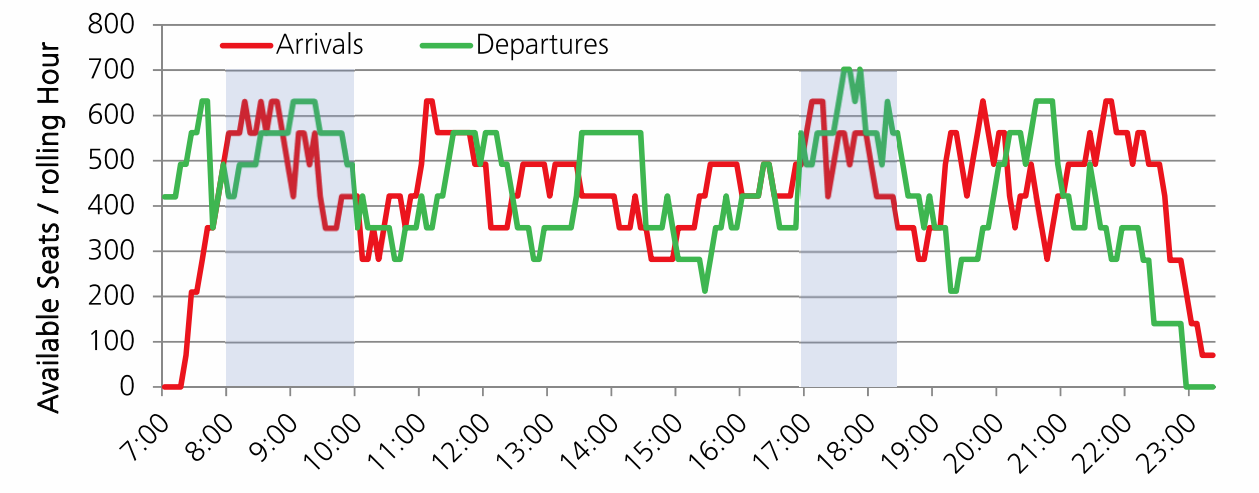


Fig 3.5 Daily Profile – Available Seats (Weekday, May 2013)

The daily profile of seat availability differs over the weekends. It shows operations starting later in the morning with a noticeable reduction in operations between Saturday afternoon and Sunday afternoon. However, Sunday evening is characterised by a surge in operations, especially for arrivals.

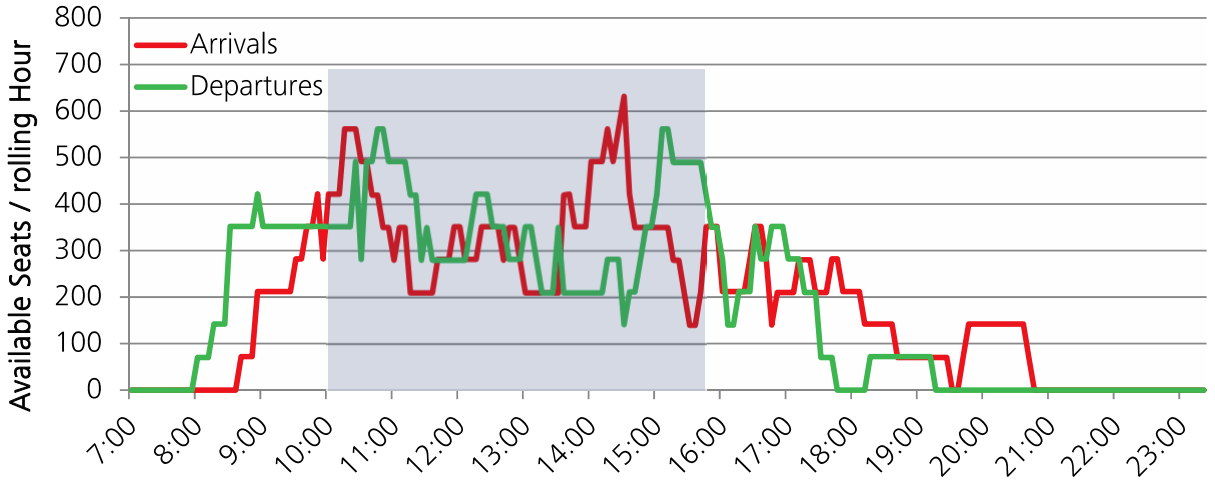


Fig 3.6 Daily Profile – Available Seats (Saturday, May 2013)

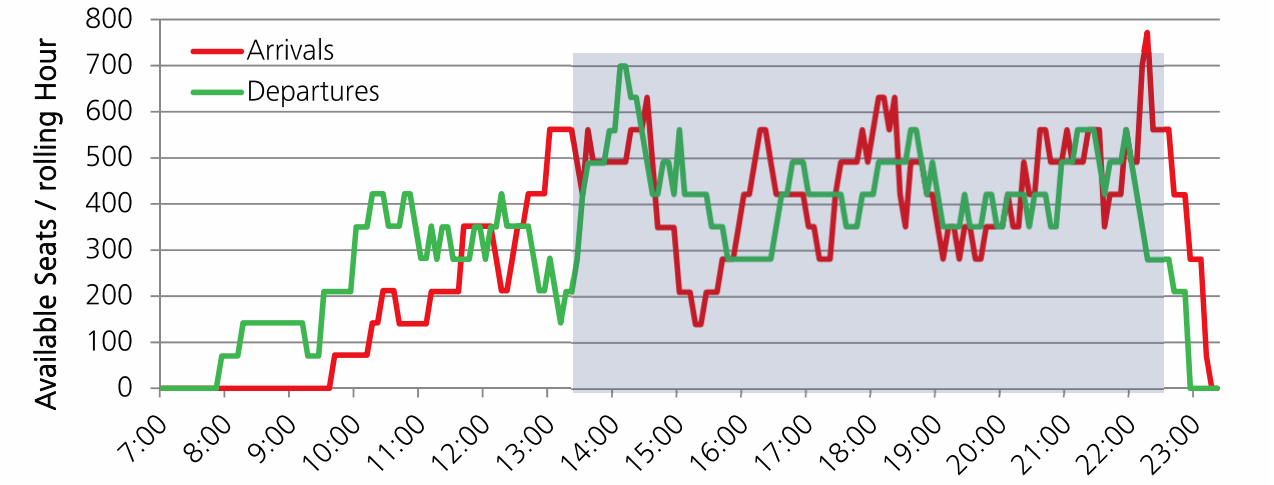


Fig 3.7 Daily Profile – Available Seats (Sunday, May 2013)

04. DESIGN AIRCRAFT

This section reviews the design aircraft proposed by Porter Airlines, the Bombardier CS100 (BD500-1A10) and its implications for infrastructure development and operational requirements at the Billy Bishop Toronto City Airport (BBTCA). Our review focussed on the available literature on the performance of the aircraft and where applicable, provides support information expanding on what is already available in the public domain.[8] As well as aircraft currently in operation, proposed new aircraft entering service within the Canadian market in the coming years were considered such as the Mitsubishi Regional Jet, the A320neo, the B737max as well as the Embraer E-jet next generation.

On April 10, 2013, Porter Airlines signed a conditional purchase order for 12 Bombardier CS100 aircraft, with options for an additional 18 CS100 aircraft[9]. The first CS100 aircraft was rolled out of the factory on March 7, 2013 and is scheduled to undertake its maiden test flight before the end of June 2013.[10]

DESIGN AIRCRAFT SPECIFICATIONS

As indicated by Bombardier, the CS100 is currently in development phase and as such is subject to changes notably in performance, design and/or systems. However as the testing and certification process evolves, revisions or new information is expected to be released by Bombardier that could impact the present review.

The enhanced performance of the CS100 aircraft compared to aircraft currently operating is driven by a range of innovations relating to the design and materials utilized in the construction of the aircraft. However, the geared turbofan engine is the most significant driver with respect to the reduction in fuel consumption and noise levels.

[8] http://media.bombardiercms.com/cseries/medias/cseries/galleries/cseries_download_high_en_2ad637.pdf
[9] Porter Airlines (May 2013)
[10] Bombardier Aerospace (March 2013)

The geared turbofan is not a new concept as it has been utilized on business jet applications since the early 1970s. It was more recently utilized on the 4-engined BAE146 aircraft which entered commercial service in 1983 and whose later models (RJ-85, RJ-100) remain in use at London City and Bromma Airports. Both of these airports are characterised by short take-off length and stringent noise restrictions commonly associated with "inner city airports".

The material reviewed indicated a runway length requirement of up to 1,463m on take-off and 1,356m on landing based on operations at Maximum Weight, Sea Level (Toronto City Centre is at 77m above sea level) and 15^0 Celsius (Based on ISA Conditions). The range achieved under these conditions will generally vary as a trade-off between payload (e.g. passengers and their bags) and range. On warm days, runway length requirements will increase assuming all other variables remain equal. ICAO (International Civil Aviation Organization) "Doc 9157, Aerodrome Design Manual / Part 1:Runways" recommends an increase of the runway length of 1% for each 1° increase in temperature above ISA. Assuming a 30°C ambient temperature, runway length requirements could therefore increase by as much as 15% based on this indicative rule.

The 1,569m runway length requirement identified by Porter Airlines through Bombardier's advice would allow the CS100 to undertake unrestricted operations except under limited conditions where a combination of a high load factor, high temperature and long range destination is involved. It should be noted that the Dash8-Q400 requires a runway length similar to the CS100 at Maximum Take-Off Weight (MTOW). However, the difference lies in the ability of the Dash8-Q400 to operate with restricted runway length under limited payload penalties due to the short range of typical missions (500 nautical miles) which do not require full fuel uplift.

In regards to noise levels, the CS100 is planned to weigh 59 tonnes. Under Chapter 3 certification requirements for this aircraft weight, the cumulative exposure noise level of the three measurements points is 286 EPNDB[11]. Chapter 4 certification requires a cumulative noise level 10 dB below Chapter 3 resulting in 276 EPNDB. Bombardier is advertising the CS100 as being able to achieve 21 dB below Chapter 4, which would result in 255 EPNDB, similar to the Dash8-Q400 certification levels. In consultation with Porter Airlines, Bombardier has guaranteed that they would meet or better the Tripartite Agreement cumulative level of 259.5 EPNDB.

[11] See Chapter 7 for additional considerations to noise and definition of EPNDB metric.

In regards to air quality, a preliminary review of literature confirms that the CS100 will meet the most current international emissions standards (CAEP/6). Emissions from the operations of the CS100 will exceed that of the Dash8-Q400 because of the different engine used (Turboprop vs Jet engine) and the type of mission (Transcontinental vs regional).

The following table outlines the key specifications of the CS100 and the Dash8-Q400 for comparative purposes.

Bombardier Dash8-Q400		Bombardier CS100
		
	Physical	
32.8 m	Length	35 m
28.4 m	Width	35.1 m
8.4 m	Height	11.5 m
74	Pax (Typical)	110
6,616 L	Fuel Capacity	tbd
	Performance	
29,574 kg	Maximum Take-Off Weight (MTOW)	58,513 kg
3,410 kW (Power)	Engine Thrust	103.5 kN
2,063 km	Range (@MTOW)	2,778 km
1,468 m	Runway Length (ISA, MTOW, SL)	1,463 m
	Noise / Environment	
84.0	Takeoff (EPNdB)	Tbd
93.1	Approach (EPNdB)	Tbd
78.6	Flyover (EPNdB)	Tbd
255.7	Cumulative (EPNdB)	is less than 259.5
21.2 g/kN	Nox Emissions	56-58% margin
5.6 g/kN	UHC Emissions	85% margin
86 g/kN	CO Emissions	80% margin

Table 4.1 CS100/Q400 Aircraft Comparative Table

COMPARABLE AIRCRAFT

The proposal by Porter Airlines is based on performance data specific to the Bombardier CS100. However, the resulting facilities may be suitable to a wider group of aircraft types. This section assesses comparable existing aircraft types as well as aircraft projected to enter service before the end of the decade using the same engine technology (geared turbofan) as the Bombardier CS100.

MITSUBISHI MRJ70/90

Mitsubishi Aircraft Corporation is currently scheduled by the end of 2013 to be the next manufacturer to roll-out a jet with the Pratt & Whitney geared turbofan technology. Two US-based regional carriers (Trans State Holdings and Skywest) have already purchased the MRJ which would end up operating as part of the regional networks of United, Delta or American/US Airways. The combined order is for 150 MRJ90 with an option for an additional 150 aircraft.

Like the CS100, the MRJ90 has yet to complete the certification process and therefore its performance specifications are subject to confirmation. However, based on the available information, the MRJ70 (approximately 78 seats) and MRJ90 (approximately 92 seats) would be able to operate at the Billy Bishop Toronto City Airport with some trade-off in range based on payload level and the exact model operated. As the MRJ70 and MRJ90 are using a smaller P&W Geared Turbofan, when compared to the CS100, the noise levels for the MRJ may be as low as or lower than the CS100.

No Canadian carriers have purchased the MRJ to date.

EMBRAER 170/190

Embraer has dominated the market for aircraft in the 70-110 seats range in recent years. This aircraft family has been in production since 2002 and it was recently announced that a new re-engined version using the same geared turbofan technology as the CSeries would enter service before the end of the decade.

A high-level review of the performance of the E170/E190 family indicates an ability to operate from the BBTCA generally with a reduced payload under most environmental conditions.

Although the current models operating do not meet the noise limits established under the Tripartite Agreement, the re-engined version of the EMB170/190 series is likely to be certified at noise levels below those set in the Tripartite Agreement by the time it enters service in or around 2018.

The Embraer 175 and 190 is operated by Air Canada as well as Transborder carriers.