

RESPONSE TO THE INDEPENDENT TORONTO AIRSPACE NOISE REVIEW



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TABLE OF CONTENTS

FOREWORD.....	4
SUMMARY OF RECOMMENDATIONS.....	5
RECOMMENDATION 1A.....	8
Sunset date for A320 without FOPP vortex generator	
RECOMMENDATION 1B.....	9
Toronto-Pearson sunset date for unmodified A320s and noise charges	
RECOMMENDATION 2A.....	10
Create an Industry Noise Management Board	
RECOMMENDATION 2B.....	11
Develop Industry 'Code of Conduct'	
RECOMMENDATION 2C.....	12
Achieving Low Power/Low Drag Descent	
RECOMMENDATION 2D.....	13
Evaluate Reduced Landing Flap Operation	
RECOMMENDATION 2E.....	14
Quarterly Publication of CDO Achievement	
RECOMMENDATION 2F.....	15
Publish Annual CDO Performance Improvement Targets	
RECOMMENDATION 3A.....	16
Design RNP-AR procedures that can reduce the need for a high / low operation	
RECOMMENDATION 3B.....	17
Maximize the usage of RNP-AR to incentivize equipage	
RECOMMENDATION 3C.....	18
Publish RNAV approaches which will allow for an increase in Continuous Descent Operations	
RECOMMENDATION 4.....	19
Consider 3.2° glideslope for RNAV approaches	

TABLE OF CONTENTS

RECOMMENDATION 5A 20
 Allow consultation to inform next steps on additional runway alternation options

RECOMMENDATION 6A21
 Encourage “short-cuts” on an ad-hoc basis, to reduce downwind usage when traffic permits

RECOMMENDATION 7A22
 Investigate Single Point Merge

RECOMMENDATION 8A23
 Implement Arrivals Manager System (AMAN)

RECOMMENDATION 8B24
 Extend horizon of influence of AMAN system

RECOMMENDATION 8C25
 Invest in development of Time Based Operations

APPENDIX A26
 Overview of Implementation Plan

APPENDIX B27
 Update on Toronto Noise Mitigation Initiatives

FOREWORD

I am pleased to present NAV CANADA's response to the Toronto Independent Airspace Noise Review.

The Airspace Review represents a year of work by Helios principal Nick Boud as well as Bo Redeborn and Graham Lake. In reviewing the report over the past 60 days, we have found it to be a substantive examination of the issues, identified through consultation and analysis, and a thorough study of possible measures to reduce community impact. It both takes into consideration the unique nature of Toronto operations and seeks to inform on best practices in air traffic management and noise mitigation from airports elsewhere.

It achieves what we had hoped for when NAV CANADA commissioned this review. By making recommendations for measures that are achievable in the short, medium and long term, the report lays out a path for the implementation of tangible actions that will deliver community benefits.

The following pages outline NAV CANADA's assessment of those recommendations. We have also provided an update on the "Six Noise Mitigation Initiatives" for which NAV CANADA has lead responsibility. While much has been done over the past 60 days, more work lays ahead, some of which will require the collaborative efforts of many stakeholders. NAV CANADA is committed to the actions identified herein and the timelines we have laid out.

I'd like to thank Nick, Bo and Graham for their work. The heavy lifting now lies with us as we turn to work with the GTAA, aircraft operators as well as communities and their representatives to map the way forward and to report regularly on our progress.

Sincerely,



Rudy Kellar
Executive Vice President
Service Delivery



SUMMARY OF RECOMMENDATIONS

<p>Recommendation 1A</p>	<p>NAV CANADA should formally write to Transport Canada requesting them to consider establishment of a sunset date of December 31st 2020 for the operation, in Canada, of Airbus A320 series aircraft without the Fuel Over Pressure Protector cavity vortex generator noise modification.</p>
	<p>Transport Canada is already aware of the issue with this specific aircraft type and we have been informed that they are reviewing the matter.</p>
<p>Recommendation 1B</p>	<p>As an indication of GTAA's and NAV CANADA's commitment to noise reduction, and a tangible indication to local communities that the noise impact of the airport is taken seriously and; to incentivise an accelerated noise modification by all airlines using A320 family aircraft at Toronto; NAV CANADA should formally approach the GTAA about the establishment of an earlier sunset date for unmodified Airbus A320 family aircraft using the airport, such as two years after publication of this report. With an appropriate noise penalty applied for non-compliant aircraft immediately thereafter, if lawful within the GTAA's or NAV CANADA's charging regimes.</p>
	<p>Action on this recommendation is underway. GTAA announced on September 27, 2017 that it will begin work on a quieter fleet incentive program aimed at encouraging air carriers to retrofit or retire aircraft that are noisier and/or cause a higher degree of irritation, such as the A320 family, and that it is aiming to implement this program in the next 18 to 24 months.</p>
<p>Recommendation 2A</p>	<p>NAV CANADA, the major Toronto Pearson airlines (Air Canada, Rouge, WestJet and Jazz), the National Airline Council of Canada, the GTAA, and possibly the Canadian Airports Council and Transport Canada, should form an Industry Noise Management Board.</p>
	<p>NAV CANADA accepts this recommendation</p>
<p>Recommendation 2B</p>	<p>The Industry Noise Management Board should develop a cross industry "Code of Conduct" that facilitates the reduction of arrival and departure noise through improvements in aircraft operation and air traffic control management at Toronto Pearson.</p>
	<p>NAV CANADA accepts this recommendation</p>
<p>Recommendation 2C</p>	<p>The Industry Noise Management Board should develop an agreed definition of Continuous Descent Operation (CDO) and guidance on achieving low power - low drag CDOs</p>
	<p>NAV CANADA accepts this recommendation</p>
<p>Recommendation 2D</p>	<p>The Industry Noise Management Board should evaluate whether landing with reduced flap is safe to operate at Toronto Pearson, and to provide guidance on how to achieve this if proven acceptable.</p>
	<p>NAV CANADA accepts this recommendation</p>

SUMMARY OF RECOMMENDATIONS

Recommendation 2E	<p>NAV CANADA should publish at least quarterly, the percentage of arrival flights achieving Continuous Descent Operation compliance at Toronto Pearson.</p>
	<p>NAV CANADA accepts this recommendation</p>
Recommendation 2F	<p>NAV CANADA should benchmark, on an annual basis, Continuous Descent Operation achievement by airlines at Toronto Pearson against a baseline of current performance and a targeted annual performance improvement.</p>
	<p>NAV CANADA accepts this recommendation</p>
Recommendation 3A	<p>NAV CANADA should design Required Navigation Performance Authorization Required procedures that can reduce the need for a high / low operation, taking due consideration of the location of the tracks, and proceed to consultation to facilitate implementation as soon as is practicable.</p>
	<p>NAV CANADA accepts this recommendation</p>
Recommendation 3B	<p>NAV CANADA should maximise the use of the Required Navigation Performance Authorization Required (RNP AR) procedure to incentivise those airlines not already capable of RNP AR to invest, as the RNP AR approach route will offer airlines a more fuel efficient arrival route.</p>
	<p>NAV CANADA accepts this recommendation</p>
Recommendation 3C	<p>NAV CANADA should develop at least one Area Navigation Continuous Descent Operation route from each downwind Standard Arrival Route to the nearest parallel runway, to improve the use and delivery of Continuous Descent Operations and increase the average height of approaching aircraft during low-traffic times.</p>
	<p>NAV CANADA accepts this recommendation</p>
Recommendation 4A	<p>The Industry Noise Management Board should consider 3.2° RNAV approaches, with a controlled evaluation of the benefits and drawbacks of changing the glide path angle at Toronto Pearson.</p>
	<p>NAV CANADA accepts the first part of this recommendation</p>
Recommendation 5A	<p>NAV CANADA should wait to understand and reflect on the output of the GTAA's current public engagement activities, that include the Residents' Reference Panel, and the upcoming consultation on weekend runway alternation; prior to determining whether to proceed to operate runway alternation when traffic levels permit.</p>
	<p>NAV CANADA accepts this recommendation</p>

SUMMARY OF RECOMMENDATIONS

<p>Recommendation 6A</p>	<p>NAV CANADA should continue to utilise short-cuts over Lake Ontario on an ad-hoc basis and should seek to promote their use, to reduce downwind usage when traffic permits. The combination of short-cuts over the lake to join the new Area Navigation approach routes recommended in 3C will facilitate low power - low drag and Continuous Descent Operation.</p>
	<p>NAV CANADA accepts this recommendation</p>
<p>Recommendation 7A</p>	<p>NAV CANADA should investigate and evaluate the operational, environmental, financial and societal impacts, of a single point merge solution for straight-in arrivals at Toronto Pearson.</p>
	<p>NAV CANADA accepts this recommendation</p>
<p>Recommendation 8A</p>	<p>NAV CANADA should implement as soon as practical an integrated extended arrivals manager to provide automatic sequencing support to air traffic controllers, and arrival planning for pilots.</p>
	<p>NAV CANADA accepts this recommendation</p>
<p>Recommendation 8B</p>	<p>NAV CANADA should implement a programme to continually stretch the horizon of influence and accuracy of an extend arrivals manager tool's output through refinement of the input data and the heuristics used within the tool.</p>
	<p>Further research is required before NAV CANADA is able to fully accept this recommendation</p>
<p>Recommendation 8C</p>	<p>NAV CANADA should invest in the development of Time Based Operations within Canadian airspace as well as international research and development activities with the strategic objective to achieve full Trajectory Based Operations.</p>
	<p>NAV CANADA accepts this recommendation</p>

RECOMMENDATION 1A

Sunset date for A320 without FOPP vortex generator

Full Recommendation

NAV CANADA should formally write to Transport Canada requesting them to consider establishment of a sunset date of December 31st 2020 for the operation, in Canada, of Airbus A320 series aircraft without the Fuel Over Pressure Protector cavity vortex generator noise modification.

 **We appreciate the intent of this recommendation and the issue is under review by appropriate parties.**

The unique noise signature of the A320 family of aircraft has resulted in airports in many jurisdictions encouraging airlines to retrofit this aircraft type with a vortex generator, usually through increased charges or voluntary agreements, in order to reduce community annoyance.

As a provider of air traffic control and related air navigation services, aircraft noise certification is outside of NAV CANADA's jurisdiction. ICAO noise standards form the basis of noise certification in most jurisdictions. In Canada these standards were incorporated into the Canadian Aviation Regulations administered by Transport Canada. Transport Canada ensures compliance with noise standards through the aircraft certification process.

We are aware however that both Transport Canada, as the authority for aircraft certification, and the major airline operators of the A320 family of aircraft in Canada have been advised of the noise issue related to the A320 fuel over pressure protector, as well as the improvements possible by adding vortex generators to the wings. These organizations are actively reviewing the matter.

RECOMMENDATION 1B

Toronto-Pearson sunset date for unmodified A320s and noise charges

Full Recommendation

As an indication of GTAA's and NAV CANADA's commitment to noise reduction, and a tangible indication to local communities that the noise impact of the airport is taken seriously and; to incentivize an accelerated noise modification by all airlines using A320 family aircraft at Toronto; NAV CANADA should formally approach the GTAA about the establishment of an earlier sunset date for unmodified Airbus A320 family aircraft using the airport, such as two years after publication of this report. With an appropriate noise penalty applied for non-compliant aircraft immediately thereafter, if lawful within the GTAA's or NAV CANADA's charging regimes.

Action on this recommendation is underway.

We appreciate that the intent of this recommendation is to incentivize an accelerated modification of the A320 family of aircraft operated to and from Toronto-Pearson Airport.

The Greater Toronto Airport Authority announced on September 27, 2017 that, as part of its 5-year Noise Management Action Plan, it will begin work on a quieter fleet incentive program, aimed at encouraging air carriers to retrofit or retire aircraft that are noisier and/or cause a higher degree of irritation. They have indicated that this will include the A320 family of aircraft.

Implementation Plan

The GTAA is aiming to implement this program in the next 18 to 24 months.

RECOMMENDATION 2A

Create an Industry Noise Management Board

Full Recommendation

NAV CANADA, the major Toronto Pearson airlines (Air Canada, Rouge, WestJet and Jazz), the National Airline Council of Canada, the GTAA, and possibly the Canadian Airports Council and Transport Canada, should form an Industry Noise Management Board.

✓ NAV CANADA accepts this recommendation.

We understand the importance of managing noise at lower altitudes where community impacts occur and appreciate that this will require a collaborative effort by many players in the system. An Industry Noise Management Board provides an appropriate forum for operational discussions and will ensure the participation of parties with the ability to influence outcomes.

Implementation Plan

NAV CANADA will immediately commence work with the major airlines operating at Toronto-Pearson International Airport, as well as the National Airlines Council of Canada, the GTAA and Transport Canada to create an Industry Noise Management Board.

The first task will be to determine appropriate membership and develop Terms of Reference for the Board in order to provide clarity on mandate. The mandate will include a broad definition of noise mitigation, including those related to airspace, airframe and operational techniques. The Industry Noise Management Board will not be limited to examining currently available mitigations but will also consider how emerging technologies may play a role in improvements.

Timeline

The first meeting will occur no later than January 31, 2018. Meetings will be held at least quarterly. We will report progress regularly to the Community Environment and Noise Advisory Committee and in other appropriate forums.

RECOMMENDATION 2B

Develop Industry 'Code of Conduct'

Full Recommendation

The Industry Noise Management Board should develop a cross industry "Code of Conduct" that facilitates the reduction of arrival and departure noise through improvements in aircraft operation and air traffic control management at Toronto Pearson.

NAV CANADA accepts this recommendation.

In developing a Code of Conduct, the Industry Noise Management Board will have discussions to define how operational performance can contribute to the generation of unnecessary noise and clarify expectations of performance by all parties that can assist with the management of noise at lower altitudes. Once the Code is complete, disseminating this information in the form of a Code of Conduct within organizations will ensure awareness levels necessary to make material improvements.

Implementation Plan

NAV CANADA will ensure that the Terms of Reference for the Industry Noise Management Board includes a mandate to develop a Cross Industry 'Code of Conduct' to ensure both pilots and controllers have a clear understanding of expectations for aircraft operating at Toronto Pearson.

By working collaboratively and giving the pilots more predictability in terminal airspace, the speed and descent/climb profile of the airplane can be better managed, providing a potential reduction in noise underneath the flight path. This will enable arriving aircraft to maximize continuous descent in various operations. The Industry Noise Management Board will also examine the potential benefits of standardizing the departure profile used for each runway.

Timeline

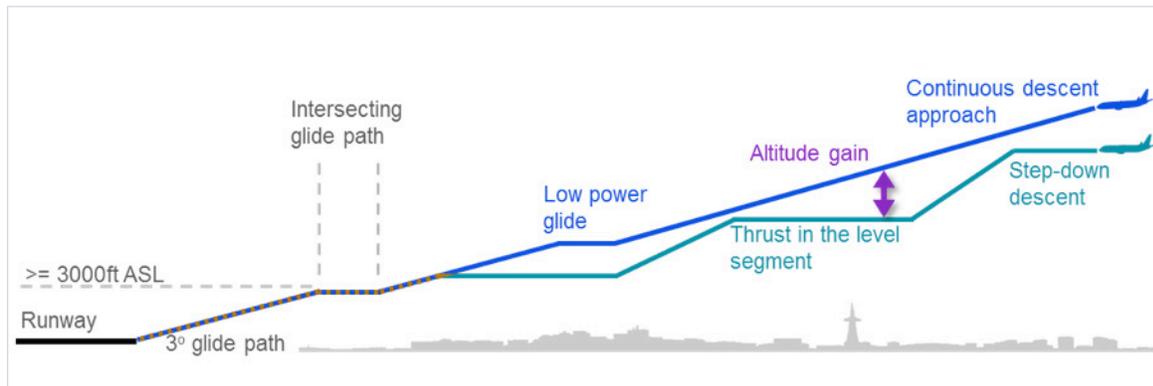
Once formed, the Industry Noise Management Board will endeavor to complete the 'Code of Conduct' by the end of 2018. At the same time, an appropriate communications plan will be developed to ensure its broad dissemination and confirm that appropriate training requirements are considered.

RECOMMENDATION 2C

Achieving Low Power/Low Drag Descent

Full Recommendation

The Industry Noise Management Board should develop an agreed definition of Continuous Descent Operation (CDO) and guidance on achieving low power – low drag CDOs.



✓ NAV CANADA accepts this recommendation

NAV CANADA recognizes that Continuous Descent Operations offer noise benefits for communities under portions of the arrival flight path, as well as fuel efficiency benefits for air operators. There are various definitions of CDO used by airports and air navigation service providers in their public reporting. It is appropriate that the Industry Noise Management Board seek to define CDO in the Toronto–Pearson operational context.

Implementation Plan

NAV CANADA will ask the Industry Noise Management Board to develop an agreed definition of a continuous descent operation as it pertains to aircraft operations at Toronto Pearson. This will include consideration of the current requirement that necessitates short level segments to ensure separation in periods of parallel operations.

NAV CANADA will work with its industry partners to include guidance on achieving low power/low drag continuous descent operations in the Code of Conduct. As part of this work, the Industry Noise Management Board will assess the impacts of delayed gear deployment and review the vertical profile of the Toronto–Pearson Standard Terminal Arrival Routes (STARs) to see if any changes would contribute to increasing continuous descent and low power/low drag operations. This will include considering possible alternatives to the 3000ft ‘anchor altitudes’ at the end of each STAR.

Timeline

Development of the definition and guidance on achieving low power/low drag continuous descent operations will be included in the ‘Code of Conduct’, which the Industry Noise Management Board will seek to complete by the end of 2018.

RECOMMENDATION 2D

Evaluate Reduced Landing Flap Operation

Full Recommendation

The Industry Noise Management Board should evaluate whether landing with reduced flap is safe to operate at Toronto Pearson, and to provide guidance on how to achieve this if proven acceptable.

NAV CANADA accepts this recommendation.

NAV CANADA is aware of initiatives at other airports related to reduced landing flap operations and the potential noise reduction this can provide on final approach close to the airport.

Implementation Plan

NAV CANADA will ask the Industry Noise Management Board to evaluate reduced landing flap operations at Toronto Pearson. This evaluation will consider the associated noise benefit as well as the potential effect on operations, including capacity impacts such as arrival/departure spacing and runway occupancy times and safety impacts such as the frequency of unstable approaches.

While not directly associated with reduced landing flap operations, NAV CANADA will also ask the Industry Noise Management Board to review the use of reverse thrust at night. Reverse thrust is used to increase braking power after landing. It can contribute to noise in areas around the airport. While increased braking power is important to reduce runway occupancy time during busy periods, overnight traffic levels are such that limits on reverse thrust may be feasible.

Timeline

These items will be investigated by the Industry Noise Management Board as part of the development of the Code of Conduct. If deemed viable they will be included in the Code which is anticipated to be complete by the end of 2018.

RECOMMENDATION 2E

Quarterly Publication of CDO Achievement

Full Recommendation

NAV CANADA should publish at least quarterly, the percentage of arrival flights achieving Continuous Descent Operation compliance at Toronto Pearson.

 **NAV CANADA accepts this recommendation.**

Air traffic control has a role in enabling Continuous Descent Operations through efficient airspace design and effective controller-pilot communications. While a certain amount of level flight is required for safety in busy terminal airspace, NAV CANADA will work to minimize low altitude level segments where possible. We will be transparent in this effort by committing to publish CDO rates achieved by aircraft arriving at Toronto Pearson.

Implementation Plan

Under recommendation 2C the Industry Noise Management Board will develop an appropriate definition of CDO in the Toronto-Pearson operational context. While that work is underway, NAV CANADA will investigate a means of reliably measuring CDO achievement rates at Toronto Pearson.

A quarterly report on CDO rates will be tabled with the Toronto-Pearson Airport Community Environment and Noise Advisory Committee.

Timeline

Measurement and publication of CDO rates will commence upon the development of an agreed on definition by the Industry Noise Management Board.

RECOMMENDATION 2F

Publish Annual CDO Performance Improvement Targets

Full Recommendation

NAV CANADA should benchmark, on an annual basis, Continuous Descent Operation achievement by airlines at Toronto Pearson against a baseline of current performance and a targeted annual performance improvement.

NAV CANADA accepts this recommendation.

Quarterly reporting of CDO achievement should not be just a transparency exercise. Progress comes not with the reporting of data, but with the development of performance improvement targets based on that data.

Implementation Plan

Once quarterly CDO rates are published to determine baseline performance and impacts of factors such as seasonality, NAV CANADA will work with its partners to determine annual performance improvement targets. The process of establishing annual performance targets will undoubtedly incentivize new procedures and technologies that enable increased CDO rates.

Timeline

The establishment of annual performance targets will follow one year of baseline data (i.e. publication of 4 quarterly reports). Once targets have been established, follow on reports will track data against those targets.

RECOMMENDATION 3A

Design RNP-AR procedures that can reduce the need for a high / low operation

Full Recommendation

NAV CANADA should design Required Navigation Performance Authorization Required procedures that can reduce the need for a high / low operation, taking due consideration of the location of the tracks, and proceed to consultation to facilitate implementation as soon as is practicable.

NAV CANADA accepts this recommendation.

'Established on RNP-AR' is a new operational procedure which is not yet approved, that leverages the accuracy of RNP-AR approaches to remove the requirement for level segments based on a 'high side' and a 'low side' during independent parallel approaches. Currently, the high/low is necessary to ensure vertical separation is maintained as aircraft intercept the final approach to runways that are closer than the horizontal separation standard. The level flight segments can be associated with increased noise levels. Established on RNP-AR can provide some noise benefit by allowing Continuous Descent Operations to both runways simultaneously, something which is not possible with the existing operation.

NAV CANADA understands the community benefits of measures which can reduce the need for high/low. Any improvements due to increasing CDO through RNP-AR will be incremental. Aircraft equipage levels and capacity implications necessitate a gradual evolution towards this operation.

While RNP offers the benefit of continuous descent and a reduction in the overall need for a high/low operation, as the Independent Toronto Airspace Noise Review notes, it also results in a precise path that can in some instances increase community impact in some portions of the flight path through concentration. For that reason, the design process must seek to reduce impact through careful placement of routes over non-residential land uses where possible, and community consultation should inform the process.

Implementation

Upon ICAO approval and publication of the new 'Established on RNP-AR' separation standard, NAV CANADA will establish a project team to develop a concept of operations for application at Toronto Pearson.

Concept designs which detail the location of the RNP track will undergo a full public consultation process, in accordance with the *Airspace Change Communications and Consultation Protocol*.

Timeline

ICAO Publication of the new separation standard that will enable this operation is currently planned for November 2018.

NAV CANADA will commence the development of a concept of operations and preparation of potential RNP concept designs for Toronto-Pearson in fall 2018.

RECOMMENDATION 3B

Maximize the usage of RNP-AR to incentivize equipage

Full Recommendation

NAV CANADA should maximize the use of the Required Navigation Performance Authorization Required (RNP AR) procedure to incentivize those airlines not already capable of RNP AR to invest, as the RNP AR approach route will offer airlines a more fuel efficient arrival route.

NAV CANADA accepts this recommendation.

As the equipage levels of airlines operating at Toronto Pearson increase, so will the opportunity for air traffic controllers to offer RNP-AR approaches to aircrew. This will in turn lead to a reduction in high/low operations over time, allowing for continuous descent to both runways simultaneously. Aircraft noise will be lessened by the reduction in low altitude level segments that results.

Implementation Plan

NAV CANADA will continue to work with our airline partners to achieve the goals of the Canadian State PBN Plan and the NAV CANADA PBN Operations Plan.

In coordination with National Airlines Council of Canada we have established a National RNP Program, which has developed plans for the implementation of RNP-AR procedures at up to 40 different airports in Canada and has started implementing those plans. Additionally, NAV CANADA is in the process of developing decision support tools which will aid air traffic controllers in managing spacing and sequencing in a PBN environment. A complete national network, in combination with continued increase in usage at airports that are already published, is expected to support growth in aircraft equipage of the fleet operating at Toronto Pearson.

Timeline

NAV CANADA's PBN Plan is a multi-year undertaking that will see RNP approaches designed and deployed following appropriate community engagement. Incentives for airlines to equip aircraft and certify crew for RNP operations will be an incremental undertaking as the availability for use, and therefore the cost/benefit decision for companies is influenced.

RECOMMENDATION 3C

Publish RNAV approaches which will allow for an increase in Continuous Descent Operations

Full Recommendation

NAV CANADA should develop at least one Area Navigation Continuous Descent Operation route from each downwind Standard Arrival Route to the nearest parallel runway, to improve the use and delivery of Continuous Descent Operations and increase the average height of approaching aircraft during low-traffic times.

✓ NAV CANADA accepts this recommendation.

Improving continuous descent operations is an important objective. We believe that area navigation (RNAV) CDO approaches could see usage during lower traffic periods of the day in which we are not in a dual operation (arriving two parallel runways simultaneously), reducing low altitude level segments over residential areas. When used, they will increase the average altitude in the baseleg and downwind area of the arrival path by as much as 1,000 feet. RNAV approaches can be designed for each runway in the manner recommended.

Implementation Plan

NAV CANADA will publish RNAV approaches for each runway at Toronto Pearson. We expect to see these approaches used during periods of lower traffic demand to increase the opportunity for aircraft to conduct their arrival consistent with constant descent operations.

Timeline

We have actioned the design of RNAV approaches to meet this recommendation. Draft approach designs will be consulted on in early 2018 as part of the upcoming community engagement that NAV CANADA will be undertaking with the Greater Toronto Airports Authority.

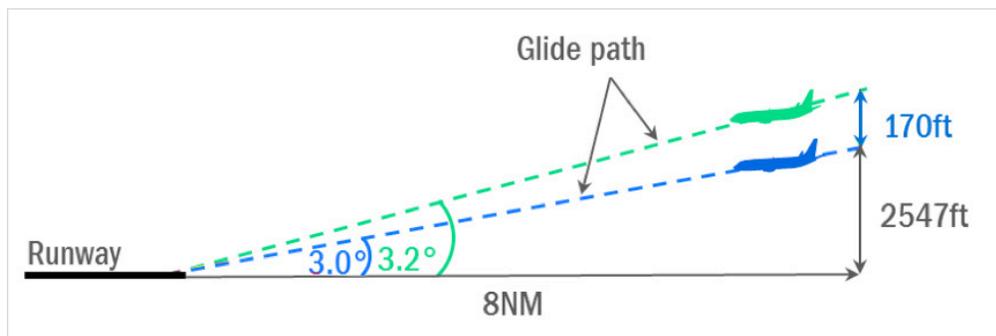
Following the completion of consultation as required by the *Airspace Change Communication and Consultation Protocol*, if supported, new RNAV approaches could be published and in use as soon as February 2019.

RECOMMENDATION 4

Consider 3.2° glideslope for RNAV approaches

Full Recommendation

The Industry Noise Management Board should consider 3.2° RNAV approaches, with a controlled evaluation of the benefits and drawbacks of changing the glide path angle at Toronto Pearson.



✓ NAV CANADA accepts the first part of this recommendation.

A 3° descent angle is standard for airport approaches in Canada unless required for obstacle clearance. However NAV CANADA is aware of initiatives and studies at other major airports where a slightly steeper approach has been implemented to increase average altitudes and reduce noise at some locations under the approach path.

Implementation Plan

NAV CANADA will ask the Industry Noise Management Board to study the operational impact of designing the RNAV approaches referenced in Recommendation 3C at a 3.2 degree descent angle.

Raising the glide path on the Instrument Landing Systems (ILS) to 3.2 degrees would impact airport accessibility in poor weather by removing the certification on the ILS for Category II/III approaches. These types of approaches provide pilots with the ability to continue to safely operate during periods of low visibility. NAV CANADA will not consider any change that would reduce the ability of pilots to safely operate in poor weather and therefore limit accessibility of Toronto-Pearson airport.

As the report notes, Ground-Based Augmentation System (GBAS) Landing Systems (GLS) are another type of system that provides similar performance to an ILS. They are not currently in use in Canada. While these systems do not yet offer Category II/III approach capability, it is anticipated that this may change in the near future. NAV CANADA will continue to monitor developments in this area to determine if GLS presents an option in the future.

Timeline

We have actioned the design of RNAV approaches in Recommendation 3C at a standard 3° descent angle and will commence community consultation in early 2018. If the Industry Noise Management Board deems a 3.2° descent angle viable, and consultation supports the draft RNAV designs, the altitude restrictions on the RNAV approaches would be adjusted accordingly and could still be published in the original timeline (February 2019).

RECOMMENDATION 5A

Allow consultation to inform next steps on additional runway alternation options

Full Recommendation

NAV CANADA should wait to understand and reflect on the output of the GTAA's current public engagement activities, that include the Residents' Reference Panel, and the upcoming consultation on weekend runway alternation; prior to determining whether to proceed to operate runway alternation when traffic levels permit.

NAV CANADA accepts this recommendation.

Runway alternation can in some instances be a means of distributing the impacts of aircraft overflight and providing respite from noise. As the Independent Toronto Airspace Noise Review notes, while runway alternation during lower traffic periods and certain wind conditions may be technically viable, lower noise for some communities means higher noise for others.

The Greater Toronto Airports Authority has been leading analysis and community dialogue on the concept of runway alternation on weekends. This is known as "Initiative #5" of the Toronto Noise Mitigation Initiatives. Should there be community support for such a measure and should it be implemented successfully, NAV CANADA will examine the potential for shorter periods of runway alternation during the week, focused on periods of the day when traffic levels permit traffic to be handled in a land one, depart one configuration.

Timeline

GTAA is intending to initiate public consultation in early 2018. NAV CANADA will defer any further examination of the possibility of runway alternation during periods of the weekday until that consultation is complete.

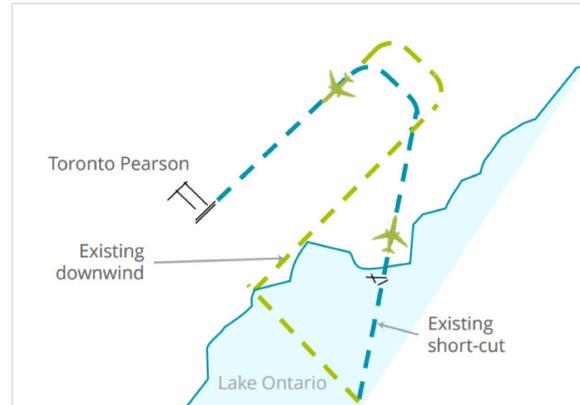
RECOMMENDATION 6A

Encourage “short-cuts” on an ad-hoc basis, to reduce downwind usage when traffic permits

Full Recommendation

NAV CANADA should continue to utilize short-cuts over Lake Ontario on an ad-hoc basis and should seek to promote their use, to reduce downwind usage when traffic permits.

The combination of short-cuts over the lake to join the new Area Navigation approach routes recommended in 3C will facilitate low power - low drag and Continuous Descent Operation. The implementation of the new Area Navigation approaches will be subject to consultation in accordance with the Protocol.



✓ NAV CANADA accepts this recommendation.

In managing sequencing in terminal airspace or in providing service to aircraft during low traffic periods air traffic controllers sometimes use vectors to either shorten or lengthen the flight path as appropriate. When in an easterly or westerly operation, the combination of short-cuts over the lake to join the new RNAV approach routes referenced in Recommendation 3C will enable an increase in low power - low drag and Continuous Descent Operations during periods of lower traffic demand and reduce the volume of traffic using the downwind.

Implementation Plan

NAV CANADA will consult with the public on new RNAV approaches to all runways at Toronto Pearson in early 2018. The advantage of these approaches is that they provide for continuous descent and therefore increase average altitudes in the baseleg and downwind portion of the flight path by as much as 1,000 feet when used in conjunction with the STAR.

In addition, NAV CANADA will use simulation exercises to provide air traffic controllers with additional training on the use of these RNAV approaches in combination with short cuts over the lake. As controllers become more familiar with the procedure, it can be anticipated that there would be an increase in usage during periods of low traffic demand and therefore a corresponding reduction in arrivals from the south utilizing the downwind.

We recognize that the increased use of short cuts for arrivals from the south will increase overflight of other communities. The expected use of the RNAV arrivals will be addressed in the public consultation in 2018.

Timeline

As noted under recommendation 3C we have actioned the design of RNAV approaches utilizing continuous descent. Draft approach designs will be consulted on in early 2018 as part of the upcoming community engagement that NAV CANADA will be undertaking with the Greater Toronto Airports Authority.

Following the completion of consultation as required by the *Airspace Change Communication and Consultation Protocol*, if supported, new RNAV approaches could be published and in use as soon as February 2019. Air traffic controller simulation training would precede implementation.

RECOMMENDATION 7A

Investigate Single Point Merge

Full Recommendation

NAV CANADA should investigate and evaluate the operational, environmental, financial and societal impacts, of a single point merge solution for straight-in arrivals at Toronto Pearson.

✓ NAV CANADA accepts this recommendation.

Point merge is a relatively new sequencing technique that has been successfully implemented at several airports in recent years. As the Report notes, it has not been implemented in North America and to date not at an airport with a runway configuration like Toronto-Pearson.



We agree that point merge is a concept that should be studied and that its use for straight in approaches may increase sequencing options. Straight-in arrivals are an important facet of the overall operation at Toronto Pearson, representing over 27 percent of arrivals in an easterly configuration and approximately 19 percent of arrivals in a westerly configuration. Point merge may offer options to reduce the need for extended downwinds to manage traffic arriving over the busier bedpost which brings arrival aircraft over the lake and which represents 32 percent of all arrivals.

Implementation Plan

NAV CANADA will establish a study team to research and investigate the operational concepts and air traffic management and airspace implications of using point merge for the management of straight-in arrivals at Toronto Pearson.

The conclusions of the study will be referred to the Industry Noise Management Board for further consideration of the environmental and operational impacts and discussion on what would be a new operational concept for both pilots and air traffic controllers.

Timeline

The NAV CANADA study team will be formed in spring 2018 and will report to the Industry Noise Management Board by the end of 2018.

RECOMMENDATION 8A

Implement Arrivals Manager System (AMAN)

Full Recommendation

NAV CANADA should implement as soon as practical an integrated extended arrivals manager to provide automatic sequencing support to air traffic controllers, and arrival planning for pilots.

NAV CANADA accepts this recommendation.

An arrivals manager system (AMAN) would provide air traffic controllers with an additional decision support tool to enable them to manage arrival traffic during periods of high traffic demand. An AMAN enables air traffic to be effectively sequenced much earlier than is currently the case, smoothing the flow of traffic into the terminal airspace and therefore potentially increasing the opportunity for continuous descent.

Implementation Plan

NAV CANADA has signed a contract to purchase an AMAN system as an arrival sequencing tool at the four busiest airports in Canada (Montreal, Vancouver, Toronto and Calgary). The Arrival Management tool, is being integrated into our existing air traffic management tools to ensure seamless data exchange.

The system is currently undergoing factory acceptance testing for a planned deployment at Toronto-Pearson International Airport first, followed by deployment at the other airports.

Timeline

Testing of the new AMAN and operational simulation is scheduled to begin by the end of 2017. Subject to successful testing and simulation, operational deployment should occur in 2018.

RECOMMENDATION 8B

Extend horizon of influence of AMAN system

Full Recommendation

NAV CANADA should implement a program to continually stretch the horizon of influence and accuracy of an extend arrivals manager tool's output through refinement of the input data and the heuristics used within the tool.

NAV CANADA accepts this recommendation.

NAV CANADA agrees that increasing the scope of the Arrivals Manager (AMAN) is desirable to provide better management of busy traffic flows and we will endeavor to achieve this. However, due to the high volume of traffic that approaches Toronto Pearson from the United States (over 50 percent), and the very short time that this traffic is within Canadian airspace, expanding the horizon of an AMAN system for Toronto-Pearson would require an extension into US airspace and coordination with the Federal Aviation Administration's operational systems.

Implementation Plan

Once AMAN is successfully in operational use in Toronto-Pearson in 2018, NAV CANADA will plan for its further development and evolution. This will include discussions with air traffic control authorities in the United States about means of extending the AMAN planning horizon into US airspace.

Timeline

Further research is needed to determine timelines for the development of an extended AMAN.

RECOMMENDATION 8C

Invest in development of Time Based Operations

Full Recommendation

NAV CANADA should invest in the development of Time Based Operations within Canadian airspace as well as international research and development activities with the strategic objective to achieve full Trajectory Based Operations.

NAV CANADA accepts this recommendation.

Time Based Operations, also sometimes referred to as 4D Trajectory, has the potential to increase the overall predictability of air traffic operations, gate-to-gate. This increased predictability allows for the planning of a more optimal profile for aircraft, leading to a potential reduction in noise on the ground, fuel burn and GHG emissions.

Implementation Plan

NAV CANADA is currently developing decision support tools for use by air traffic controllers to manage and regulate the flow of aircraft to and from airports. These will include tools that facilitate consideration of the full trajectory of a flight from leaving its airport departure gate to arriving at the destination airport gate and all parts of the flight in between. Eventually it is believed that Time/Trajectory Based Operations will aid in systematically managing aircraft, with integrity of a few seconds, throughout the entire flight, therefore requiring less tactical intervention.

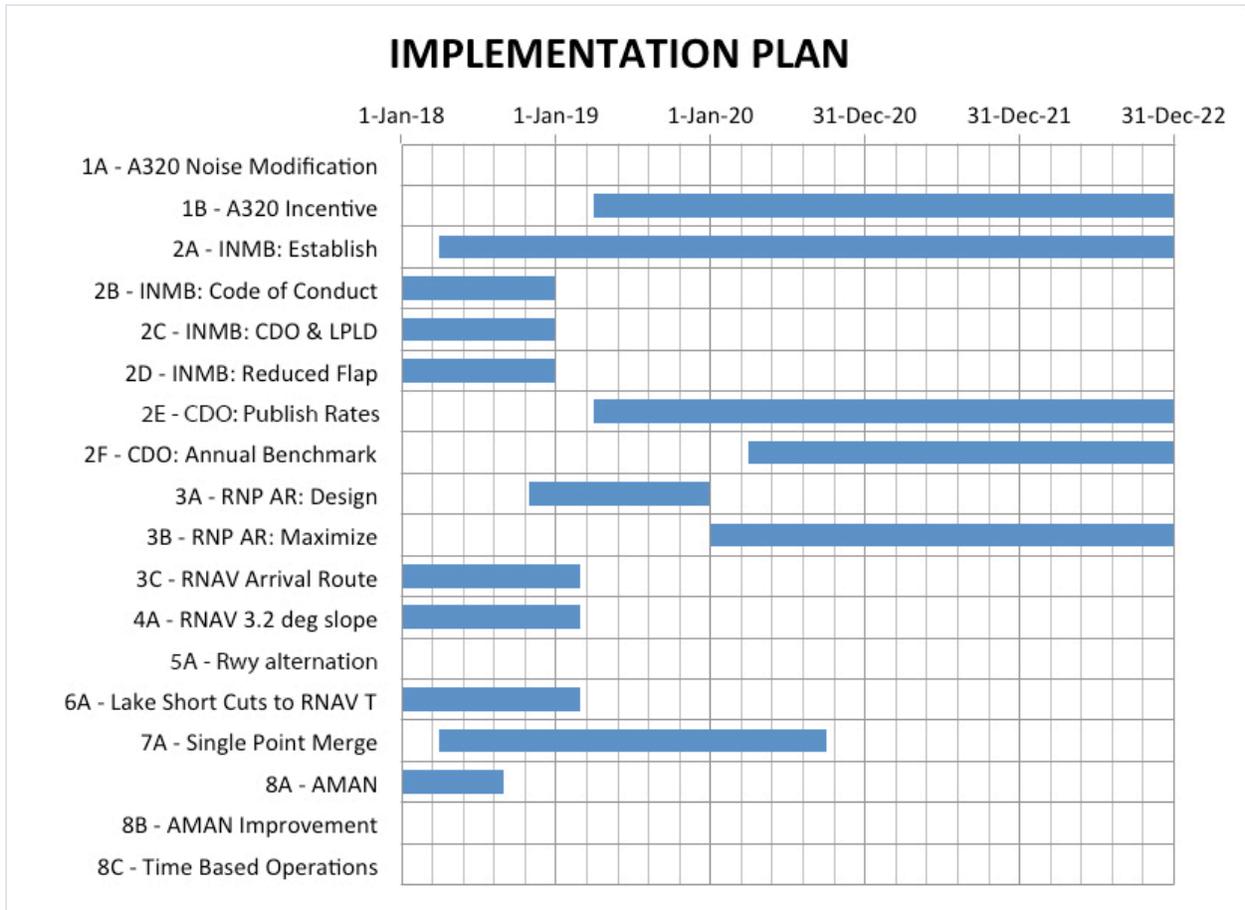
Decision support tools will evolve to a highly efficient, cohesive system allowing operators to align to the most optimal flight profile, minimizing environmental impact. Eventually, this form of managing flights will allow for different options around airspace and procedure design.

NAV CANADA continues to be an active participant in the development of new operational concepts at ICAO and in working groups like the Air Traffic Management Requirements and Performance Panel (ATMRPP) and in other international forums where these ideas are being developed and refined.

Timeline

NAV CANADA will remain active in the continued development of time based operations internationally. Our work in this area will be ongoing.

APPENDIX A
 Overview of Implementation Plan



APPENDIX B

Update on Toronto Noise Mitigation Initiatives

The Independent Toronto Airspace Noise Review referenced work that NAV CANADA and the Greater Toronto Airports Authority had undertaken previously on measures to mitigate community noise impacts. This work, referred to as the “Six Noise Mitigation Initiatives” has been ongoing and we acknowledge that from the communities’ perspective little visible progress has occurred since spring 2016 when updates were provided on the technical work plan.

As is referenced in this report, public consultation is planned for 2018 on the measures. We are pleased however to provide an update here on each of those items for which NAV CANADA was identified as the lead agency.

INITIATIVE #1

Design new approaches for night-time operations

During busy daytime periods, the safe management of air traffic necessitates adherence to a predictable structure, including the use of downwind flight paths for sequencing in the busy terminal airspace. However, when traffic volumes are lighter at night, there are options to manage traffic in a different way, without relying on the downwind structure for sequencing.

NAV CANADA undertook to design new arrival flight paths for use during overnight periods (12:30 to 6:30). Night time arrival paths have been designed to reduce overflight of residential areas where possible.

Figure 1 shows the paths of typical overnight arrival flights to runway 05 today.

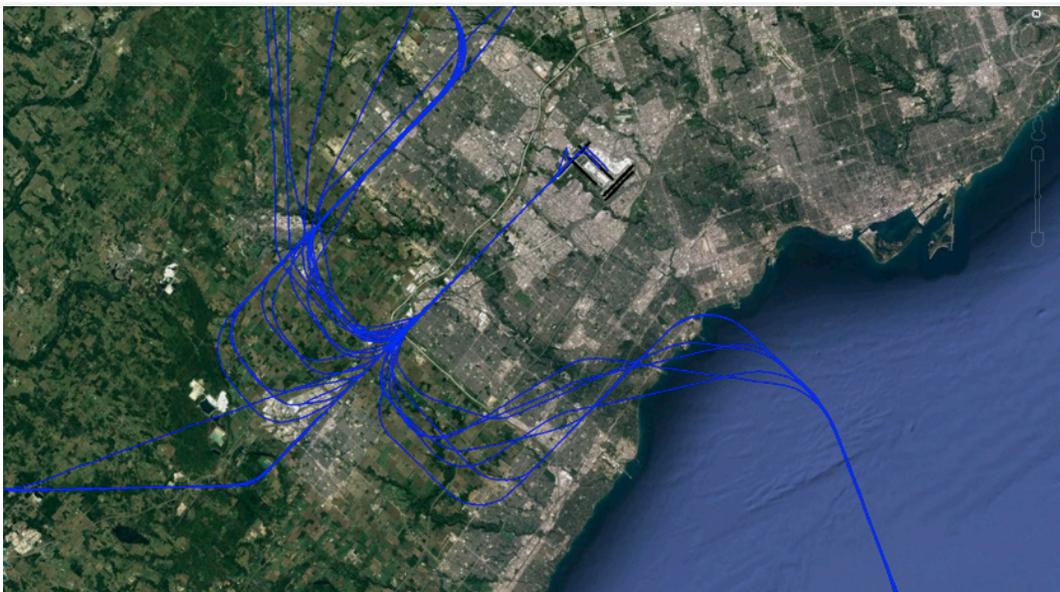


Figure 1

APPENDIX B (cont.)

Figure 2 below shows an example of a concept night flight path to runway 05 designed to avoid areas of Georgetown overflowed today and to overfly industrial corridors in Milton, Mississauga and Oakville as much as possible.

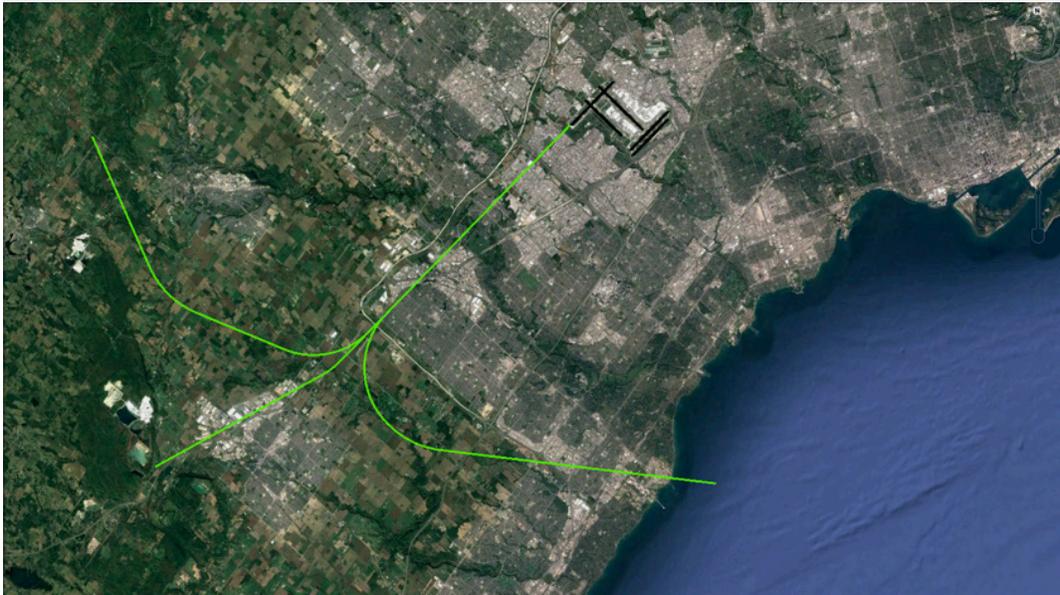


Figure 2

Noise modelling of these procedures suggests that the population experiencing noise >55 dBA would be reduced by as much as 37 percent for arrivals from the north and 31 percent for arrivals from the south.

This design and similar designs for other CYYZ runways will be included in a public consultation planned for 2018. Subject to community consultation, these new arrival procedures could be in operational use later in 2018.

APPENDIX B (cont.)

INITIATIVE #2

New departure procedures for night-time operations

NAV CANADA believes there are opportunities to alter night-time departure procedures. Current noise abatement rules for departures require aircraft to climb to 3600 ft ASL before commencing a turn.

Consideration has been given to raising the altitude of the turn to 5000ft however modelling has suggested that this does not guarantee a reduction in community impacts as the location of the turn will vary based on the climb performance of individual aircraft and wind.

In response we developed a custom option that would provide air traffic controllers working overnight traffic with guide marks on the radar screen to facilitate an optimal operation. Figure 3 below shows an example of the proposed location of guidemarks that will be used by air traffic controllers on their radar display to determine the location for departure turns. These can be used irrespective of altitude.

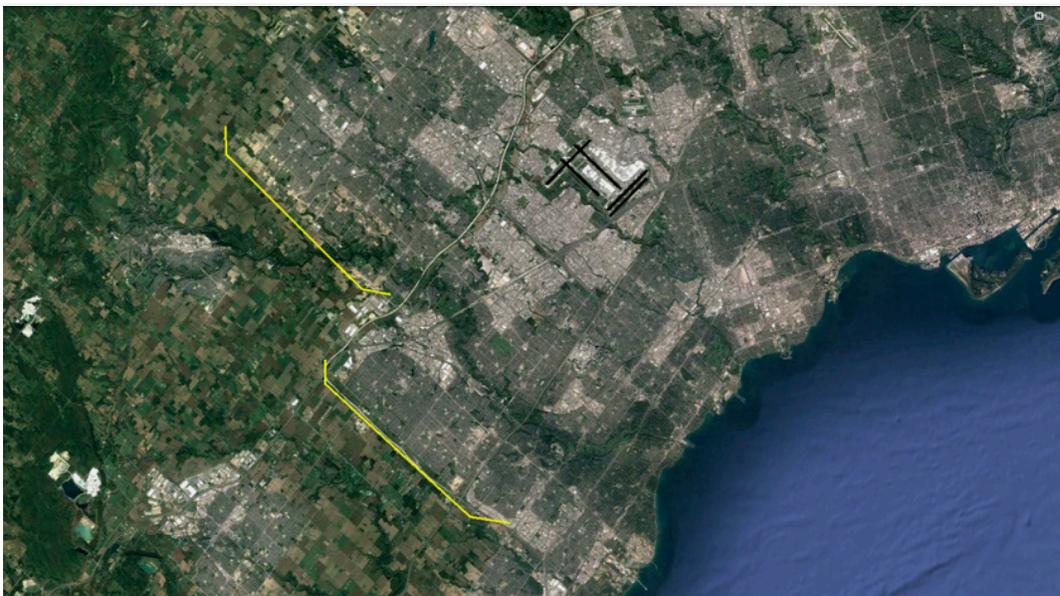


Figure 3

This change to overnight departure procedures will be included in the upcoming public consultation planned for 2018. Subject to the results of consultation this change could be implemented quickly as it does not require publication or change to aircraft databases.

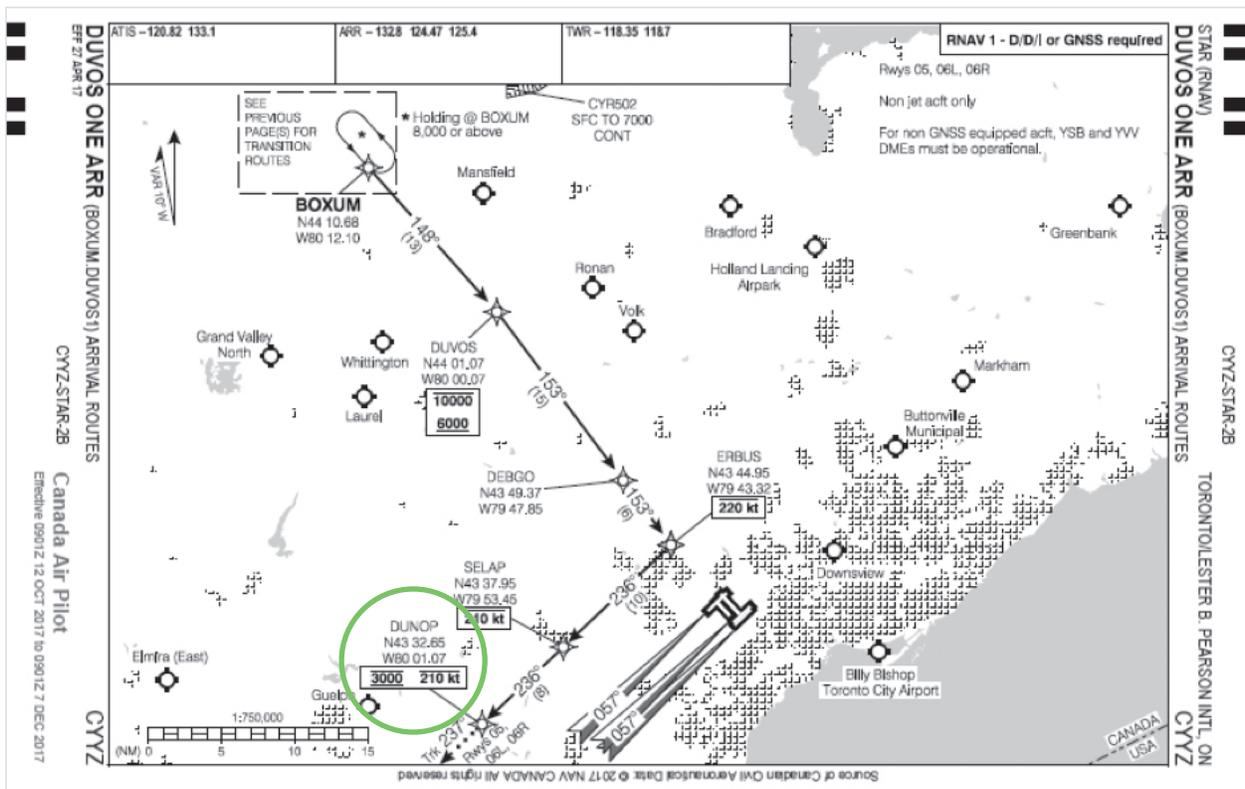
APPENDIX B (cont.)

INITIATIVE #3

Increase downwind arrival speeds

An increase in the published speed on the downwind portion of the arrival flight path to 210 knots was implemented effective April 27, 2017.

This increase in the speed restriction by 10 kts has the potential to reduce noise in portions of the flight path by decreasing the need for pilots of some aircraft to deploy flaps to slow their airspeed.



APPENDIX B (cont.)

INITIATIVE #4

Use new technology to reduce the need for low altitude leveling by arriving aircraft

While noise from aircraft operations cannot be eliminated, continuous descent operations have been proven to reduce noise levels experienced by communities. The Independent Toronto Airspace Noise Review makes a number of recommendations for measures to reduce low altitude levelling of aircraft arriving at Toronto Pearson and recommends increased transparency through public reporting on CDO rates and the eventual establishment of annual performance improvement targets.

NAV CANADA will consult in 2018 on RNAV approaches designed to improve continuous descent during lower traffic periods in which the high/low operation is not required in a parallel runway operation. As indicated in this report, eventually we will pursue RNP approach procedures for Toronto once ICAO approval of the “Established on RNP-AR” concept is complete. This holds the potential to increase continuous descent rates even during busy traffic periods by leveraging the accuracy of RNP to permit aircraft to be deemed “established on final” earlier in the flight path.