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AIRSPACE CHANGE
COMMUNITY CONSULTATION REPORT

Alternate Departure Headings
Runways 17L and 17R
YYC Calgary International Airport (CYYC)

NAV CANADA
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August 2022

The information and diagrams contained in this report are for illustrative purposes only and are not to be used for navigation.

Executive Summary

In partnership with the Calgary Airport Authority, NAV CANADA commenced a trial in 2019 of alternate departure headings for aircraft departing runways 17L and 17R at Calgary International Airport (CYYC). The trial was extended several times through 2021 and 2022 due to the impact of the COVID-19 global pandemic. The trial evaluated a second set of departure headings to be applied tactically when conditions permit based on the flight plan of the departing aircraft as an alternative to those already in place that serve as the predominant departure headings. This report examines the operational trial and reports on the community consultation undertaken as per the Airspace Change Communications and Consultation Protocol (ACCCP).

Through increased overflight of non-residential land, the trial was anticipated to reduce the cumulative noise exposure for many communities south of the airport, while ensuring a safe and efficient operation. The alternate headings target areas of commercial use land on initial take off and allowing aircraft to gain more altitude before they are directly above residential areas when compared to the existing heading.

The consultation process ran from January 24, 2022, to March 11, 2022 and was promoted through the airport authority's Airport Community Consultative Committee meetings, community newsletters, and online via the NAV CANADA and Calgary Airport Authority websites. Two online public meetings were held during the consultation period designed to educate attendees on the alternate departure heading trial. Elected officials at all three levels of government were contacted with information and four officials or their representatives were provided a direct briefing.

Feedback was gathered from the public through a 14-question self-administered internet questionnaire consisting of open- and closed-ended questions. Throughout the consultation, participants voiced concerns about aircraft overflights such as arriving aircraft or local traffic versus aircraft using the alternate departure headings; this was echoed in the survey results. When considering the results of the survey, interactions with members of the public such as email/telephone conversations, and discussions during public meetings, there was a mix of support and opposition to the alternate departure headings.

Following the consultation, all input received was assessed and considered; many residents provided feedback about the greater impact of the trial during the overnight period. Based on the overall benefits of reduced track mileage and the associated reduction in GHG emissions, permanent use of Alternate Departure Headings for departures from runways 17L and 17R should proceed but their use will be discontinued daily between the hours of midnight and 6:00 a.m. (0000–0600) local time.

NAV CANADA will continue to collaborate with the Calgary Airport Authority and the Airport Community Consultative Committee on aircraft noise topics, including those that were raised during the consultation.

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1.0 Purpose

This report examines the operational trial conducted by NAV CANADA for use of alternate headings for aircraft departing southerly from runways 17L and 17R at Calgary International Airport (YYC). It reports on the community consultation undertaken as per the Airspace Change Communications and Consultation Protocol (ACCCP)[1].

Included is an overview of the trial, expected environmental effects (emissions reductions and acoustic analysis), public engagement activities and their results, and recommendations.

2.0 Background

2.1 NAV CANADA

NAV CANADA was incorporated in 1996 as a non-share capital corporation pursuant to Part II of the Canada Corporations Act; it owns, manages, operates, maintains, and develops the Canadian civil air navigation system (the ANS), as defined in the Civil Air Navigation Services Commercialization Act [2] (the ANS Act). NAV CANADA has been continued under the Canada Not-for-profit Corporations Act. Principles governing the mandate conferred on NAV CANADA by the ANS Act include the right to provide civil air navigation services and the exclusive ability to set and collect customer service charges for such services.

The core business of NAV CANADA is to provide air navigation services (primarily within Canada). NAV CANADA is responsible for helping aircraft safely navigate the 18 million square kilometres of Canadian airspace and the North Atlantic oceanic airspace under Canada's control. As one of the world's largest air navigation service providers, NAV CANADA typically oversees several million flights a year through a network of area control centres, air traffic control towers, flight service stations, flight information centres and navigation aids across the country. As a not-for-profit corporation, NAV CANADA invests directly into its operations, people and infrastructure to keep Canada's ANS as safe, efficient and innovative as it can be. NAV CANADA is self-sustaining with revenue coming primarily from the fees charged aviation customers for our services.

As part of its ANS Act responsibilities, NAV CANADA has been designated as the authority in Canada responsible for providing aeronautical information services. This responsibility included design, maintenance and publication of instrument flight procedures (including departure and arrival procedures). All instrument flight procedures in Canada are designed in accordance with Canadian Aviation Regulations and the standards and criteria specified by Transport Canada (including the manual entitled Criteria for the Development of Instrument Procedures).

[1] Airspace Change Communications and Consultation Protocol (https://www.navcanada.ca/en/aviation-industry-airspace-change-communications-and-consultation-protocol-en.pdf)
[2] Civil Air Navigation Services Commercialization Act (S.C. 1996, c. 20) https://laws-lois.justice.gc.ca/eng/acts/C-29.7/

2.2 YYC Calgary International Airport and the Calgary Airport Authority

YYC Calgary International Airport (CYYC) is the country's third-busiest airport[3] and is approximately 17 kilometres northeast of Calgary's central business district. The airport is connected to downtown Calgary and the balance of the Calgary area through a network of expressways, arterial roads and public transit. The airport sits within the fourth-largest employment zone in Canada. The airport contributes to the productivity of industries across the country by linking Canadian firms with markets, commercial partners and investors worldwide.

Figure 1: Calgary Airport Diagram

The airport has four runways shown in Figure 1. To accommodate varying wind conditions, there are two parallel runways in the north-south direction (runways 17L/35R and 17R/35L) and two crosswind runways in roughly the east-west direction (runways 08/26 and 11/29). The north-south runways (17L/35R and 17R/35L) offer higher aircraft movement capacity and are used more frequently because of the prevailing wind conditions. Since aircraft should land or take off into the wind, the two crosswind runways (11/29 and 08/26) permit operations when the wind is blowing in these directions. Runway 08/26 is rarely used, and almost exclusively by light aircraft and the general aviation sector.

The airport is served by a variety of arrival and approach procedures including ground-based Instrument Landing System (ILS) and Required Navigation Performance Authorization Required (RNP AR) approach procedures. Area Navigation (RNAV) Standard Terminal Arrival Route (STAR) procedures guide aircraft to a point where the pilot can intercept the approach procedures through a combination of Global Navigation Satellite Systems (GNSS)-based guidance and air traffic control instructions

The airport is managed and operated by the Calgary Airport Authority (the Authority) which is a not-for-profit, non-share capital corporation, incorporated under Alberta's Regional Airports Authorities

[3] Based on 2019 aircraft movement statistics prior to the COVID-19 pandemic. Statistics Canada. Table 23-10-0003-01 Aircraft movements, by civil and military movements, airports with NAV CANADA towers, monthly (https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310000301)

Act. Since 1992, the authority has been responsible for the operation, management, and development of YYC Calgary International Airport (YYC) and–since 1997–Springbank Airport (YBW), under a long-term lease from the Government of Canada.

The authority's mandate is defined by the governing legislation of the Regional Airports Authorities Act of Alberta and defines who they are and why they exist. The authority's mandate includes managing and operating the airports for which they are responsible in a safe, secure and efficient manner, and advancing economic and community development by means that include promoting and encouraging improved airline and transportation service and an expanded aviation industry for the general benefit of the public in the region. The authority is governed by a community-based board of directors and led by a skilled Executive Team, dedicated to the long-term success of the authority and the airports we manage and operate.

2.3 Noise Management

Managing aircraft noise exposure on a community is a collective effort of several parties.

International Civil Aviation Organization (ICAO)

ICAO is an agency of the United Nations and was created to promote the safe and standardized development of international civil aviation. ICAO sets standards and regulations necessary for aviation safety, security, efficiency and regularity, air navigation, and environmental protection (including noise and emissions). ICAO endorses a balanced approach to aircraft noise management which aims to identify aircraft noise and implement a variety of measures best suited to address aircraft noise at a particular airport. These typically fall within the following categories: noise reduction at source; land-use planning and management; and, noise abatement operational procedures and operating restrictions.

Transport Canada

Transport Canada is the regulator of aviation in Canada. Its role is to develop transportation policies and legislation that provide for a high level of safety and security and support a successful, stable aviation sector in Canada. The responsibilities of Transport Canada regarding noise include reviewing, approving, and publishing of new proposed noise control measures at airports, as well as conducting enforcement of suspected violations to published Noise Abatement Procedures. Transport Canada establishes noise and emissions standards and is responsible for setting the criteria that governs flight path design. Transport Canada must also review and approve any new or proposed changes to noise abatement procedures at an airport.

Airport Operators

The Calgary Airport Authority maintains a Noise Management Plan[4] which identifies key areas to advance the Authority's Noise Management Program. The authority actively monitors aircraft noise in

[4] Calgary Airport Authority Noise Management Program (https://www.yyc.com/en-us/calgaryairportauthority/noisemanagement.aspx)

the Calgary region using a network of Noise Monitoring Terminals and continues to engage with and educate communities on the airport's operations and how aircraft noise can be mitigated.

The authority stays connected with the communities in and around Calgary by regularly attending community-led events to strengthen communications with surrounding neighbourhoods and provide space for stakeholders to ask questions directly to Authority staff. The authority hosts the Airport Community Consultative Committee (ACCC) as one of their key community engagement initiatives.

NAV CANADA

NAV CANADA is responsible for the safe coordination and the efficient movement of aircraft and is also responsible for planning and managing airspace, including flight paths and airways used by airlines. NAV CANADA operates and maintains navigation and approach aids and equipment. NAV CANADA publishes the Canada Air Pilot and Canadian Flight Supplement, two aviation reference publications that provide pilots with information on airport operations, including details on noise abatement procedures at different facilities. Flight procedures designed and published by NAV CANADA adhere to noise abatement procedures set by the Airport Operators.

Airlines and Other Operators of Aircraft

Airlines and other aircraft operators are responsible for conducting their operations in accordance with Transport Canada regulations and published Noise Abatement Procedures and Noise Operating Restrictions. Airline and air operator subject matter experts are also actively involved in working groups and teams that support improvements to aviation safety and efficiency through responsible development of performance-based navigation and airspace design.

Municipalities and Other Levels of Government

The role of municipalities is to ensure compatible development occurs around the airport through the development and exercise of land use planning controls. While Transport Canada provides guidelines for land use in the vicinity of airports, planning is delegated to local cities that may or may not choose to follow the guidelines.

3.0 Overview of Alternate Departure Heading Trial

NAV CANADA and its industry partners–including the Calgary Airport Authority–recognize that aircraft and airport operations affect the community and are committed to pursuing collaborative efforts to minimize and mitigate environmental effects – both noise and emissions – where possible.

In partnership with the Calgary Airport Authority, NAV CANADA commenced a 12-month trial of alternate departure headings for aircraft departing runways 17L and 17R starting in late 2019. Additional background on the trial is available via the notice originally posted in September 2019 (see Appendix B). Through increased overflight of non-residential land, the trial was anticipated to reduce the cumulative community noise exposure for many communities south of the airport, while ensuring a safe and efficient operation and minimizing greenhouse gas emissions. The length of the trial was subsequently extended due to the COVID-19 pandemic-related downturn in air traffic levels. The trial

was also intended to distribute flights more evenly across residential communities when they cannot be routed over non-residential areas for operational reasons.

Historically, distribution between a north (35 L/R) and south flow (17 L/R) has been approximately even; the trial headings will only apply when departing runways 17 L/R. It is not anticipated that the trial would affect flow direction, as this is primarily determined by wind and weather conditions. The ability to apply alternate headings could be further impacted by weather, capacity considerations, construction, runway surface conditions, ground infrastructure, taxiing requirements, traffic and fleet mix and operator requests.

3.1 Traditional Departure Operations

Prior to the trial, aircraft departing the airport (taking off) would climb on–or with a slight deviation from–runway heading. These departure headings are necessary for consistent and safe management of traffic at YYC. Figure 2 above depicts the regular departure heading for both runways 17R and 17L is 165° and heading 155° for runway 17L when both runways are being used for simultaneous departures.

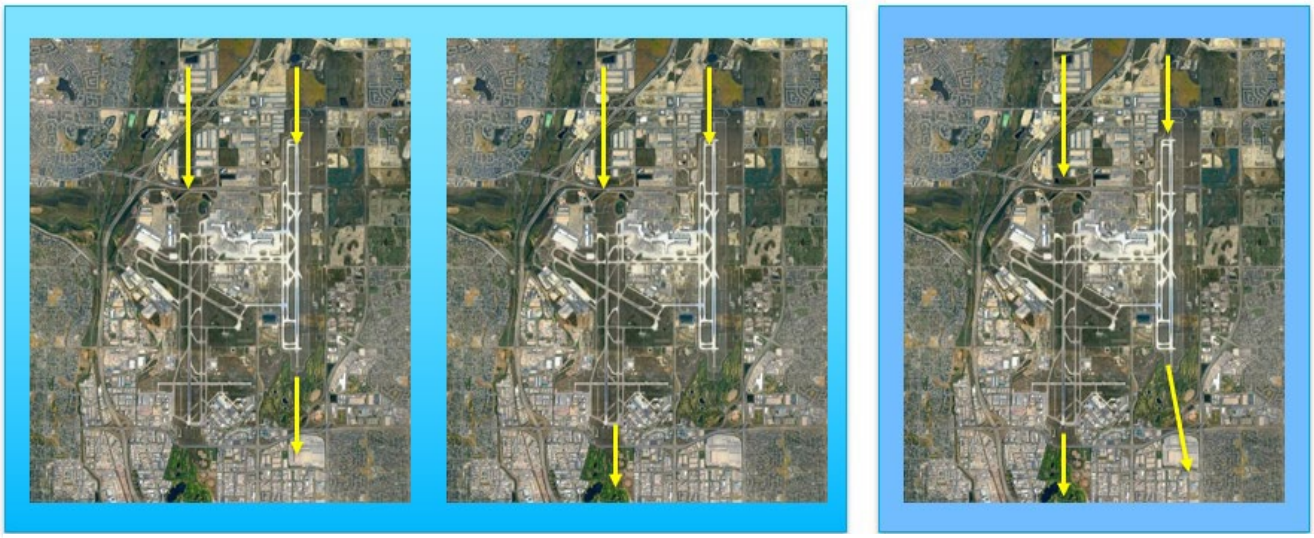

Figure 2: Regular departure headings

3.2 Alternate Departure Heading Operations

In addition to existing headings for departures, the trial evaluated a second set of headings to be applied tactically when conditions permit as shown in Figure 3 below. Air traffic controllers will be able to assign heading 135° for departures from runway 17R and heading 185° for departures from runway 17L based on the flight plan of the departing aircraft. The track of aircraft varies depending on factors such as aircraft type/performance and atmospheric conditions like wind.

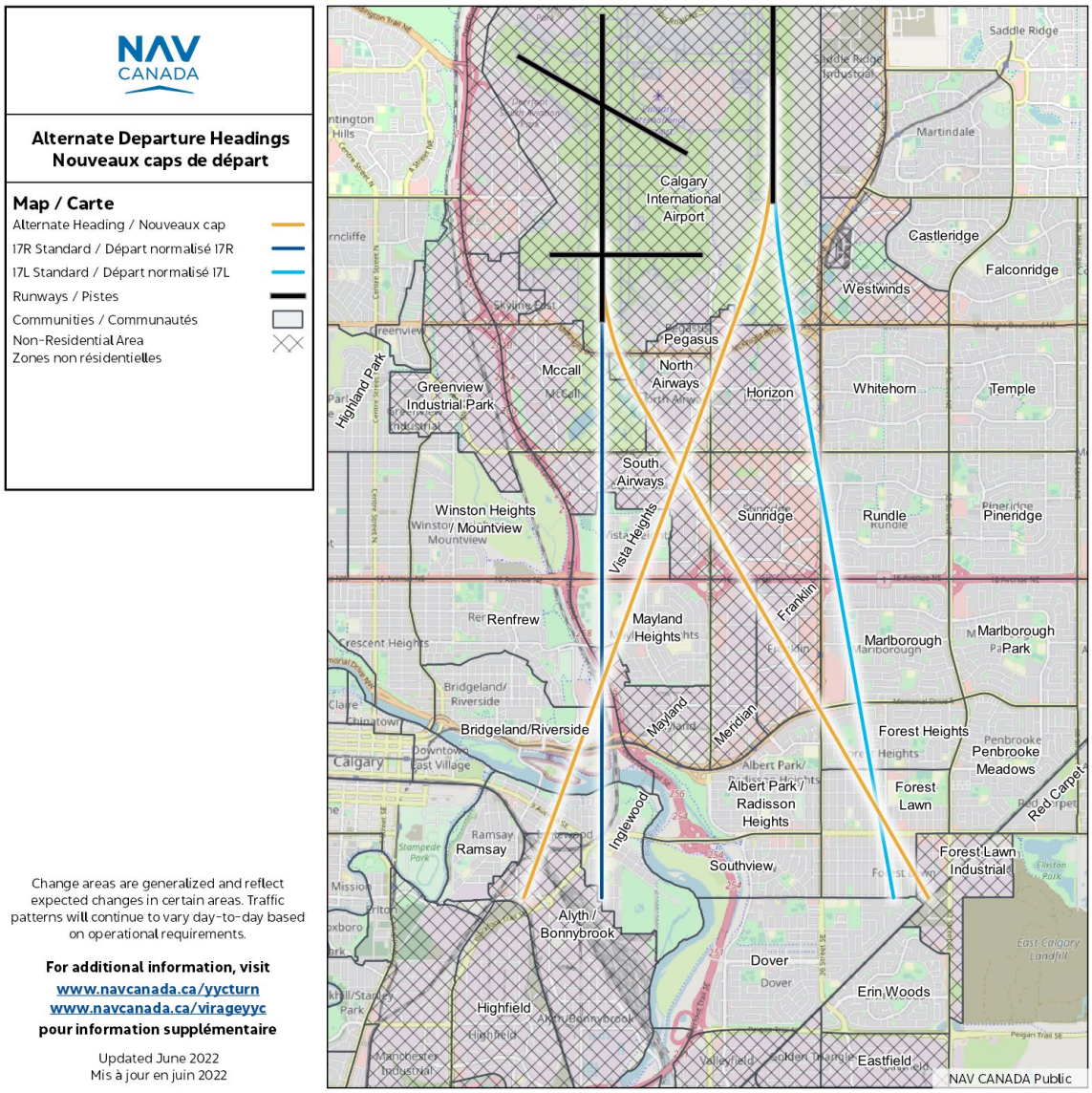

Figure 3: Alternate departure headings

Aircraft departing runway 17R heading toward eastern destinations were more likely to utilize the new heading (turning left on departure). The alternate heading for 17R provides community noise benefits by targeting commercial use land on initial take off and allowing aircraft to gain more altitude before they are directly above residential areas when compared to the existing heading.

Aircraft departing runway 17L heading toward western destinations were more likely to utilize the new heading (turning right on departure). The alternate heading for 17L also results in aircraft over commercial use land on initial take off. Since the runway is further north compared to 17R, aircraft will gain more altitude before they are directly above residential areas that would typically observe departures from 17R.

3.3 Trial Usage

The number of aircraft expected to utilize the alternate departure headings before the trial commenced and the actual proportion of aircraft utilizing the alternate headings is detailed below in Table 1.

Runway	% on alternate headings (pre-trial estimate)	Actual % alternate headings (during trial)	Aircraft per month on alternate headings
17L	5–10%	3–11%	8–65 (~0.3-2 per day)
17R	30–50%	27–49%	150–450 (~5–15 per day)

Table 1: Runway 17L and 17R alternate departure heading usage

Figure 4 shows a sample of actual aircraft tracks from aircraft on both the standard departure headings and the alternate departure headings.

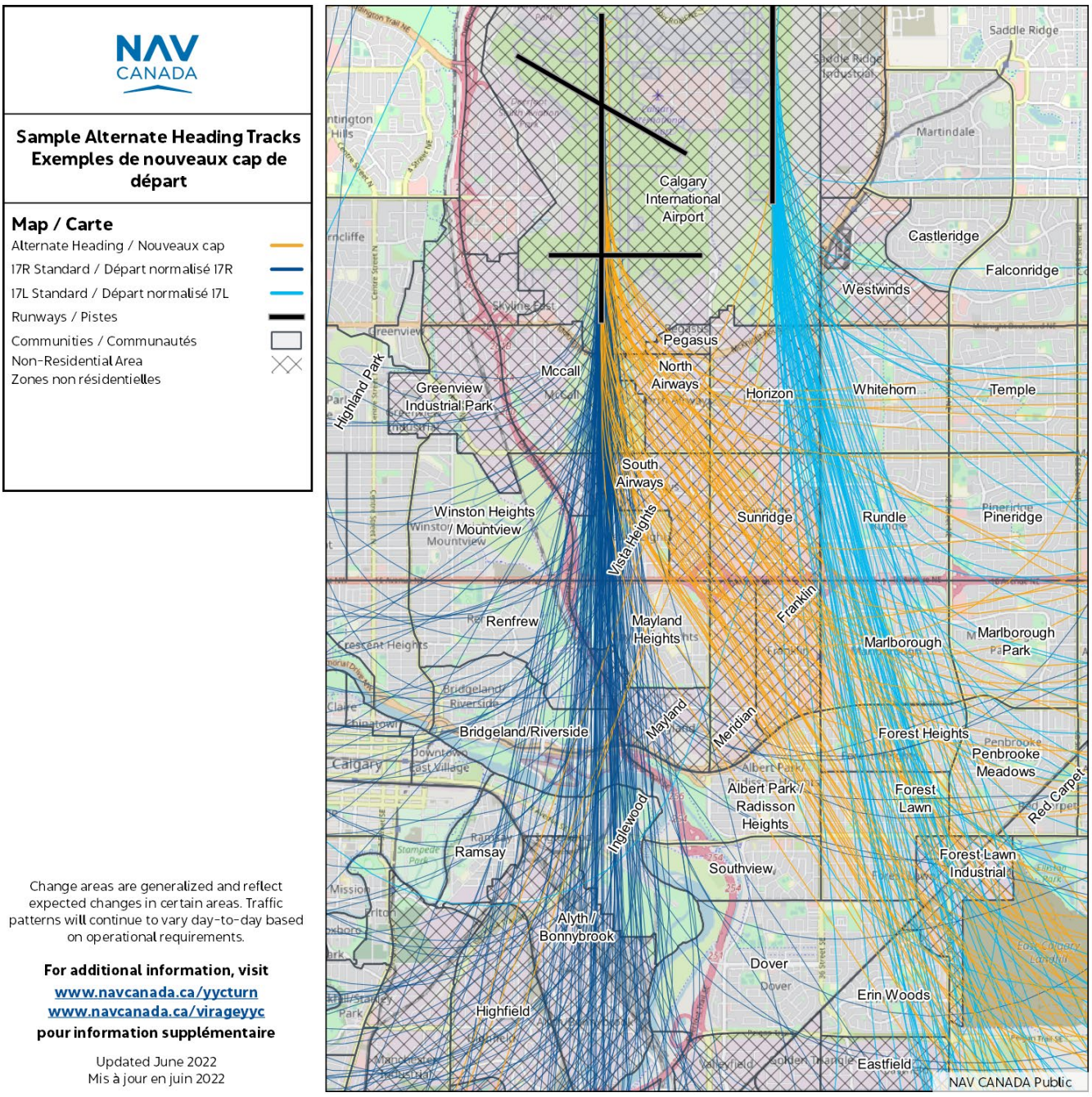

Figure 4: Sample aircraft tracks, regular and alternate departure headings

4.0 Environment

Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation[5] describes ongoing and planned activities to reduce GHG emissions from Canada's domestic and international aviation activities. The aviation industry continues to look ways to reduce its environmental footprint through

[5] Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation (https://tc.canada.ca/en/corporate-services/policies/canada-s-action-plan-reduce-greenhouse-gas-emissions-aviation)

initiatives like sustainable fuels and alternative energy sources, improvements in aircraft technology and ground equipment, and modern flight procedures.

Due to the nature of the airspace and air traffic environment in the vicinity of Calgary International Airport, most areas in the northeast portion of the city experience aircraft overflight. When flight path design changes are expected to result in changes to the frequency or altitude of aircraft in areas around airports, residents and local municipal governments in the affected areas are informed of a proposed change to build awareness and understanding. In the case of this proposal, environmental effect analysis considered anticipated noise, including the number of people likely to be affected, flight frequency, distribution of traffic, and the exposure to aircraft operations.

In addition to reductions in greenhouse gas emissions–a key focus of the industry and governments working toward greater environmental sustainability in the transportation sector–a primary design consideration for the proposed alternate departure headings was placing procedures over non residential land where possible.

4.1 Acoustic Analysis

The analysis in this section provides an overview of how the Alternate Departure Heading trial compares to the baseline of acoustic events before the trial. The goal of the analysis is understanding if and how the trial has changed the acoustic profile of the events associated with jet aircraft departing runways 17L and 17R.

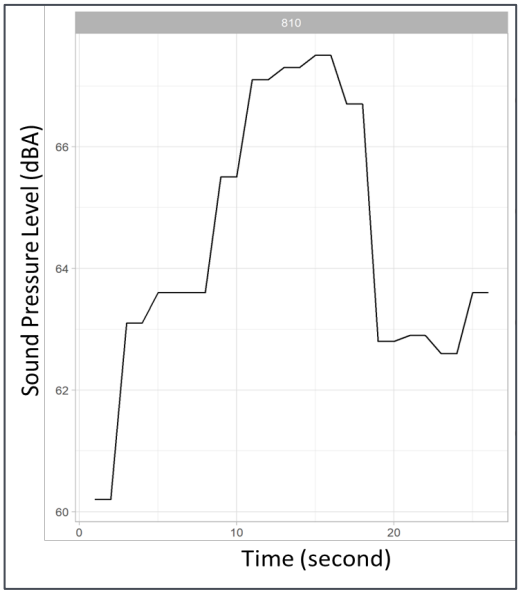

Figure 5: Example sound event profile

4.1.1 Background and Methodology

Analysis of the acoustic profile of the trial was completed by the Calgary Airport Authority using data gathered from several of their sound monitoring terminals south of the airport which record sound from both "flight" events and "community" events (such as local background noise). The terminals are essentially microphones that record the profile of any event above a certain decibel threshold and correlate it to a flight or not. Figure 5 provides an example of a typical aircraft sound event as measured and recorded by a terminal.

A-weighted noise levels expressed in decibels as dB(A) were used for noise level metrics. It is used extensively for measuring and predicting community and transportation noise.[6] Noise metrics used as the acoustic analysis included:

[6] FAA, Fundamentals of Noise and Sound (https://www.faa.gov/regulations_policies/policy_guidance/noise/basics)

- **Sound Exposure Level (SEL).** SEL was the primary metric selected for the analysis and represents all the acoustic energy (sound pressure) of a noise event as if that event had occurred within a one-second period. SEL captures both the level (magnitude) and the duration of a sound event in a single numerical quantity by "squeezing" all the noise energy from an event into one second. This provides a way to make comparisons among noise events of different durations and is illustrated below in Figure 6.[7]

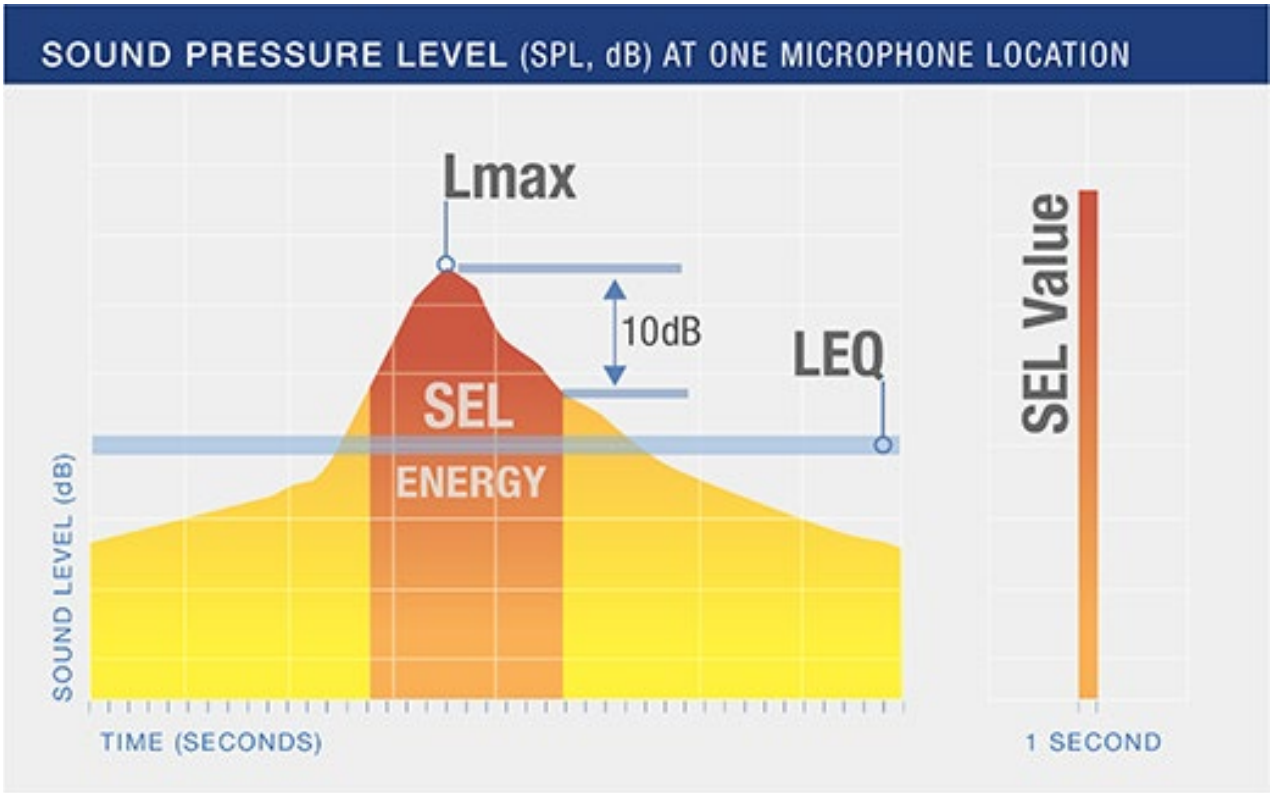

Figure 6: Visualization of SEL noise metric

- **Maximum Sound Level (L_{max}).** Single-event noise level metrics represent the maximum noise level at a receptor location, considering a set of aircraft operations. This is found by calculating the maximum noise level due to each single flight path segment and then computing maximum noise level at a receptor location through the analysis of all the individual flight path segment noise contributions. Figure 7 provides a comparison of various typical sounds as measured using the L_{max} metric.

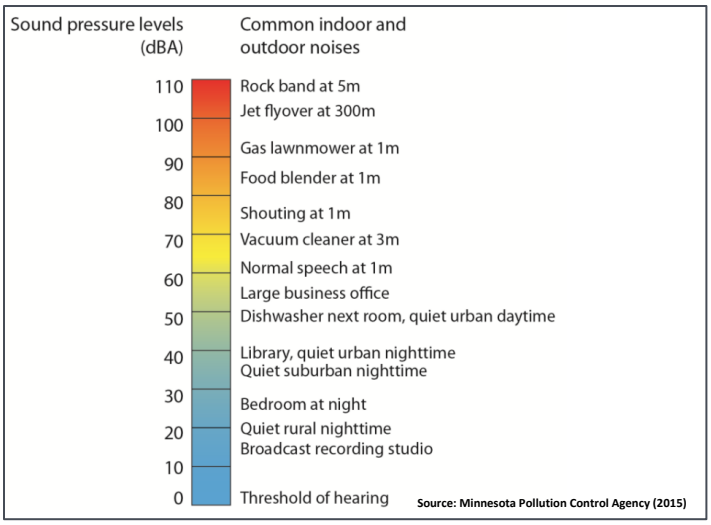

Figure 7: Sound pressure levels of common noises

[7] FAA, Fundamentals of Noise and Sound (https://www.faa.gov/regulations_policies/policy_guidance/noise/basics)

These measures of acoustic energy are for quantitative comparison and it is recognized that different people will have different responses and experiences to different levels of acoustic energy (from aircraft or otherwise) based on their specific situation. What people hear from aircraft is a result of many complex processes including the way the sound is being generated, ambient community noise levels, the topography, atmospheric conditions, the type and altitude of aircraft, its direction, and even whether it's performing a turn or not. The orientation of objects on the ground such as buildings may affect what is perceived.

The analysis considered pre-trial data between January 1, 2019, and September 30, 2019 (222,265 community and flight acoustic events) and data during the trial between October 1, 2019, and June 30, 2020 (313,492 acoustic events). An acoustic event was defined as anything greater than 60 dB(A) instantaneous noise and events less than 41 second long which captures over 95% of all noise events. The analysis did not consider arriving aircraft or propeller/turboprop aircraft.

4.1.2 Sound Monitoring Locations

Data from seven monitoring terminals located south of the airport were used for acoustic analysis:

- Inglewood (INGL)
- Marlborough (MARL)
- Mayland Heights (MAY1)
- Mayland Heights (MAY2)
- Radisson Heights (RADI)
- Renfrew (RENF)
- Rundle (RUND)

Their locations relative to flight paths prior to the Alternate Departure Heading trial and during the trial are shown below in Figure 8 and Figure 9 respectively.

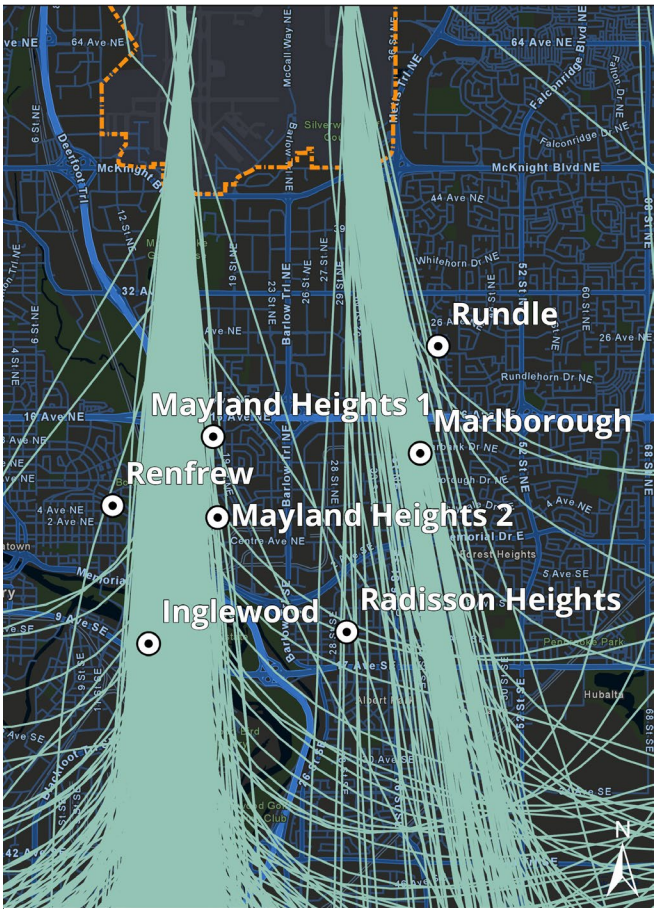

Figure 8: Aircraft tracks before trial

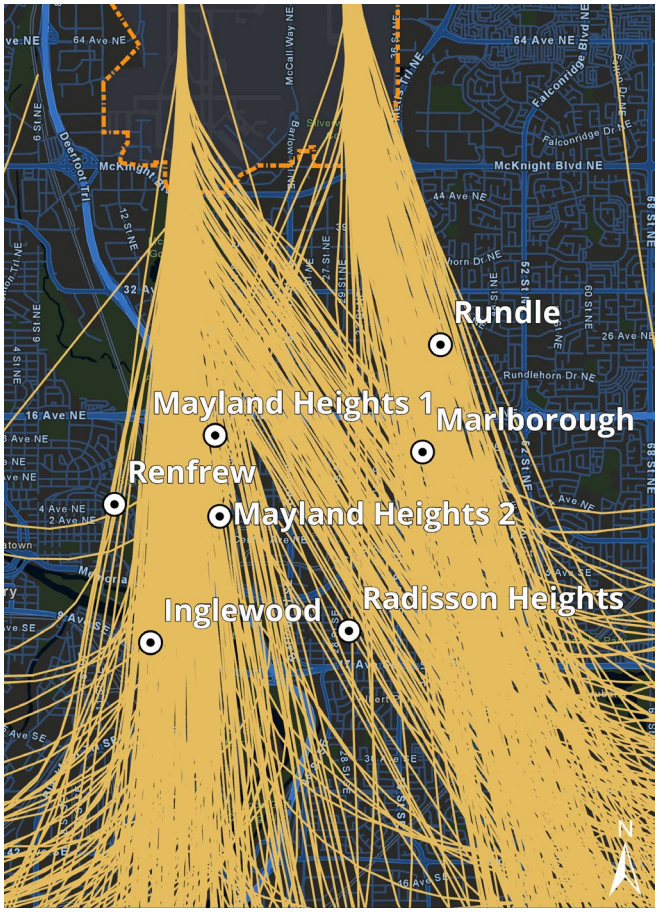

Figure 9: Aircraft tracks during trial

4.1.3 Initial SEL Analysis

Figure 10 below depicts the statistical spread of all acoustic events occurring in the vicinity of each sound monitoring terminal using the SEL metric. It includes all aircraft acoustic events regardless of the type of operation (arrival/departure/overflight) and regardless of aircraft type. The main item to note is that in all monitored locations with the exception of Renfrew and Mayland Heights 2 (south Mayland Heights), the aircraft sound is stronger than the community (background) acoustic events.

The pool of available data was narrowed in Figure 11 to show only the jet departures from runways 17L and 17R in order to understand the effects of the Alternate Departure Heading trial. For these events specifically, the overall sound exposure level at all measuring stations was lower during the trial than prior to its implementation.

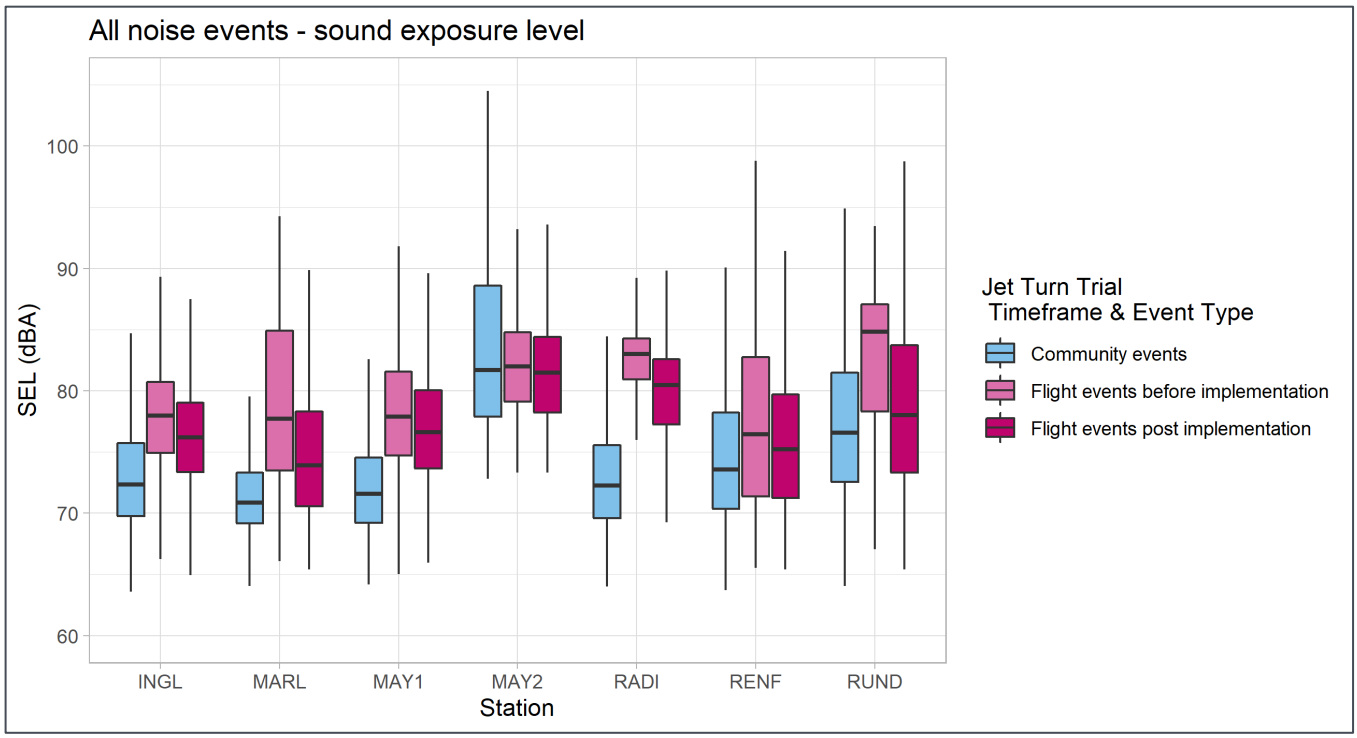

Figure 10: Sound exposure level – All noise events

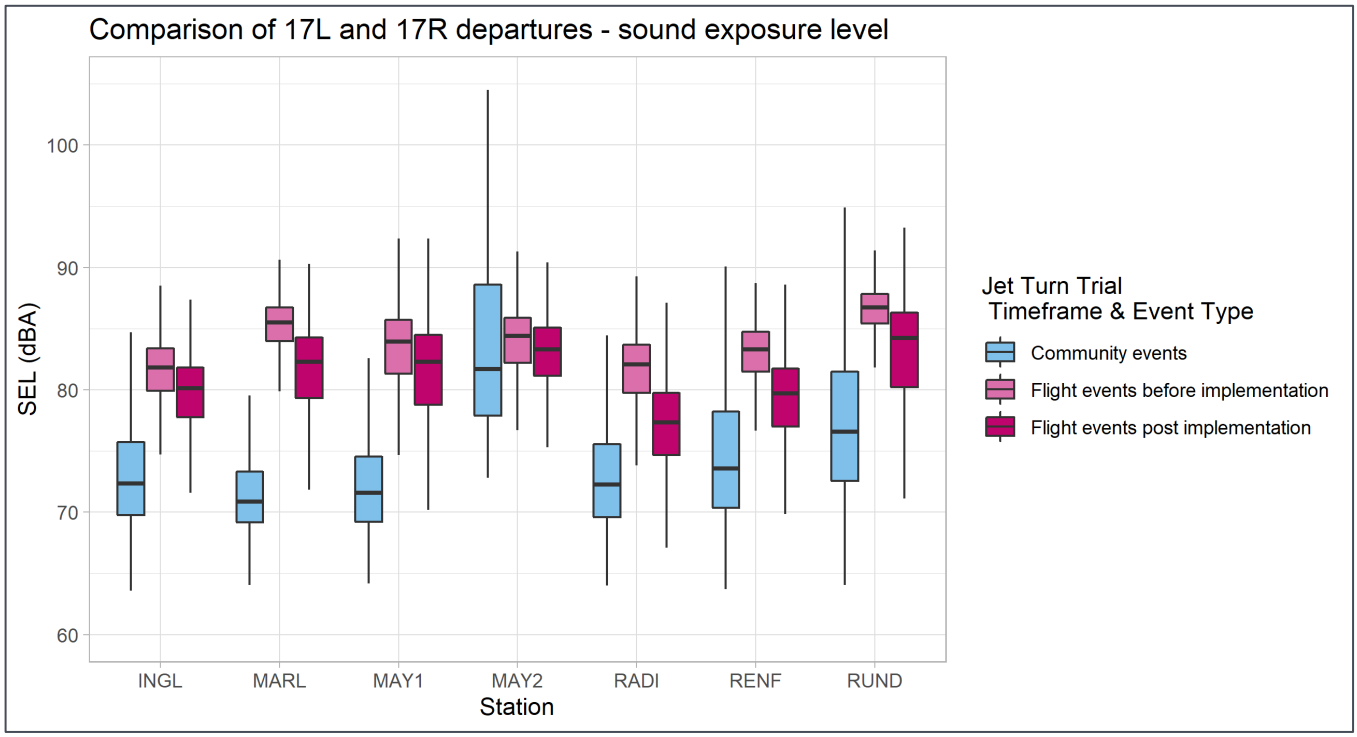

Figure 11: Sound exposure level – 17L and 17R departures

To help account for decreased volumes of air traffic during the COVID-19 pandemic, the data was also analyzed in a slightly different manner to examine the "acoustic profile" of the area surrounding each monitoring station. The number of acoustic events at each Sound Exposure Level (SEL) both before and during the trial are shown in Figure 12 below. Through this analysis, the volume of acoustic events can be viewed separately from their magnitude and any shift in profile either left or right along the

graphs helps illustrate the nature of events in a particular area. The altitude of aircraft at the time a noise event occurred is also recorded and Figure 13 below depicts the altitudes of jet aircraft at each monitoring station. In all cases, aircraft altitude at the time of the noise event was higher during the trial period than pre-trial.

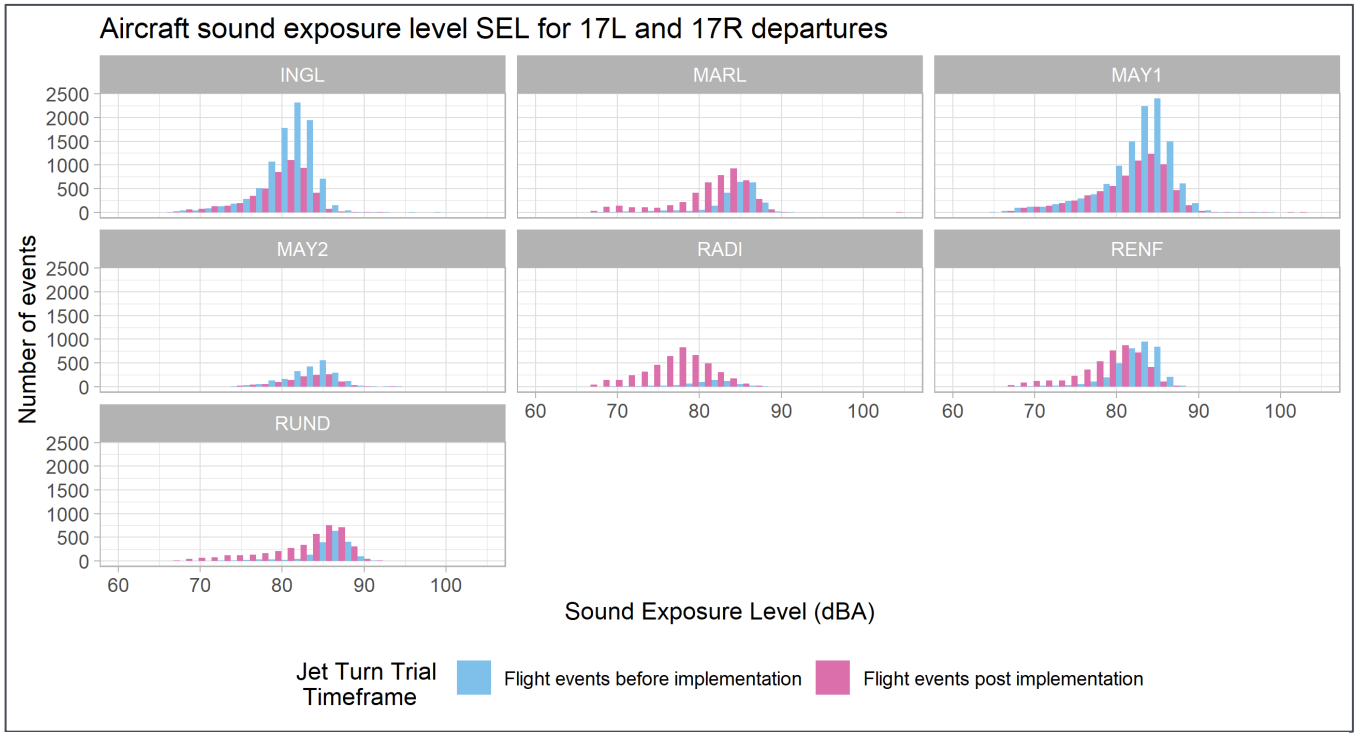

Figure 13: Number of acoustic events by sound exposure level by station

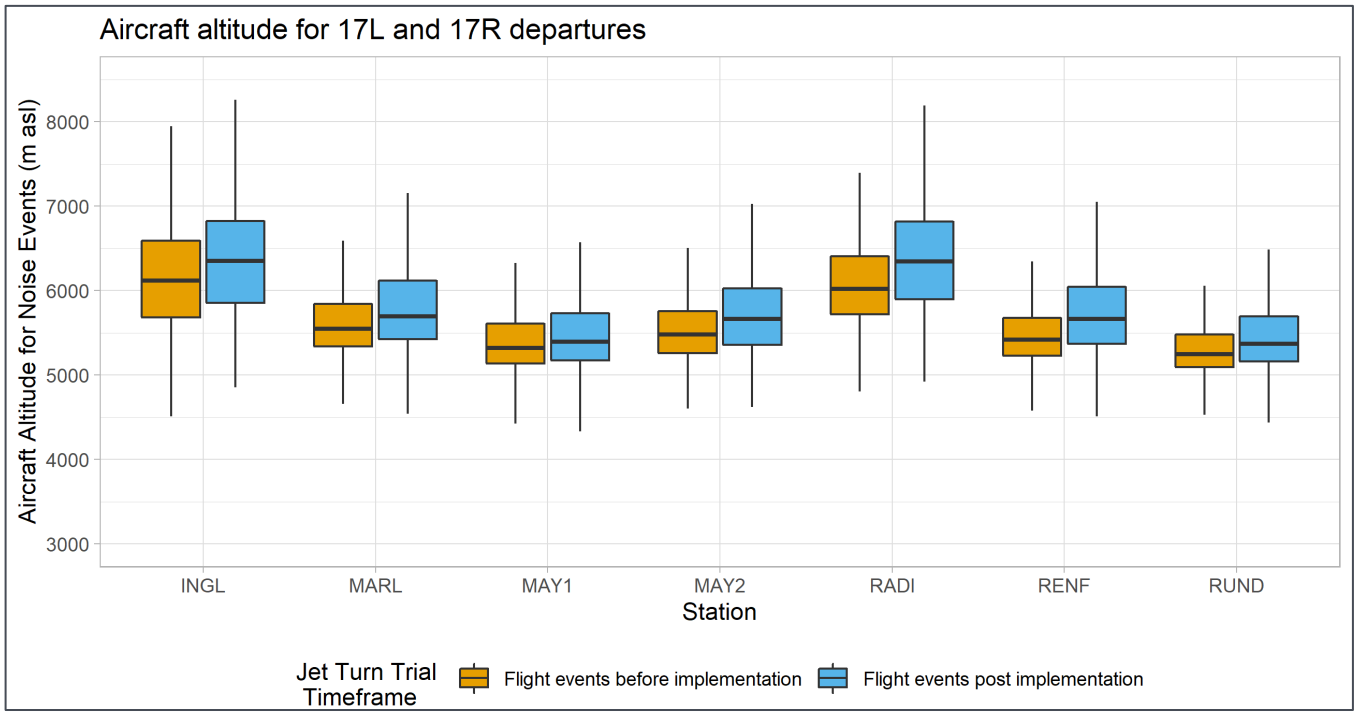

Figure 12: Aircraft altitudes - 17L and 17R departures

4.1.4 Additional Analysis in Mayland Heights

The Calgary Airport Authority's noise monitoring station locations are based on historical flight paths for arriving and departing aircraft; this meant some areas between the parallel runways south of the airport were further from a monitoring station. To improve the characterization of the acoustical profile for aircraft departing runways 17L and 17R and using an Alternate Departure heading in the East Mayland Heights community, a mobile noise monitoring terminal was erected.

Several locations were initially identified; the final location at Mayland Dr. and Motherwell Rd. (photographed in Figure 14) was selected based on:

- Minimal interference from community noise sources;
- Located within the area identified by community members as being exposed to aircraft overflight noise from the Alternate Departure Heading Trial;
- Minimal visual disruption;
- Able to meet City of Calgary Street Use Permit requirements; and
- Ability to perform continuous monitoring/recording of noise from March 14, 2022, and onward.

Figure 14: Mayland East mobile monitor terminal

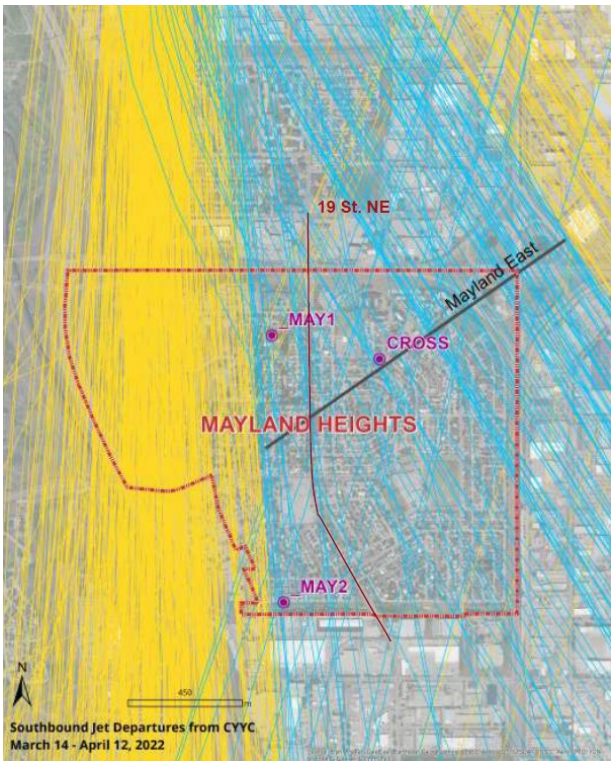

Figure 15: Mayland East gate aircraft tracks

Analysis using this extra data examined noise events from stations in the Mayland Heights area (2,551 events); specifically, the 830 events arising from flights that crossed the, "Mayland East" gate (black line in Figure 15).

The analysis goal was determining the difference in noise exposure between the mobile station and the two existing noise monitoring stations in the area.

The mobile terminal was successful in capturing the signature of Mayland East noise events more clearly than other stations in the network. Significant differences were observed in SEL and L_{max} profiles between Mayland East overflights at CROSS (mobile station) versus at the MAY 1 and MAY 2 stations. East Mayland Heights receives aircraft noise from both the east and west runways and the breakdown by runway (Figure 16) shows greater frequency of events from both runways.

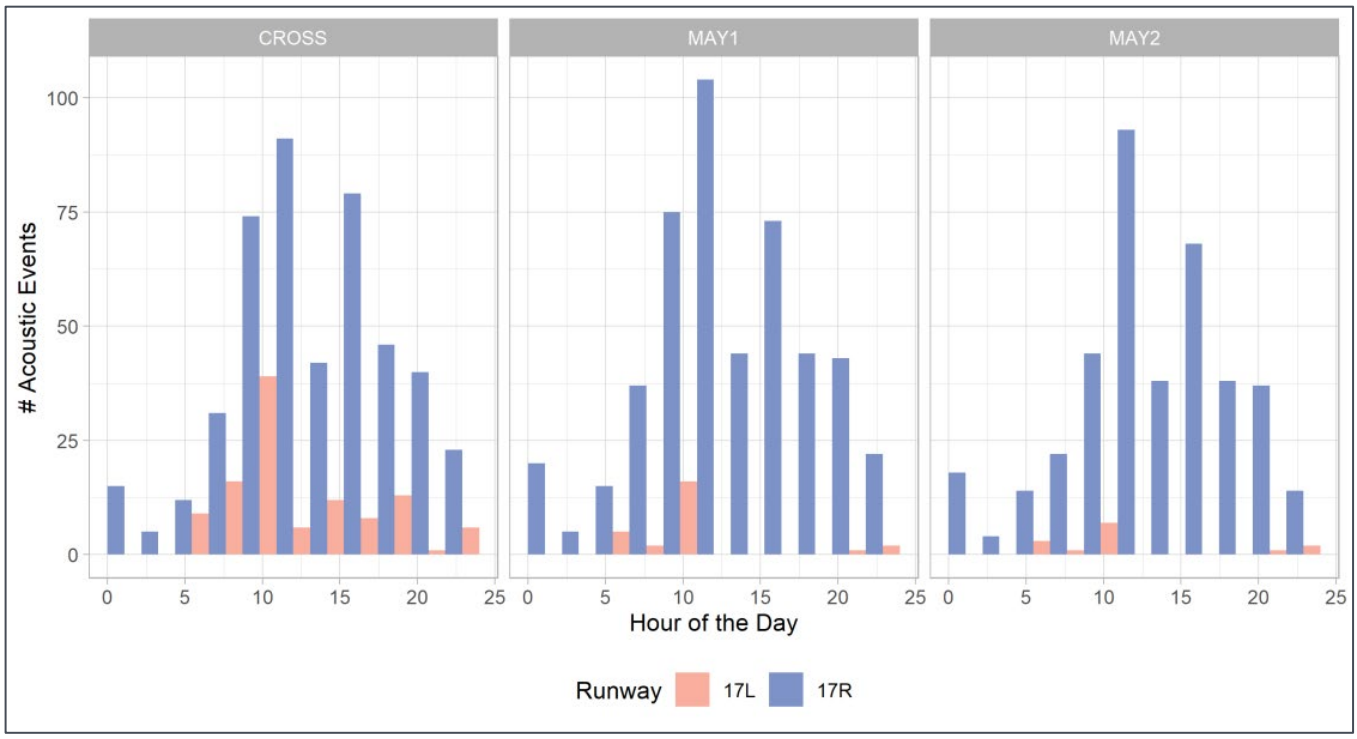

Figure 16: Number of acoustic events by hour by station

A day-night comparison of acoustic events by SEL and L_{max} was also performed between the CROSS, MAY1, and MAY2 stations to identify any differences between the station acoustic profiles depending on the time of day. The analysis shown in Figure 17 and Figure 18 identified less variability, lower frequency and slightly higher sound pressures at night vs. day. Day-night comparison shows far fewer events at night (80% of all acoustic events occurred from 0700 through 2200).

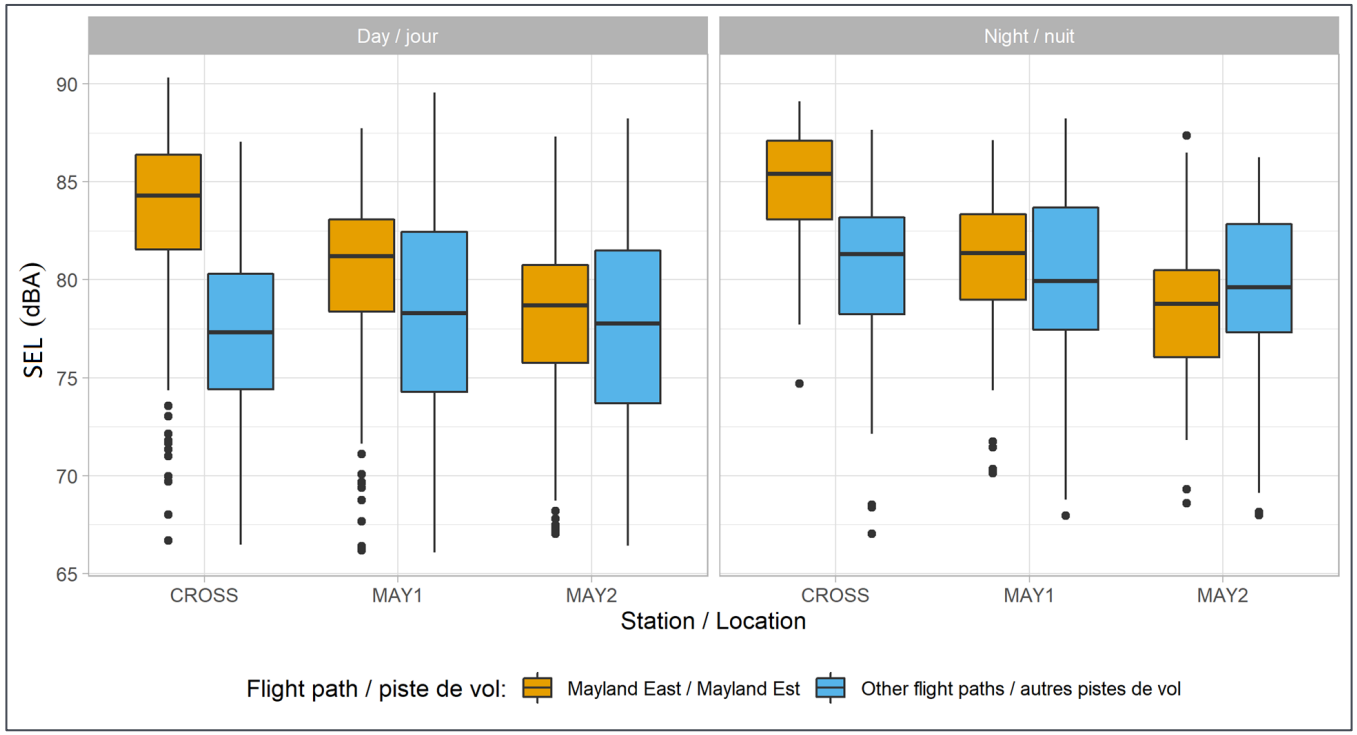

Figure 17: Sound exposure level by station - Day and night

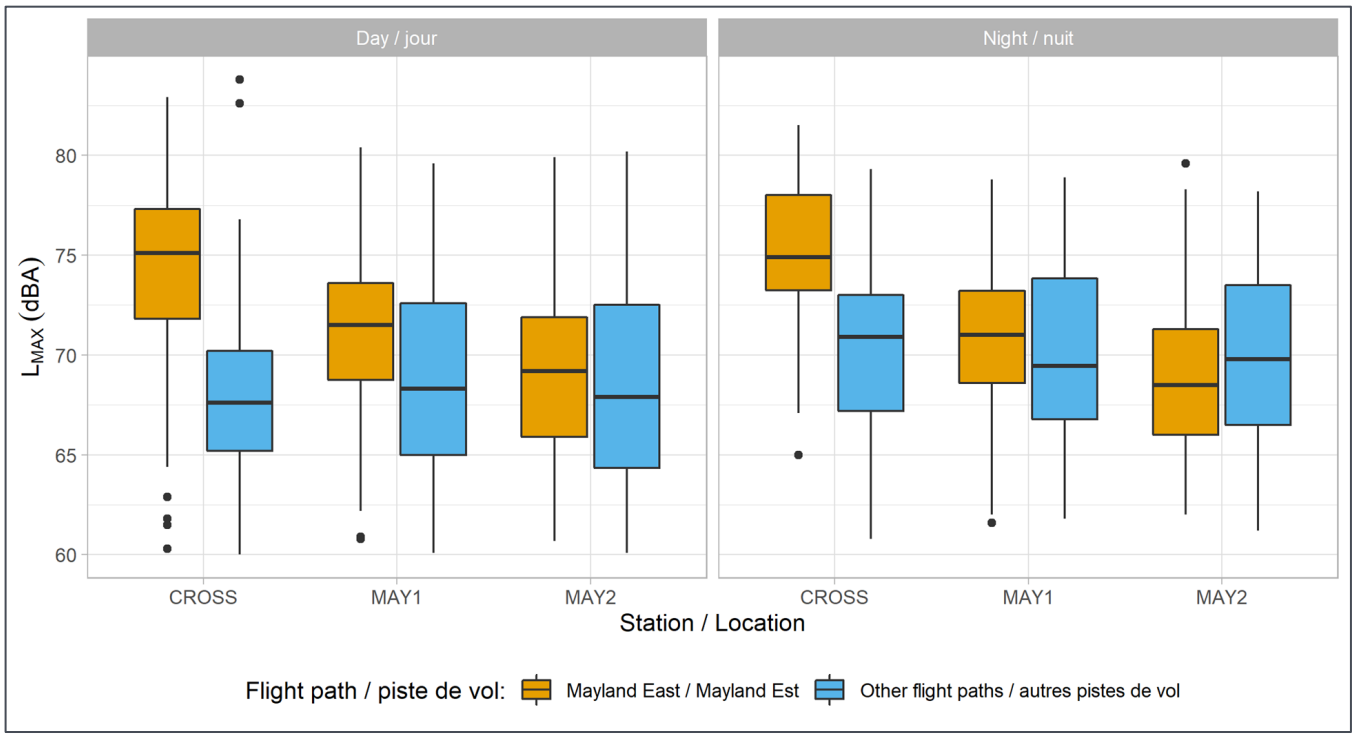

Figure 18: Maximum sound level by station - Day and night

Sound pressure levels (SEL and L_{max}) are within the same range at all monitoring stations. While variability and median levels may vary, the differences are 4–5 dB(A) among stations for the same periods. The overall minimum-maximum ranges are the same.

4.1.5 Analysis Conclusions

Most areas surrounding the airport continued to observe many of the arrival or departure aircraft operations they did prior to the trial. Entirely avoiding residentially populated areas is simply not possible and some residents observed aircraft operating more regularly in certain areas than they had before. The effect on overall community noise from the trial was expected to be positive, largely due to improved noise distribution south of the airport by targeting overflight of non-residential land.

To verify this, analysis reviewed whether sound levels decreased and whether the distribution of noise events became more even across communities. The data revealed a statistically significant difference in all mean flight event SEL values and aircraft altitudes at a 95 percent confidence level pre-trial versus during the trial. Results of the analysis are shown in Table 2 below.

Station	Pre-Trial SEL [dB(A)]	SEL with Alternate Headings [dB(A)]	Pre-Trial Altitudes [m ASL]	Post-Implementation Altitudes [m ASL]
Inglewood	81.3	79.4	6,161	6,416
Marlborough	84.9	81.1	5,651	5,830
Mayland Heights 1	83.0	81.3	5,439	5,514
Mayland Heights 2	84.0	83.0	5,555	5,753
Radisson Heights	81.5	77.1	6,090	6,393
Renfrew	82.8	79.0	5,484	5,785
Rundle	86.2	82.7	5,328	5,485

Table 2: Comparison of pre- and post-trial SEL and aircraft altitude

The average altitude of aircraft was higher at all stations, sound exposures decreased, and a greater distribution of noise events was achieved. It is important to note that while the differences between the pre-trial period and during the trial are statistically significant, these decreases in SEL are not large. The observed 2–3 dB(A) decrease in SEL may not be noticeable by some people.

The overall findings reflect what can be measured and analyzed, which can be different than what is experienced by someone on the ground. It is nonetheless a useful measure to gauge whether the goals of the trial were achieved.

4.2 Greenhouse Gas Emissions

Improving airport ground operations and infrastructure use is an objective of Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation due to its potential to reduce fuel burn and associated emissions from aircraft operations. The Action Plan was the Government of Canada's response to the International Civil Aviation Organization's (ICAO) Assembly Resolution A37-19, which encourages Member States to submit national plans detailing the measures they are taking to address aviation emissions.

By using the alternate departure headings, certain aircraft can avoid long taxis and depart from a runway closer to their departure gate. It is estimated that the reduced taxi times along with the quicker turn after departure to send aircraft on course to their destination will reduce flight times by approximately three to eight minutes per flight. When compared to conventional departures, the use of alternate headings by over 2,600 aircraft in 2021 translated to an estimated savings of 433,000 litres of fuel and 1,100 metric tonnes of greenhouse gas emissions.

Based on regular traffic levels[8], between 5,100 and 9,100 aircraft annually are expected to utilize the alternate departure headings resulting in an estimated 844,000–1,489,000 litres of fuel saved and a reduction of 2,150–3,790 metric tonnes of greenhouse gas emissions.

5.0 Community Outreach and Engagement

NAV CANADA and industry partners are committed to engaging with the public on changes to airspace design that may have a material impact on residential communities. The Airspace Change Communications and Consultation Protocol (ACCCP) describes when consultation should be considered and the approach to be taken for engagement with stakeholders and communities in which we operate. The protocol promotes opportunities for residents to provide input prior to implementing material changes.

The public consultation began January 24, 2022, and concluded on March 11, 2022, for a total of 46 days.

5.1 Published Information

A page was added to the NAV CANADA public website[9] to provide specific information about the alternate departure heading trial and associated consultation. Webpage analytics shows that this section of the website received 1,517 unique page views. Consultation materials added to the website included:

- Background information about the trial.
- Information about the typical headings of departures prior to the trial.
- Details about the proposed alternate departure headings for both runways 17L and 17R.
- A schedule of virtual consultation events.
- A recording of a virtual consultation event for those unable to attend a live event.
- Access to the feedback mechanism of a survey with open- and close-ended questions.
- Information about how to contact NAV CANADA with additional questions.

Information about the public consultation was also made available on the Calgary Airport Authority website[10] with links back to the NAV CANADA website.

[8] Based on 2019 aircraft movement statistics prior to the COVID-19 pandemic.
[9] Changes to southerly departures at Calgary Airport (https://www.navcanada.ca/en/air-traffic/airspace-reviews/calgary-alternate-departure-heading-trial.aspx)
[10] Share Your Thoughts: NAV CANADA Alternate Departure Heading Trial (https://www.yyc.com/CalgaryAirportAuthority/NoiseManagement/Notices/TabId/1015/ArtMID/2457/ArticleID/211/Share-your-thoughts-NAV-CANADA-Alternate-Departure-Heading-Trial.aspx)

5.2 Consultation Promotion

The campaign goal was increasing awareness of the consultation and maximizing participation. Social Media was utilized with posts also being shared through the Calgary Airport Authority's social media channels to increase their visibility. Information about the trial and public consultation was shared during Airport Community Consultative Committee (ACCC) meetings to spread awareness through local channels.

NAV CANADA also promoted the public consultation through the "Get Engaged E-Newsletter" from the Federation of Calgary Communities. This newsletter is sent to over 2,400 subscribers including all community association board members, Federation of Calgary Communities partners, sponsors, donors, and City Council. The newsletter contains information of interest to their members, directing them websites for more information. Promotion of the public consultation occurred in the February 9 and February 23, 2022, editions of the newsletter.

5.3 Stakeholders and Community Engagement

Community engagement was integral to consultation on the alternate departure heading trial. Stakeholders including members of the communities surrounding the airport provided their feedback through online survey feedback forms, emails and other methods of correspondence during consultation. Stakeholder input assisted NAV CANADA in understanding priorities and concerns related to the proposal.

Community engagement activities included Airport Community Consultative Committee (ACCC) meetings and online public consultation events. The following section provides a synopsis of the engagement methodologies that were used to generate stakeholder input.

Due to public health restrictions in place during the consultation period resulting from the ongoing COVID-19 pandemic, required that all consultation events and personalized information sessions be held virtually.

5.3.1 Airport Community Consultative Committee (ACCC) Meetings

The Calgary Airport Authority established the Airport Community Consultative Committee (ACCC), a community-based group that meets quarterly (or as often as needed) and is comprised of representatives from several stakeholder groups.

The primary objective of the ACCC is to provide a forum that enables dialogue and information exchanges between airport operators, community representatives, and airport users. This community-based approach ensures that stakeholders are at the table to discuss current and future aircraft operations, keeping at the forefront any concerns from the surrounding communities.

During alternate departure heading operational trial, extensive communication was conducted by NAV CANADA as an attendee of the ACCC meetings to ensure group members were aware of the trial and

associated public consultation. Meetings at which the alternate departure headings or associated public consultation were discussed are detailed below in Table 3.

Meeting Type	Meetings which included Alternate Departure Heading information or discussion
ACCC Meeting	• September 18, 2019 • January 28, 2020 • September 16, 2020 • January 14, 2021 • April 8, 2021 • July 8, 2021 • October 14, 2021 • January 20, 2022 • April 21, 2022

Table 3: Meetings with alternate departure heading information or discussion

5.3.2 Public Consultation Events

Two public consultation events were held during the consultation period designed to educate attendees on the alternate departure heading trial including sufficient background information to support residents in the provision of feedback. All events attendees were asked to provide feedback through the publicly accessible online feedback survey. The information sessions were designed and intended for residents from communities south of the airport with information and maps focused on a smaller geographic area.

Table 4 below outlines the timing of each public consultation event. In total, 102 residents registered to participate in the events.

Event Name	Consultation Event Date
Information Session #1	February 16, 2022
Information Session #2	March 2, 2022

Table 4: Public consultation event schedule

Information Session #1 was recorded and made available on the NAV CANADA website to ensure members of the public unable to attend a live session could access the presentation received by events participants. The recording was viewed 142 unique times after being posted to the website.

Following each Consultation Event, a follow-up email was sent to the email address used to register for the session with links to the online survey feedback form.

5.3.3 Direct Queries

A dedicated email address (consultation@navcanada.ca) was set up to answer queries from the public regarding the trial and associated consultation. The NAV CANADA Customer and Stakeholder Services team also answered telephone queries received through the toll-free number for inquiries.

5.4 Elected Official Engagement

Federal, provincial and municipal elected and administrative officials were contacted in regions south of the airport and in the immediate vicinity of the airport. Tailored briefings were delivered to federal MPs, provincial MLAs, and municipal councillors or their delegated representatives. The number of offices contacted and number of briefings held are detailed in Table 5 below.

Level of Government	Officials/Offices Contacted
Federal Elected Officials	3
Provincial Elected Officials	5
Municipal Elected and Administrative Officials	4

Table 5: Engagement with elected officials

6.0 Community Feedback

The decision being considered during this consultation was whether to make permanent the alternate departure headings for runways 17L and 17R as well as any potential modifications to the procedure based on community feedback. The objective of NAV CANADA research was to determine public beliefs and attitude toward the change and identify areas of concern related to potential implementation. To achieve this objective, a survey was selected as the primary method for collecting data and was supported by inputs from other channels such as the public information sessions or direct phone/email queries.

6.1 Survey Methodology

A questionnaire was made available through links provided on the NAV CANADA website and directly to consultation event attendees. Internet surveys allow collection of responses from large audiences in a consistent, effective, and user-friendly manner. The survey consisted of 14 structured (closed-ended) questions and 2 unstructured (open-ended) questions. Survey responses were collected at a single point in time between January 24, 2022, and March 11, 2022, for a total of 46 days.

6.2 Survey Results and Other Feedback

A total of 83 respondents provided feedback (76 completed surveys and 7 partial responses). Figure 19 below depicts the approximate location of respondents who provided a postal code. Details of responses received for individual questions can be found in Appendix A (Feedback Survey Response Details). Overall, the number of survey respondents is relatively low when considering the overall population of the surrounding communities; however, it is in line with expectations based on the number of participants who attended one of the information sessions and historical trends in community participation on airspace change topics.

During other interactions with members of the public such as email/telephone conversations and conversations during public meetings, there was a mix of support and opposition to the alternate departure headings. Many participants took the opportunity to voice concerns related to aircraft overflights they experienced prior to the trial such as arriving aircraft or local traffic versus aircraft utilizing the alternate departure headings; this was echoed in the survey results.

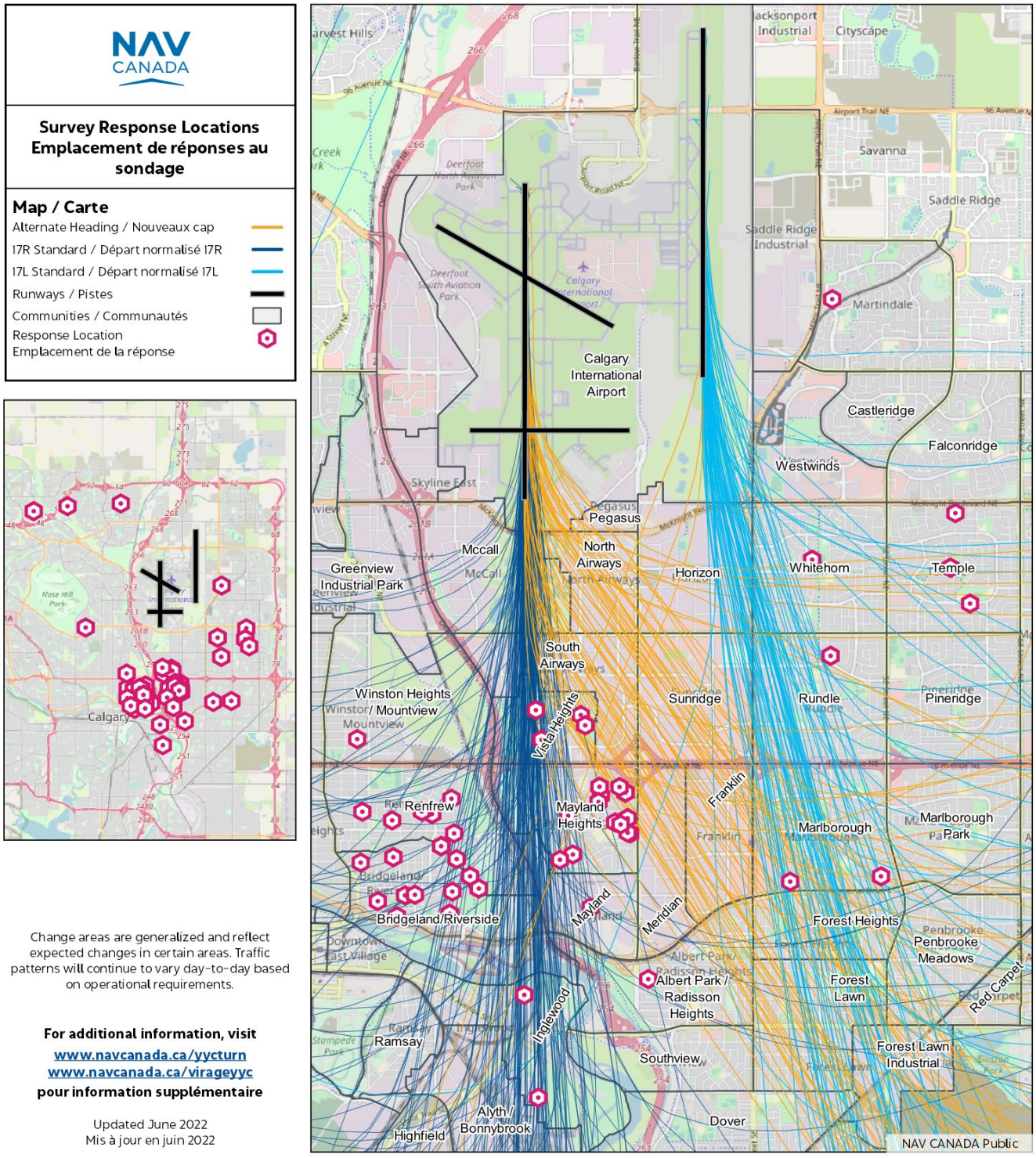

Figure 19: Location of survey respondents

Below are some highlights and findings from the survey responses:

- Most respondents who indicated they either observed no change or observed less aircraft overflight since the trial began are located in Bridgeland, Riverside, and Renfrew.
- Most respondents who indicated they observed a change in aircraft overflight since the trial began are located in Mayland, Mayland Heights, and Vista Heights.
- About 42% of respondents who indicated they observed an increase in aircraft overflight since the trial began are located in areas either unaffected by the alternate departure heading trial or in areas which are further away from the departure path when alternate departure headings are used.
- More than 30% of respondents who indicated they observed a significant change in aircraft overflight since the trial began stated it was more noticeable or disruptive during the overnight period.

6.3 Consideration of Proposed Mitigation

Consultation related to the alternate departure heading trial revealed concerns from respondents about the location of departure paths and altitude of aircraft. Feedback received indicated residents preferred that flight paths be designed to avoid overflying populated areas where possible or that flight paths allow aircraft to climb higher before flying over populated areas. Another common piece of feedback was that aircraft using alternate departure headings were more noticeable or disruptive during overnight hours. The following sections detail mitigation considered based on feedback received from residents during the information sessions and from survey respondent feedback.

6.3.1 Reduce the Number of Aircraft Departing From the Airport

Aircraft operators schedule flights to arrive and depart the airport based on their operational requirements and work with the airport operator to ensure there is adequate capacity available. The role of NAV CANADA as the air navigation service provider is to ensure the safe, orderly, and expeditious flow of aircraft arriving and departing the airport in line with what has been scheduled.

This role does not include placing limits on the number of aircraft permitted to depart or arrive from the airport other than what is necessary to ensure the safe movement of aircraft in accordance with conditions prevalent at the time. For example, weather such as strong winds may require use of the certain runways which in turn limits the rate at which NAV CANADA air traffic controllers can safely depart aircraft.

Reducing the overall number of aircraft who plan to use the airport on a scheduled basis is not within the scope of NAV CANADA responsibility.

6.3.2 Avoid Overflying Communities and Fly Over More Non-Residential Lands

Due to the location of airports in relation to communities, flight path design criteria and operational requirements, it is not always possible to avoid overflying residential areas. As much as possible, the

company designs flight paths that overfly commercial and non-residential areas in a manner that respects Transport Canada-approved design criteria.

Some of the suggestions to move existing flight paths were unrelated to the alternate departure heading trial and beyond the scope of this consultation. With respect to the alternate departure headings, discussion centred around changing the alternate departure heading values assigned to aircraft.

Airspace structure and the separation of arrival traffic from departure traffic mean departing aircraft remain below arriving aircraft until they are laterally separated and able to continue climbing. The current airspace structure provides a compromise between the ability of arrivals to descend at a safe rate and the ability of departures to keep from flying long distances at low-level altitudes before continuing their climb.

The headings used in the trial keep aircraft within a prescribed corridor that normally allows the departures to continue to climb without conflicting with arrivals. If departing aircraft were to turn further to the east or west, they would be, "stuck" underneath arrivals for a longer distance. As departing aircraft tend to be louder than arriving aircraft due to higher thrust settings, this results in increased noise to the communities below as well as the introduction of new noise to communities currently not affected. Arrivals would also be kept higher, potentially increasing miles flown, and greenhouse gas emissions.

6.3.3 Increase Altitude of the Aircraft

NAV CANADA understands the intent of proposals to force aircraft higher to provide noise mitigation. The majority of proposals received during the consultation related to increasing the minimum altitude of aircraft south of the airport after departure.

Instrument departure procedures at airports are designed with a standard climb gradient which defines how much elevation an aircraft must gain for each unit of distance travelled along the ground; it is most often expressed in feet per nautical mile (ft/NM). Transport Canada instrument procedure design criteria assumes all aircraft using the departure procedure can achieve a certain minimum climb gradient. The minimum climb gradient is increased when there is terrain or an obstacle present in the vicinity of the airport; however, increasing it introduces some disadvantages and complications to airport operations. To meet increased minimum climb gradients, aircraft may be required to use higher power settings on departure, resulting in increased noise.

6.3.4 Limit Alternate Departure Headings Hours of Use

NAV CANADA is sensitive to the fact that overflight of residential areas can be perceived as a nuisance for communities. As such, it makes efforts to balance the requirements for safe air navigation, the interests of surrounding communities and the need to reduce the environmental effect of the industry.

About 30% of respondents who indicated they observed a significant change in aircraft overflight since the trial began stated it was more noticeable or disruptive during the overnight period. Based on

typical traffic patterns and the volume of aircraft utilizing the airport during the overnight period, limiting the hours of use of alternate departure headings is a potentially viable mitigation proposed by consultation participants to mitigate noise and disruption.

7.0 Decision

Following the consultation, all input received was assessed and considered. Based on the benefits such as reduced track mileage and the associated reduction in GHG emissions, permanent use of Alternate Departure Headings for departures from runways 17L and 17R at Calgary International Airport (CYYC) should proceed with the following adjustments to the original proposal.

7.1 Post-Consultation Adjustments

As a result of stakeholder consultation and technical analysis, adjustments will be made to the original proposal. In response to feedback received from residents in regard to aircraft on an alternate heading being more noticeable during the overnight period, the use of Alternate Departure Headings will be discontinued between the hours of midnight and 6 a.m. local time (0000–0600) daily.

8.0 Communication

As per the Airspace Change Communications and Consultation Protocol, NAV CANADA will communicate the decision by posting this report on both the NAV CANADA and Calgary Airport Authority websites at least three weeks prior to implementation.

9.0 Post Implementation Review

An assessment of the change will be conducted by NAV CANADA and the Calgary Airport Authority reviewing the first 180 days of implementation of the Alternate Departure Heading procedures. The 180-day review will be shared with Airport Community Consultative Committee participants and published on NAV CANADA's website.

APPENDIX A

Feedback Survey Response Details

1. Please select the community you reside in:

Choice	Number of Responses	% of Respondents
Mayland/Mayland Heights	27	32.5%
Renfrew	16	19.3%
Bridgeland/Riverside	14	16.9%
Vista Heights	6	7.2%
Other (elsewhere in the City of Calgary)	6	7.2%
Temple	4	4.8%
Inglewood	2	2.4%
Marlborough	2	2.4%
Rundle	2	2.4%
Whitehorn	2	2.4%
Albert Park/Radisson Heights	1	1.2%
Winston Heights/Mountview	1	1.2%
Total responses and respondents	**83**	**100.0%**

2. Please provide your postal code.

   Of the 83 total survey responses received, 69 respondents elected to provide a postal code. More detailed geographic analysis may be found in Section 6.2 (Survey Results and Other Feedback).

3. How often do you travel by air?

Choice	Number of Responses	% of Respondents
1 to 5 times per year	41	49.5%
Once every 2 to 5 years	27	32.5%
5 to 10 times per year	8	9.6%
Never	4	4.8%
More than 10 times per year	3	3.6%
Total responses and respondents	**83**	**100.0%**

4. How did you learn about this public consultation for the Alternate Heading Initiative? (select all that apply)

Choice	Number of Responses	% of Respondents
A community association or organization	51	64.6%
Advertisement on a social media (like Facebook or Instagram)	10	12.7%
Other (please specify)	10	12.7%
A family member, friend, or neighbour	8	10.1%
The Calgary Airport Authority website	2	2.5%
The NAV CANADA website	1	1.3%
Information received from an elected official	1	1.3%
Through Eventbrite's website or advertisements	1	1.3%
Total responses[11]	**84**	
Total respondents	**79**	

5. Have you reviewed the informational material related to the Alternate Heading Initiative (available at navcanada.ca/yycturn)?

Choice	Number of Responses	% of Respondents
Yes	70	88.6%
No	9	11.4%
Total responses and respondents	**79**	**100.0%**

6. Did you attend one of the online public information sessions?

Choice	Number of Responses	% of Respondents
Yes	28	35.4%
No	25	31.8%
I am planning to attend the information session in the future.	12	15.2%
I have watched the pre-recorded information session.	7	8.8%
I didn't know I could attend an information session.	7	8.8%
Total responses and respondents	**79**	**100.0%**

[11] Total responses exceed respondents because they were permitted to select as many options as applicable.

7. Are current levels of aircraft noise a concern to you?

Choice	Number of Responses	% of Respondents
Yes	65	82.3%
No	14	17.7%
Total responses and respondents	**79**	**100.0%**

8. What do your concerns about current levels of aircraft noise relate to? (select all that apply)

Choice	Number of Responses	% of Respondents
Aircraft on approach to landing (arrivals)	29	36.7%
Aircraft taking off (departures)	49	62.0%
I don't know/I'm not sure	14	17.7%
Total responses[12]	**92**	
Total respondents	**63**	

9. How would you describe your current exposure to aircraft noise (1-Low to 5-High)?

Choice	Number of Responses	% of Respondents
5	28	36.8%
4	28	36.8%
3	11	14.6%
2	7	9.2%
1	2	2.6%
Total responses and respondents	**76**	**100.0%**

[12] Total responses exceed respondents because they were permitted to select as many options as applicable.

10. What do you think should be considered when designing flight paths?

Choice	Weighted Average Response Score
Community noise exposure	6.62
Safety	6.53
Land use under the flight path (residential vs. commercial/industrial)	5.42
Air quality/pollution	4.92
Reducing fuel burn/greenhouse gas emissions	4.59
Reducing delays	2.88
Increasing airspace capacity	2.54
Shortening flight times	2.50
Total responses and respondents	**76**

11. Do you support the concept of greater traffic distribution if it means some areas see more aircraft and others see less?

Choice	Number of Responses	% of Respondents
Unsure	37	48.7%
No	26	34.2%
Yes	13	17.1%
Total responses and respondents	**76**	

12. Have you observed a change in aircraft overflight since the trial commenced?

Choice	Number of Responses	% of Respondents
Yes	55	72.4%
No	21	27.6%
Total responses and respondents	**76**	**100.0%**

13. What is the magnitude of the change you've observed?

Response	Number of Responses	% of Respondents
Significantly more aircraft	33	63.5%
A few more aircraft	12	23.1%
A few less aircraft	3	5.8%
Significantly fewer aircraft	2	3.8%
About the same	2	3.8%
Total responses and respondents	**52**	

14. Have you found the change more noticeable during certain times of the day?

Response	Number of Responses	% of Respondents
No, there's no difference based on the time of day.	18	34.62%
Yes, in the afternoon/evening.	16	30.77%
Yes, during the overnight period.	14	26.92%
Yes, in the mornings.	4	7.69%
Total responses and respondents	**52**	

15. Please describe what changes you have observed:

Response	Number of Responses	% of Respondents
A perceived change in the amount of noise or volume of individual noise events	30	57.7%
An increase in the overall number of aircraft observed	20	38.5%
An increased number of overnight flights or overnight flights being more noticeable/remarkable	13	25.0%
A decrease in the overall number of aircraft observed	10	19.2%
Total responses[13]	**73**	
Total respondents	**52**	

[13] Responses to this question were open-ended (free text) and coded for categorization and analysis. Total responses exceed respondents because they were permitted to select as many options as applicable.

16. Do you have any additional feedback about the Alternate Departure Heading Trial?

Response	Number of Responses	% of Respondents
Concerns about noise levels and/or quality of life	23	41.8%
Comments about the consultation process or about participation in the consultation process	13	23.6%
Comment or concern about overnight flights	11	20.0%
Comment or concern about conducting the operational trial during the COVID-19 pandemic	11	20.0%
Positive feedback on the Alternate Departure Heading trial and/or its associated benefits	11	20.0%
Concern about noise over new areas (picked the area because of how quiet it seemed)	10	18.2%
Feedback unrelated to the Alternate Departure Heading trial	9	16.4%
Request to move one or more flight path(s) to different neighbourhoods	7	12.7%
Total responses[14]	**95**	
Total respondents	**55**	

[14] Responses to this question were open-ended (free text) and coded for categorization and analysis. Total responses exceed respondents because they were permitted to select as many options as applicable.

APPENDIX B

Alternate Departure Heading Trial Notice
September 2019

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Notice: Alternate Departure Heading Trial

NAV CANADA, in partnership with the Calgary Airport Authority, will be conducting a trial of alternate departure headings for aircraft departing runways 17 Right (17R) and Left (17L) when in a southerly flow. The goals of the 12-month trial, which will commence in mid/late October, include:

- delivering noise mitigation to communities south of the airport,
- responding to airport infrastructure changes, and,
- improving air traffic management during high demand periods.

Existing Departure Operations

Currently, aircraft on departure climb on runway heading, or with a slight deviation from runway heading (17L). The current departure heading for 17R is 165˚, while the departure heading for 17L is also 165˚ (155˚ when two runways are being used for departures). While these departure headings are necessary to the consistent and safe management of traffic at YYC, the trial will evaluate a second set of headings that will be applied tactically when conditions permit.

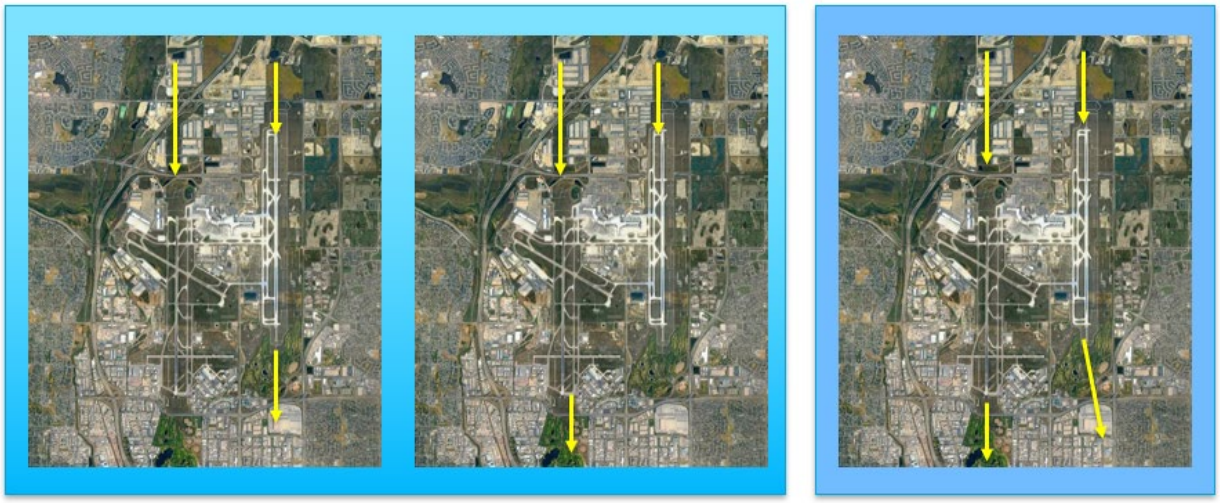

Figure 1: Calgary Airport operates in one of two modes for arrivals and departures when using parallel runways:

- *arrive one or two runway(s) and depart one runway (maps on left), or*
- *arrive two runways and depart two runways, known as SPID – simultaneous parallel instrument departure (map on right)*

Trial Departure Operations

In addition to continuing to utilize existing headings, air traffic controllers will be able to assign heading 135˚ for departures off of runway 17R and heading 185˚ for departures off of runway 17L. These headings will be used based on the flight plan of the departing aircraft.

Runway 17 Right

Aircraft departing 17R that are headed towards eastern destinations are more likely be instructed to utilize the new heading, thereby turning left on departure. It is anticipated that 30-50% of departures in a single departure runway mode will utilize the new heading.

The new heading provides community noise benefits by targeting commercial use land on initial take off and allowing aircraft to gain more altitude before they are directly above residentially populated areas when compared to the existing heading.

*Figure 2: Existing heading for **17R** in green; new heading in blue*

Runway 17 Left

Aircraft departing 17L that are headed towards western destinations are more likely be instructed to utilize the new heading, thereby turning right on departure. It is anticipated that less than 15% of departures will utilize the new heading (use of the new heading is not anticipated in a single departure runway mode).

The new heading also results in aircraft over commercial use land on initial take off. Since the runway is further north compared to 17R, aircraft will gain more altitude before they are directly above residentially populated areas that would typically observe departures from 17R.

*Figure 3: Existing heading for **17L** in green; new heading in blue.*

Operational Considerations

Historically, the distribution between a north (35 R/L) and south flow (17 R/L) has been approximately even; the new headings will only apply when departing runways 17 R/L. It is not anticipated that the trial will affect flow direction, as these are primarily determined by wind and weather conditions.

The ability to apply the Alternating Departure Heading Trial may be further impacted by weather, capacity considerations, construction, runway surface conditions, ground infrastructure, taxiing requirements, traffic and fleet mix and operator requests.

Summary

Through increased overflight of non-residential land, the trial is anticipated to reduce the cumulative community noise exposure for many communities south of the airport, while ensuring a safe and efficient operation. NAV CANADA and YYC are committed to providing updates over the course of the 12-month trial to YYC's Airport Community Consultative Committee, which brings together representatives from communities across the region to consider aircraft-noise related concerns and mitigations. Should you have any questions or feedback regarding the trial, please contact service@navcanada.ca.