



AERONAUTICAL STUDY

NAVAID Modernization

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Aeronautical Study – NAVAID Modernization

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Aeronautical Study – NAVAID Modernization

TABLE OF CONTENTS

Executive Summary	1
1.0 Purpose	2
2.0 Background.....	2
3.0 Analysis	4
3.1 Methodology	4
3.2 Study Team	4
3.3 Consultation.....	4
3.3.1 Issues	5
3.4 Risk Analysis	11
3.4.1 Hazards	11
3.4.2 Risks.....	11
3.5 Mitigation	11
3.5.1 Service.....	11
3.5.2 Technical	11
3.5.3 Human Factors	12
3.5.4 Communication.....	12
4.0 Conclusion	12
4.1 Recommendations	12
4.1.1 Change Management Table.....	12
4.1.2 Communication.....	13
5.0 Monitoring.....	13
Appendix A.....	15
Appendix B.....	57
Appendix C.....	64
Appendix D.....	67
HIRA Summary	68
Appendix E	79
Appendix F	83
Appendix G	87

Aeronautical Study – NAVAID Modernization

Executive Summary

This Study examined the proposal to decommission non-directional beacons (NDB) and very high frequency (VHF) omni-directional ranges (VOR) in support of NAV CANADA's plan to transition to a fully-implemented, satellite-based air navigation system (ANS).

The Study concluded that decommissioning the recommended VOR and NDB and designing and publishing RNAV (GNSS) instrument procedures where required will not have a negative impact on safety and will maintain IFR access to the affected airports. Establishing an RNAV 'L' and 'T' routes in place of the revoked VHF, LF/MF airways and air route segments will maintain the safety and efficiency of en route operations.

The decommissioning of NAVAID cannot occur prior to the required mitigation being enacted. This will occur over several years and will allow for aircraft operators to make the necessary fleet and equipment changes to enable them to operate in a satellite-based ANS.

The list of NAVAID recommended for decommissioning and the proposed mitigation is found in Appendix 'A'.

Maintaining a network of ground-based NAVAID to support a network of recovery airports will maintain safety of operations in the unlikely event of a significant GNSS loss of service. The list of recovery airports and the supporting recovery NAVAID is found in Appendix 'B'.

In addition to the revoking of instrument procedures (IP) supported by the NAVAID recommended for decommissioning, additional IP assessed to be supplemental are recommended for revoking and are listed in Appendix 'E'.

Aeronautical Study – NAVAID Modernization

1.0 Purpose

This aeronautical study will examine the proposal to decommission non-directional beacons (NDB) and very high frequency (VHF) omni-directional ranges (VOR) in support of NAV CANADA's plan to transition to a fully-implemented, satellite-based air navigation system (ANS) with a proposed network of conventional navigation aids (NAVAID) that will be capable of allowing aircraft to land at a suitable airport or continue as directed by air traffic control (ATC).

2.0 Background

The shift from NAVAID-based navigation to coordinate-based navigation enabled by performance-based navigation (PBN) provides significant benefits to NAV CANADA and its customers, in particular by providing the flexibility required to design airspace and associated routes and procedures according to operational needs. The most suitable navigation infrastructure to support PBN is the Global Navigation Satellite Systems (GNSS). Consequently, the role of conventional NAVAID is currently evolving towards that of a terrestrial infrastructure capable of maintaining safety and an adequate level of operations in case of unlikely unavailability of GNSS (for example due to outages). During this evolution, terrestrial NAVAID may also enable PBN operations for users not yet equipped with GNSS. The use of GNSS for aircraft navigation has increasingly reduced the need for ground-based navigation aids for most international and domestic flights under Instrument Flight Rules (IFR). The result is that many aviation users no longer use VOR and NDB for normal navigation over low frequency (LF) and VHF low-level (Victor) and high-level (Jet) airways and navigate safely using GNSS and inertial navigation.

The GNSS is susceptible to decreased performance from naturally-occurring phenomena as well as being vulnerable to denial of service from radio frequency interference, intentional and otherwise. This is possible due to the system-designed low power output of the satellite signals. Although there have been cases of localised interference caused by use of illegal radio frequency jammers or unintentional splash over effect from an adjacent frequency band, since 1993 when use of the GNSS for aviation was authorized there has never been a widespread loss of GNSS service. Owing to the proven robust nature of the system, Canadian Aviation Regulations have evolved such that regulations now permit instrument flight operations to destination and planned alternates using GNSS as the only navigation reference.

GNSS resiliency has been proven; however, there remains a highly remote possibility of lost or degraded service. Therefore, a recovery network based on an alternate navigation system infrastructure will be retained for the safety and efficiency of operations.

Future Global Positioning System (GPS) modernization programs and the development of complementary systems will in time allow some operations to be conducted by aircraft carrying no other navigation source other than GNSS ("sole-means" operation), but for the foreseeable future a subset of an alternate navigation system infrastructure will be retained to mitigate the possible negative consequences of an unlikely loss of GNSS service.

Enroute surveillance coverage in Canada is the airspace environment where most air carriers and domestic regional carriers operate. Total reliance on satellite-based technology and procedures introduces a risk to the ANS when either an internal or external failure of this technology occurs. In the unlikely event of a catastrophic GNSS failure the majority of these aircraft will be able to self-navigate or be directed using surveillance services by air traffic control (ATC) to a suitable landing airport. The greatest impact of a catastrophic GNSS failure will be on unpressurised aircraft operating in non-surveillance airspace owing to line-of-sight limitations for receipt of ground-based NAVAID signals and surveillance coverage. Therefore, a recovery NAVAID network predicated on non-pressurised aircraft

Aeronautical Study – NAVAID Modernization

operating below 10,000 ft ASL which provides navigation and approach assistance to pilots enabling them to safely recover at a suitable recovery airport is required.

Maintaining the full conventional NAVAID infrastructure, however, represents an unnecessary cost to NAV CANADA's customers and is unsustainable in the long-term. Existing aging ground-based conventional NAVAID (VOR and NDB) must be either replaced or decommissioned in the near and medium terms.

NDB serve no role in PBN operations except as a means for position cross-checking and general situational awareness. Therefore except where no other alternative is available due to constraints in operator fleet, financial, terrain or safety limitations the use of NDB as enroute navigation aids or to support instrument procedures are considered obsolete or redundant.

Transport Canada is supportive of and accepts the ICAO Performance Based Navigation (PBN) initiative and the need for globally-harmonized operations. Transport Canada, NAV CANADA and the Canadian aviation industry are working together to implement an ICAO State PBN plan for Canada. The [NAV CANADA PBN Operations Plan](#) outlines the overarching plan for the way forward and this proposed system further defines the specific means to address both normal and exceptional recovery operations.

NAV CANADA recognises the robust nature of satellite-based navigation and has developed guiding principles to support a navigation infrastructure that will continue to provide a safe and efficient network under all operational scenarios. The critical path elements under a degraded operation are:

- A recovery network of VORs and NDBs that will support navigation from NAVAID to NAVAID and/or to an area of surveillance coverage to a recovery airport served with a ground-based instrument approach procedure;
- A network of recovery NAVAID and airports; and
- Navigation and surveillance coverage at 10,000 ft ASL in Canadian Domestic Airspace (CDA).

The goal is to retain a recovery network of ground-based navigation aids to meet aviation needs. Within this network there would be a set of recovery airports with approach capabilities not dependent on GNSS. Recovery airports will be selected based on:

- Geographic location
- Runway/Apron capacity
- Useable instrument approaches
- Availability of aviation weather information
- Common routings

The NAVAID used to facilitate this recovery activity would be ground-based; either a NDB or VOR to enable navigation from up to 100 NM at 10,000 Ft ASL to a suitable or recovery airport. The NAVAID may also support the primary instrument approach for the recovery airport.

In the unlikely event of GNSS degraded performance, aircraft that are not within line-of-sight range of either a ground-based navigation aid or surveillance facility and do not have a self-contained navigation capability, may use dead reckoning for up to 100 NM to re-enter a NAVAID signal or surveillance coverage area. This will be employed as an acceptable recovery manoeuvre.

Reliance on ILS as the primary means of achieving precision approach will continue. However, the use of a NDB as part of the ILS approach will be eliminated and replaced with DME as required.

Aeronautical Study – NAVAID Modernization

3.0 Analysis

Methodology

The aeronautical study process conforms to the Canadian Standards Association's *CAN/CSA-Q850-97 Risk Management: Guideline for Decision Makers*.

A study team was formed, led by Brian Stockall, Manager Level of Service and Aeronautical Studies, to gather all relevant information, comments and concerns, related to proposal to ~260 NDB and ~ 60 VOR across Canada.

Lists of the NAVAID proposed for decommissioning and the related actions (i.e. revoking approach, procedures, airway segments, publishing RNAV procedures and airways) in each FIR as well as the NAVAID that were proposed for retention were sent to customers and stakeholders to provide opportunity for both feedback and constructive discussion.

A HIRA was conducted to address all the safety and efficiency issues raised by customers and to develop mitigation, if required, to ensure they would not be materially impacted by the change. See the HIRA summary as Appendix 'D'.

Study Team

The study team comprised of the following:

	Name	Title
Project Manager	Brian Stockall	Manager, Level of Service and Aeronautical Studies
Team Members	Boyd Barnes	Manager, Level of Service and Aeronautical Studies
	Tod Davidson	Manager, Level of Service and Aeronautical Studies
Contributors	Anthony Mackay	Director, Flight Operations

Consultation

NAV CANADA personnel from Level of Service surveyed and subsequently visited all ACCs and met with the Manager Program Coordination. The purpose of the discussions was to identify any needs, issues and concerns related to the decommissioning of NAVAID identified as redundant for the maintenance of a recovery NAVAID network.

Consultation was conducted with aircraft operators and associations and other stakeholders in all areas of the country, in person, by telephone and by e-mail. The majority of the consultation was conducted by email. Lists of the NAVAID proposed for decommissioning and the related actions (i.e. revoking approach, procedures, airway segments, publishing RNAV procedures and airways) in each FIR as well as the NAVAID that were proposed for retention were sent to aircraft operators and their

Aeronautical Study – NAVAID Modernization

comments were requested. One meeting, arranged by the Saskatchewan Aviation Council (SAC), was held in Saskatoon with Saskatchewan-based commercial operators, flight schools and airport operators participating. Four working papers were provided by the Canadian Owners and Pilots Association (COPA) to the Canadian Performance-based Aviation Action Team (CPAAT) in 2016 which were reviewed and the issues identified were incorporated into the analysis. A list of stakeholders from which feedback was requested is included in Appendix 'B'. Although not all stakeholders responded those that did represent a cross-section of Canadian aircraft operators. While the aircraft operators supported the move from traditional NAVAID and instrument procedures and airways based on ground-based NAVAID, an on-going operational need was identified for NAVAID to allow pilots to set their compasses in Northern Domestic Airspace (NDA) and to allow airports to qualify as IFR alternate airports when they were less than 100 NM apart.

3.1.1 Issues

Some aircraft operators design their Engine Failure Procedures (EFP) based on the NDB, particularly in mountainous areas. Decommissioning the NDB may result in these operators being unable to operate to these airports.

Some NAVAID proposed for decommissioning will render several airports to be inaccessible, due to the reliance of Engine Failure Procedures (EFP) on these NAVAID, particularly in mountainous areas. Without an EFP, the operators will be unable to operate to these airports, resulting in a reduction in service to the community.

For ease of flight operations, to eliminate ground proximity warnings (GPWS) calls on EFP based on the conventional procedures and most importantly, since some EFP based on conventional NAVAID don't ensure adequate signal coverage when downrange and at low altitude, particularly in mountainous areas AeroData, General Electric (GE) and other aircraft performance companies have developed RNAV-based EFP. These RNAV EFP are in use today and coded for the Universal and Collins FMS. These have been available for use since 2015.

If NDB are decommissioned in the north, pilots will be unable to reset their gyroscope or magnetic compass to a true track prior to commencing their approach as required by regulation.

CAR 605.15 (1) (g), CAR 605.16 (1) (g) and, CAR 605.18 (1) (a) and (b), stipulate that all power-driven aircraft operating under Night visual flight rules (VFR), VFR over-the-top (OTT) or instrument flight rules (IFR) are required to have a means of establishing direction that is not dependent on a magnetic source when operating in Northern Domestic Airspace (NDA). The gyro or compass must be reset prior to commencing the descent for the approach as all runway headings in NDA are identified with relation to True North. Resetting the compass using the NDB/ADF and GPS method, or the NDB/VOR or astro-compass method involves adjusting the compass so the heading on the compass rose, equivalent to the GPS bearing to the NDB, aligns with the head of the aircraft's ADF needle. For most northern operators the NDB is really the only way to switch to a true track.

Retaining NDB at major centres North of 60 with high-powered facilities (Inuvik, Yellowknife, Rankin Inlet, Iqaluit) and at other sites as required to provide NDB signal reception to all registered or certified aerodromes, but not necessarily required as recovery airports, will allow pilots to meet the regulatory requirement to reset their compass prior to descent.

The lack of surveillance in the north, combined with the great distances in many cases between suitable airports may result in pilots being unable to locate a suitable recovery airport in the event of decreased performance of the GNSS.

Aeronautical Study – NAVAID Modernization

The remote nature of Canada's North will be a challenge should a large-scale GNSS outage occur. In the case that a diversion to a recovery airport is required, the aircraft may be required to fly a rather long distance to reach the recovery airport. The weather in the North can also be unpredictable. Unlike in the South, there may not be any other airports in close proximity to the diversionary airport. As a result, the aircraft may only be faced with one airport to use – which may or may not have suitable weather. In Southern Canada this risk may be somewhat mitigated with the large number of potential recovery airports. Since this is not the case in the North, given the distance between airports, it may be necessary to ensure that the network of diversionary airports is large enough to account for the inability to use some of them depending on the weather conditions.

In addition to the radar at Yellowknife, Iqaluit, Kuujuaq and Goose Bay, retaining NDB at major centres North of 60 with high-powered facilities and at other sites as required to provide NDB or VOR signal reception to all airports with 24 hour aviation weather observations (METAR) and aerodrome forecasts (TAF) as well as additional airports in northern and remote regions suitable to the needs of the operators serving the area will be included in the recovery network to allow pilots more choices in the event of large-scale GNSS outage.

Decommissioning ground-based NAVAID at airports located less than 100 NM distance from other airports with RNAV (GNSS) approaches only will not allow these airports to be held as IFR alternate airports.

The Canada Air Pilot – General Pages (CAPGEN) Alternate Aerodrome Weather Minima Requirements states that: "Credit may be taken for satellite-based approaches provided that ... Where a satellite-based approach is planned at both the destination and alternate, the aerodromes are separated by a minimum of 100 NM." Decommissioning NAVAID at airports for which an aerodrome forecast (TAF) is issued and could therefore be used as an alternate airport and are separated by less than 100 NM, would limit the choices of alternate aerodrome for aircraft operators. This is particularly restrictive in remote areas where there are fewer alternate airport options and they may be a considerable distance away which would increase operating expenses as more fuel would have to be carried at the expense of passengers or freight.

Ground-based NAVAID at airports for which a TAF is issued and have other airports within 100 NM, will be retained to provide for choices for alternate airports that are less than 100 NM from the destination airport.

Decommissioning ground-based NAVAID will result in the airway and air route segments that are based on them to be revoked. There is a requirement for an air route for commercial flight in uncontrolled airspace.

Regulations (CAR 703.34, CAR 704.29, CAR 705.37) state that "No person shall, in uncontrolled airspace, conduct an IFR flight or a night VFR flight on a route other than an air route unless the air operator establishes the route in accordance with the Commercial Air Service Standards." If the low frequency (LF) air routes that are based on ground-based NAVAID are revoked when the NAVAID are decommissioned, due to the lack of controlled airspace in many parts of Canada, commercial aircraft operators will not be able to operate in low-level airspace. This will have an impact on operators of non-pressurised aircraft and those operating between airports separated by short distances (<250 NM) and it is not possible or efficient to fly above uncontrolled airspace.

Low-level RNAV routes (L-routes) will be established where required between airports to replace the LF air routes that are revoked when the NAVAID are decommissioned. This will permit commercial IFR flight between the airports.

Pilots of non-DME equipped aircraft would be unable to access a recovery airport if the recovery instrument procedure required the use of a DME.

VOR approach procedures have largely been replaced by VOR/DME approaches, which provide a slightly lower minima. While most IFR aircraft are equipped with a LOC/GS receiver, some light

Aeronautical Study – NAVAID Modernization

aircraft that are flown IFR are not DME equipped. For emergency recovery use, which is most likely the only time these approaches would ever be used, non-DME-equipped aircraft would not be able to use the procedure and the airport would therefore not be available as a recovery airport.

All VOR in Canada are coupled with DME. Most ILS and VOR instrument procedures in Canada require a DME, where one is available. At locations where a NDB supports the ILS procedure, the NDB will be replaced by a DME. To fly these current procedures an ADF is required; equipment that is becoming increasingly less common. Where possible, airports for which the VOR is the recovery NAVAID, if there is a VOR procedure it will be retained as the recovery instrument procedure and the VOR/DME procedure revoked. This will increase the number of recovery airports available to the greatest number of IFR pilots. At recovery airports where terminal radar service is provided, the air traffic controllers could provide radar assistance to pilots of non-DME equipped aircraft to identify the FAF. It should be noted that NAV CANADA is not proposing to decommission enroute DME at this time. The current number of enroute DME will remain in place. Operators of non-DME- equipped aircraft will have to consider their area of operations when making equipment related decisions.

If the NAVAID on which the missed approach (MA) portion of an instrument procedure is decommissioned, the minima for that procedure may be raised. This may reduce airport accessibility.

Concern was expressed as to whether the removal of these NAVAID, specifically the ones that form a part of the ILS MA at airports in mountainous areas, would cause the minimums to be raised for the standard approaches in the Canada Air Pilot (CAP).

Criteria for the Design of Instrument Procedures (TP308) makes for the provision of the use of distance measuring equipment (DME) to support the missed approach segment. DME will be relocated if the VOR is decommissioned or installed to replace a NDB to maintain the MA segment of an IFR procedure and every attempt will be made to maintain the minima at the current limits.

GNSS signals can be interrupted by illegal GPS jammers. If the instrument procedure based on the VOR or NDB is revoked because of the decommissioning of the NAVAID the airport will be inaccessible for IFR operations.

Jamming, directed at non-aviation users, could affect aircraft operations. Over the past few years, there have been cases of illegal use of radio communication jamming devices, which are prohibited under the Radiocommunication Act. Depending on signal strength, these jammers can also inadvertently and probably unknowingly prevent aircraft operating in the vicinity from receiving GNSS signals. Many of the observed failures may be as a result of signal integrity being degraded below that required for terminal operations, but the signal might still be adequate for enroute operations.

The use of illegal GPS jammers is usually transient, being located in a vehicle and therefore temporary in its impact in the vicinity of the airport and to date it has usually been reported near airports served by an ILS and located within an area of terminal airspace in which radar service is available. The pilots of aircraft for which the GNSS signal is temporarily unavailable could request radar assistance from ATC and conduct a landing approach to the airport by either a visual approach or by using the ILS.

Some IFR aircraft may not be able to maintain flight at 10,000 Ft ASL, or may have to use additional fuel to climb to 10,000 Ft ASL to be within surveillance airspace or receive a signal from a NAVAID.

Sophisticated piston engine aircraft are suitable for sustained flight above 10,000 Ft ASL. Others lack the oxygen systems as required by CAR 605.32 (1) or pressurisation, and their climb performance is very much reduced at higher altitudes. Additionally, for about 6 months of the year in southern Canada, and longer in more northerly latitudes, they may have to fly at much lower altitudes to avoid icing.

Aeronautical Study – NAVAID Modernization

An aircraft operating in accordance with IFR may not be able to climb to 10,000 Ft ASL due to icing conditions. In the event of a wide-spread prolonged GNSS failure, these pilots may be unable to climb high enough to receive radar assistance or a signal from a ground-based NAVAID to enable them to proceed to a recovery airport.

CAR 605.30 requires that an aircraft must be adequately equipped to operate in icing conditions. An aircraft operating in accordance with IFR may not be able to climb to 10,000 Ft ASL due to icing conditions. In the event of a wide-spread prolonged GNSS failure, these pilots may be unable to climb high enough to receive radar assistance or a signal from a ground-based NAVAID to enable them to proceed to a recovery airport.

The pilot of an aircraft operating IFR below 10,000 Ft in instrument meteorological conditions (IMC) at the time of a significant GNSS failure would have to climb as high as possible to obtain radar assistance from ATC or a signal from a ground-based NAVAID and make a decision on the best course of action regarding the most appropriate recovery airport to proceed to. Recognising the 10,000 Ft limitation, the recovery plan is based on surveillance and signal coverage at 10,000 Ft ASL.

It is assumed that IFR qualified pilots would be able to use dead reckoning for up to 100 NM to enter a NAVAID signal or surveillance coverage area at which point they would be able to receive radar assistance to proceed to a suitable recovery airport, or navigate to one themselves by use of the NAVAID signal. This is deemed as an acceptable recovery strategy.

The proposal is to retain sufficient NAVAID to provide signal coverage to serve as recovery NAVAID to support the recovery airport network and supplement the areas of radar surveillance. This will lower the likelihood of a pilot being unable to receive a signal from a recovery NAVAID in the event of a significant GNSS outage.

ATC cannot provide vectors to a recovery airport if the pilot is flying in uncontrolled airspace and the airport is in an area of uncontrolled airspace.

If an airport that is designated as a recovery airport is located in an area of uncontrolled airspace, but within an area of surveillance coverage it is not available to pilots for radar vectoring. A pilot operating in uncontrolled airspace (below 18,000 Ft ASL in Southern Domestic Airspace (SDA), below FL230 in the Northern Control Area (NCA) of Northern Domestic Airspace (NDA) and below FL270 in the Arctic Control Area (ACA) is not able to receive radar service from ATC to enable navigation to a recovery airport served by an ILS, but not by either a VOR or NDB.

Airports equipped with an ILS are considered to be recovery airports and an airport located in an area of uncontrolled airspace will also be equipped with a ground-based NAVAID to enable pilots to navigate to the airport in the event of a significant GNSS outage. The Manual of ATS provides guidance to air traffic controllers which allows them to provide vectors to an aircraft into Class G airspace provided that they inform the pilot and obtain the pilot's approval.

If the NAVAID is a NDB only, at a recovery airport, many aircraft, especially new ones may not be able to use the airport as a recovery airport.

Many aircraft today are not equipped with an automatic direction finder (ADF). The ADF is an expensive piece of equipment (~\$12K) which is now only made by one general aviation avionics manufacturer and is often a high maintenance item. In future, when the ADF is only used in the rare event of a GNSS failure, operators that operate in southern domestic airspace will have an even stronger desire to dispense with it.

Where surveillance coverage is not available, or insufficient to provide radar vectors to the ILS, a VOR, if available will be retained as the recovery enroute NAVAID to assist navigation to a recovery airport or to serve as the recovery NAVAID to support the instrument approach to the airport. NDB will only be retained as a recovery NAVAID where there is no alternative.

Aeronautical Study – NAVAID Modernization

Some aircraft have only one GPS receiver and a VOR/DME which means that they have to have a secondary navigation source available if the GPS should fail.

Canadian Aviation Regulations (605.18) require in part that “No person shall conduct a take-off in a power-driven aircraft for the purpose of IFR flight unless it is equipped with sufficient radio navigation equipment to permit the pilot, in the event of the failure at any stage of the flight of any item of that equipment, including any associated flight instrument display,

- to proceed to the destination aerodrome or proceed to another aerodrome that is suitable for landing, and
- where the aircraft is operated in IMC, to complete an instrument approach and, if necessary, conduct a missed approach procedure.”

In the instance of an aircraft GNSS receiver becoming unserviceable before or during a flight the CAR requires the ability to continue to destination or suitable alternate and complete an approach. Minimum Equipment Lists (MEL) detail the minimum serviceable equipment level required onboard the aircraft to plan an IFR flight. MELs are approved by the Minister of Transport. In some cases the aircraft is equipped with more than one GNSS receiver; in other cases the Flight Management System (FMS) could have multiple radio navigation sources. In each case the MEL dictates the navigation equipment required to plan an IFR flight.

The proposal includes decommissioning many VOR and NDB; however, a number of these NAVAIDs will remain in place as part of the recovery network, or to meet other CAR requirements and can be used to navigate to an airport. Additionally, NAV CANADA is not proposing to decommission enroute DME at this time. The current number of enroute DME’s will remain in place and may be used by suitably equipped aircraft for DME/DME or DME/DME/IRU (DDI) navigation.

A list of DME and locations is provided at Annex D. Within the DME structure there may be opportunities for system efficiency gains through moving an existing DME to a new location and improving the DME/DME signal geometry over frequently used routings.

Many operators use aircraft that have a dual GNSS receiver capability. Others have plans to upgrade their fleets to dual GNSS receivers. These aircraft will be able to plan or continue to destination based on single GNSS if the MEL allows. Aircraft with a single GNSS receiver will need to meet the CAR requirement in another way. (e.g.: Navigating directly to a VOR or NDB at a recovery or other airport or navigating to the destination or alternate via DME/DME or DME/DME/IRU.) Additionally, the decommissioning of NAVAID will be coordinated with aircraft operators in the area to allow them sufficient time to upgrade their aircraft if required.

With the decommissioning of VOR and NDB, there will be less opportunity for flight schools to train students on the use of these NAVAID, for both en route and approach navigation.

Flight training schools use both the VOR and NDB for training students both for the Commercial Pilot Licences, and the Instrument Ratings. Eliminating these NAVAID in areas around flight schools will increase cost due to travel to locations where these facilities continue to exist. With regard to the Instrument Rating, pilots need to use the facilities to maintain their proficiency in flying with the NAVAID, and as these facilities become less accessible, there will likely be deterioration in the ability of pilots to use them in the event of a GPS outage.

Training schools would be remiss to not train the VOR and NDB tracking, holds and approaches with students if they still exist in Canada, even though Transport Canada may not require it to be tested on a flight test.

Aeronautical Study – NAVAID Modernization

Flight training schools are increasingly focussing on simulator usage to overcome the increased cost in operating the aircraft. Today's simulators are very realistic and can easily be used to teach the basics of VOR and NDB navigation. If live practice is deemed necessary, travel to a location that a VOR or NDB remains in place is an option.

NAV CANADA estimates that the likelihood of a total GNSS system failure is very low. It is so low in fact that the Transport Canada Flight Test Guide (TP9939) no longer requires the completion of a VOR or NDB approach during an initial or recurrent flight test. NAV CANADA is transforming the air navigation system to one based on GNSS. In the highly unlikely event of a wide spread GNSS failure many recovery airports are equipped with ILS and are within surveillance coverage. In some remote areas where there is no surveillance service, navigation to a remote recovery aerodrome may involve tracking to a VOR or NDB and then completing an ILS approach. At recovery aerodromes that are not ILS equipped, a VOR or NDB procedure will have to be flown. Pilots who operate in remote regions have the opportunity to practise using the VOR or NDB procedures that are in place during the course of their normal operation.

Operators of non-RNAV equipped aircraft will not be able to fly IFR if the majority of VOR and NDB are decommissioned.

Some operators have operational fleets or aircraft within their fleet that have no RNAV capability. These aircraft fly minimal hours per day and there is no business case to upgrade to aircraft to a GNSS capability. Some companies may choose to not make an unrecoverable investment representing a substantial portion of the total value of the aircraft.

NAV CANADA is following the ICAO lead in modernizing Canada's airspace. The transition to a Space Based Air Navigation System has been part of the NAV CANADA's Operations Plan for the implementation of performance-based Navigation (PBN) in Canadian airspace that was published in 2014 was developed collaboratively with our customers in recognition of the shared role, responsibility and benefits that PBN represents. The concept of a PBN has been on the agenda of our FIR based customer forums and our meeting with the various operator and airport groups.

As NAV CANADA progresses through the transition and modernizes the ANS, there is an expectation that operators must also make an investment to upgrade current equipment or obtain new fleets that are capable of operating within the new structure. The implementation of the proposed decommissioning of NAVAID will occur over several years which will allow aircraft operators time to make decisions regarding their fleet. Advance notice of change has been given and NAV CANADA will continue to work with operators to ensure the system transition is scheduled to minimise the impact on air operators.

In the event of a significant GNSS outage pilots operating IFR will have to fly to an airport with a ground-based NAVAID which may be other than their planned destination or alternate. They therefore may not be aware of the weather conditions at the recovery airport.

While any airfield can legally serve as a weather alternate, they are in practice selected from a set of airfields for which a TAF is available, since any other field requires an area forecast of visual meteorological conditions (VMC).

Identifying airports as recovery airports from those for which a TAF is issued where possible will allow pilots to select the weather alternate and could also serve as a GNSS failure alternate, greatly simplifying the pre-flight planning process, and ensuring that requirements for diversion fuel would be no more onerous than they are today.

Where possible all airports designated as recovery airports will have 24-hour aviation weather observations (METAR) and TAF available. Where this is not possible the site will have at least limited hour METAR and TAF. Airports without weather information will not be included in the recovery network.

Aeronautical Study – NAVAID Modernization

Risk Analysis

No safety hazards or risks were identified with the proposal to decommission the NDB and VOR listed in Appendix 'A'. The HIRA summary at Appendix 'D' provides a complete analysis of the issues and concerns raised.

3.1.2 Hazards

N/A

3.1.3 Risks

N/A

Mitigation

Mitigation is required to address issues and concerns identified during consultation. The mitigation for each issue when required is identified in Appendix 'C' and was a factor in determining which NAVAID to recommend for decommissioning which are listed in Appendix 'A'. Additional mitigation specifically associated with the decommissioning of each NDB or VOR in Appendix 'A' is identified alongside each NAVAID in Appendix 'A'.

3.1.4 Service

The required RNAV (GNSS) instrument procedures to provide IFR access to the airports are designed and published at the majority of locations at which the decommissioning of ground-based NAVAID are recommended. Decommissioning the NDB and VOR as recommended in Appendix 'A' will eliminate the facilities that support the only IP that provides access to the airport for pilots operating IFR at some locations. Where this is the case, designing and publishing RNAV (GNSS) IP to the appropriate runway ends will maintain IFR access to the airport.

Where the decommissioning of a NDB or VOR will result in the revoking of an airway or air route segment, the publishing of low-level RNAV routes ('T' routes, or 'L' routes as appropriate) is identified to provide suitable MOCAs for enroute operations or to maintain controlled airspace. Airspace redesign was not proposed as mitigation for the revoking of any airways. If required, this will be the subject of separate initiatives. The redesign of high-level jet airways was not identified as no airspace is associated with these airways and their redesign does not require an aeronautical study.

3.1.5 Technical

The NDB and VOR equipment will need to be removed from the sites following the decommissioning of the NAVAID, including any required restoration of the occupied lands. Some aircraft will have to continue with the equipment upgrades or fleet replacements already underway.

The relocation of DME to an airport, or the installation of an on-airport DME will be required at some locations to support the ILS instrument procedure, or in some cases to support the DDI network.

Aeronautical Study – NAVAID Modernization

3.1.6 Human Factors

No human factor issues were identified with the proposed service change. Aircraft operators, pilots, dispatchers, air traffic service personnel, instrument procedure designers and airport operators are familiar with operation in a PBN environment.

3.1.7 Communication

The service changes will be announced in advance of aeronautical publication changes via an Aeronautical Information Circular (AIC) and an Aviation Notice published on the NAV CANADA web site. The notices will be distributed to aircraft operators, associations and other stakeholders. The appropriate aeronautical publications will be amended including the CAP, CFS, HI / LO Enroute charts and VFR Navigation Charts (VNC). As the implementation of the recommendations will occur over a period of years, there will be multiple AIC and Notices and publication amendments. Additionally, presentations at various association meetings and NAV CANADA area operation consultation meetings (AOCM) will be provided to identify recent and proposed NAVAID decommissionings.

4.0 Conclusion

Publishing RNAV (GNSS) instrument procedures where required and decommissioning the recommended VOR and NDB and designing and will not have a negative impact on safety and will maintain IFR access to the affected airports. Establishing an RNAV 'L' and 'T' routes in place of the revoked VHF, LF/MF airways and air route segments will maintain the safety and efficiency of en route operations.

Maintaining a network of ground-based NAVAID to support a network of recovery airports will maintain safety of operations in the event of a significant GNSS event.

In summary, with the phased decommissioning of the recommended NDB and VOR over a number of years. There will be no material impact to customer operations.

Recommendations

The study recommends that:

- the ground-based NAVAID (NDB and VOR) as identified in Appendix 'A' be decommissioned
- the instrument procedure associated with the decommissioned NAVAID be revoked;
- Instrument procedures associated with ground-based NAVAID that are not required to support the recovery network be revoked
- RNAV 'T' and 'L' routes be published in place of the revoked VHF, LF/MF airways and LF air route segments; and
- RNAV (GNSS) instrument procedures be designed and published for the required runway ends at airports without RNAV (GNSS) procedures.

4.1.1 Change Management Table

Present	Proposed System	Change
NAVAID-based navigation system and satellite-based air navigation system	satellite-based air navigation system	Enroute and approach navigation based on GNSS supplemented by ILS at select airports

Aeronautical Study – NAVAID Modernization

Present	Proposed System	Change
NAVAID-based navigation system and satellite-based air navigation system	satellite-based air navigation system with minimal network of NAVAID for recovery purposes	network of conventional NAVAID to support recovery network in the event of a significant GNSS outage
NDB for compass-setting in NDA	NDB at selected airports for compass-setting in NDA	NDB signal for compass setting may not be at destination airport

4.1.2 Communication

All regulatory requirements will be met with respect to the changes listed in this report including:

- Notification of all affected NAV CANADA departments (Operations, Engineering, Communications, Training and Aeronautical Information Services)
- Publication of an Aeronautical Information Circular a minimum of one publication cycle prior to implementation of the changes
- Publication of a Notice in accordance with the Civil Air Navigation Services Commercialization Act
- Notification to the affected Airport Operators of any changes that may be required to the Airport Operations Manual and operation of airport lighting and vehicle management
- Aeronautical information publication changes will be co-ordinated with the change implementation date.

4.1.3 Implementation

This project is estimated to take up to seven years to complete. In addition to the normal Aeronautical Study Communication described in 4.1.2 above; coordination and ongoing consultation with affected users will also take place based on the change schedule and its implications. NAV CANADA will continue to communicate and coordinate with stakeholders to ensure the concepts defined in this Study are respected while recognizing the specific application of infrastructure change continues to meet the agreed level of service. This outreach will be conducted with individual stakeholders and/or their representative groups through the existing multiple NAV CANADA consultation forums.

In addition, the Hazard Identification and Risk Analysis (HIRA) conducted as part of the Aeronautical Study (see Appendix D), will be supplemented with NAV CANADA’s Safety Management System (SMS) process which includes the use of implementation HIRAs prior to the introduction of operational change. Therefore as this project unfolds the implementation HIRAs will identify if any new risks have arisen since the study was completed. Prior to implementing changes as a result of this study all current risks will be appropriately mitigated. Implementation will occur on regularly scheduled AIRAC effective dates.

5.0 Monitoring

The Level of Service and Aeronautical Studies Branch is responsible for monitoring the implementation and post implementation of approved recommendations to ensure that service changes are performing as expected and that no unforeseen risks or hazards are introduced. In the event of any discrepancy, appropriate corrective action will be identified and initiated. The following monitoring actions will take place:

1. AIS publication changes will be reviewed for accuracy;
2. ANS safety reporting will be monitored for events related to the service changes;

Aeronautical Study – NAVAID Modernization

3. Occurrence reporting will be monitored for events related to the service changes;
4. Customer Service reports will be monitored for issues related to the service changes; and,
5. An initial and a follow-up post implementation assessment will be completed approximately 90 days and one year after the implementation of the recommendations. These reviews will assess the effectiveness of the service change in terms of aviation safety, customer service and NAV CANADA efficiency, and may include interviews with customers and other stakeholders as required.

Aeronautical Study – NAVAID Modernization

Appendix A

NAVAID RECOMMENDED FOR DECOMMISSIONING

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
GANDER FIR					
Argentia	Argentia (UWP)	Decommission NDB	Revoke: R14 ZNF-UWP-QY	N/A	T routes already in place
Churchill Falls	Churchill Falls (UM)	Decommission NDB	Revoke: NDB RWY 13 R29 YYR-UM BR11 UM-UAC RR23 UM-KR V331 YYR-UM-YWK	GNSS Procedures already in place	Replace V331 with T Route
Deer Lake	Deer Lake (DF)	Decommission NDB	Revoke: NDB/DME RWY 07 R18 AY-DF R15 QX-DF BR12 BX-DF	ILS RWY 25 redesign MA VOR DME A redesign MA	Replace BR12 with T Route if required
Gander	Gander (QX)	Decommission NDB	Revoke: NDB RWY 13 B21 AY-QX G4 JT-QX R13 QY-QX R15 DF-QX	ILS/DME RWY 03 redesign MA ILS RWY 13 redesign FAF, MA, MSA and transition.	Controlled Airspace and VICTOR Airways in place
Hopedale	Hopedale (HO)	Decommission NDB	Revoke: NDB RWY 25 AR28 YFT-HO-YDP	GNSS Procedures in place	Replace AR28 with L Route
Makkovik	Makkovik (YFT)	Decommission NDB	Revoke: NDB A AR28 JC-YFT-HO	GNSS Procedures in place	Replace AR28 with L Route
Rigolet	Rigolet (JC)	Decommission NDB	Revoke: NDB A AR28 CA-JC-YFT AR23 YR-JC	GNSS Procedures in Place	Replace AR28 with L Route
St. Anthony	St. Anthony (AY)	Decommission NDB	Revoke: VOR/DME A VOR RWY 10 R18 DF-AY	GNSS Procedures in Place	Replace RR2 and RR6 with L Routes AR13 parallels AR21

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
GANDER FIR					
			B21 QX-AY RR6 AY-YMH AR21 YR-AY RR2 BX-AY		VICTOR Airways currently parallel R18 and B21
St. John's	Wabana (ZNF)	Decommission NDB	Revoke: R14 ZNF-UWP	ILS RWY 11 Redesign FAF, MA, MSA, and hold. ILS RWY 29 Redesign MA, MSA and hold	V312 in place
St. John's	Signal Hill (NL)	Decommission NDB	Revoke: NDB RWY 34	ILS RWY 16 Redesign MA, MSA and hold	N/A
Stephenville	Harmon (ZJT)	Decommission NDB	Revoke: LOC (BC) RWY 09	Redesign FAF and MA ILS RWY 27	N/A
Stephenville	Stephenville (JT)	Decommission NDB	Revoke: NDB Z RWY 09 NDB Y RWY 09 LOC (BC) RWY 09 G4 QX-JT-QY BR4 YHR-JT	GNSS Procedures to be developed prior to decommission. RNAV (GNSS) RWY 09	G4 parallels V319 which will be replaced with a T Route BR4 not required by customers
Stephenville	Stephenville (YJT)	Decommission VOR Retain DME (if required for DDI or ILS support)	Revoke: V382 YDF-YJT V311 YQX-YJT-YGR V319 YQY-YJT	N/A	Replace V319 YQY-YJT and V311 YQX-YJT with T Routes

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
MONCTON FIR					
Charlo	Charlo (CL)	Decommission NDB	Revoke: NDB A BR1 YY-CL-GP RR22 YRI-CL-F9 BR25 YXK-CL-1F-F9	GNSS Procedures already in place	New air routes as required

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
MONCTON FIR					
Charlottetown	Charlottetown (YYG)	Decommission VOR Retain DME (if required for DDI or ILS support)	Revoke: VOR/DME RWY 10 VOR/DME RWY 28 VOR RWY 28 V300 YQY-YYG-YQM V374 YGR-YYG V310 YYG-YHZ	GNSS Procedures already in place	New air routes as required
Fredericton	Fredericton (FC)	Decommission NDB	Revoke: NDB RWY 15 R11 SJ-ADRAX-FC-EMBIM G1 QM-FC-IRGUB A6 FC-BIVPU	ILS RWY 09 revise MA, MSA and hold.	Replace R11, G1 and A6 with T Routes if required
Fredericton	Fredericton (YFC)	Decommission VOR Retain DME (if required for DDI or ILS support)	Revoke: VOR RWY 09 VOR RWY 27 V300 YQM-FRENN V310 YSJ-SATUX	N/A	T Routes from YSJ and YQM will be designed to avoid class F airspace
Halifax	Bluenose (ZNS)	Decommission NDB	Revoke: NDB RWY 23	GNSS Procedures In place	N/A
Halifax	Split Crow (ZHZ)	Decommission NDB	Revoke: NDB RWY 05	GNSS Procedures In place	N/A
Iles-de-la-Madeleine	Grindstone (YGR)	Decommission VOR Retain DME (if required for DDI or ILS support)	Revoke: VOR/DME RWY 16 VOR/DME RWY 25 VOR RWY 16 VOR RWY 25 V311 YJT-YGR-YQM V374 YGR-YYG V382 YGR-YGP	GNSS Procedures In place LOC RWY 07 revise MA, MSA and hold.	Replace V311 and V382 with T Routes Replace V374 with T route if required
Moncton	Moncton (QM)	Decommission NDB	Revoke: NDB RWY29 A8 QM-F9 A3 QM-YZX B18 QM-SJ G1 QM-FC	GNSS Procedures In place ILS RWY 29 revise MA, MSA, hold and transitions	New air routes as required

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
MONCTON FIR					
Moncton	Riverview (ZQM)	Decommission NDB	Revoke: NDB RWY 06	GNSS Procedures In place ILS RWY 06 Redesign FAF, MA, MSA, and hold.	N/A
Moncton	Lewisville (ZMN)	Decommission NDB	Revoke: NDB RWY 11	GNSS Procedures In place ILS RWY 29 revise MA, hold and transitions	N/A
Moncton	Moncton (YQM)	Decommission VOR Retain DME (if required for DDI or ILS support)	Revoke: VOR RWY 24 V311 YGR-YQM-YSJ V313 YHZ-YQM	GNSS Procedures In place	Replace V311 and V313 with T Routes if required
Port Hawkesbury	Port Hawkesbury (PD)	Decommission NDB	Revoke: NDB RWY 29	GNSS Procedures in place	N/A
Saint John	Alpine (ZST)	Decommission NDB	Revoke: NDB RWY 05	GNSS Procedures In place ILS RWY 05 revise FAF, MA, MSA and transitions	N/A
Saint John	Saint John (SJ)	Decommission NDB	Revoke: NDB RWY 23 B16 QM-SJ-QI R11 SJ-ADRAX-FC	GNSS Procedures In place ILS RWY 23 revise FAF, MA, MSA and transitions	Replace R11 with T Route B16 parallels V311
Saint John	Saint John (YSJ)	Decommission VOR Retain DME (if required for DDI or ILS support)	Revoke V311 YQM-YSJ-YQI V301 YHZ-YSJ- SATUX V318 YSJ-MOWND- SPGSK	GNSS Procedures In place	Replace V311, V301 and V318 with T routes as required.
Saint Leonard	Saint Leonard (YSL)	Decommission NDB	Revoke NDB RWY 18 NDB/VOR RWY 36	GNSS Procedures in place	N/A
Sydney	Sydney (QY)	Decommission NDB	Revoke: NDB RWY 24 R14 QY-UWP R13 QY-QX G4 QY-JT	GNSS Procedures in place Redesign ILS RWY 06 MA	T 601 QY-QX already in place Replace G4 YQY- YJT with T Route

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
MONCTON FIR					
Sydney	Sydney (YQY)	Decommission VOR Retain DME (if required for DDI or ILS support)	Revoke: V312 YQY-YYT-YHZ V319 YQY- YJT V300 YQY-YYG	GNSS Procedures in place	Replace V312 and V319 with T Routes V300 already covered with T735
Yarmouth	Pleasant Lake (AC)	Decommission NDB	Revoke: NDB RWY 24	GNSS Procedures in place	N/A
Yarmouth	Yarmouth (QI)	Decommission NDB	Revoke: NDB RWY 06 A3 YZX-QI B16QI-SJ	GNSS Procedures in place	B16 parallels V311
Yarmouth	Yarmouth (YQI)	Decommission VOR Retain DME (if required for DDI or ILS support)	Revoke: VOR RWY 15 VOR RWY 33 V312 YQI-YHZ V311 YQI-YSJ	GNSS Procedures in place	Replace V311 and V312 with T routes as required.

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
MONTREAL FIR					
Aklulivik	Aklulivik (YKO)	Decommission NDB	Revoke: NDB RWY 08 AR16 YPX-YKO-YIK	GNSS Procedures already in place	Replace AR 16 with a L Route
Aupaluk	Aupaluk (YLA)	Decommission NDB	Revoke: NDB RWY 04 NDB RWY 22 AR13 VP-YLA-YAS	GNSS Procedures already in place	Replace AR 13 with a L route
Bonaventure	Bonaventure (YVB)	Decommission NDB	Revoke: NDB RWY 13	GNSS Procedures already in place	N/A
Bromont	Bromont (ZBM)	Decommission NDB	Revoke: NDB RWY 05	GNSS Procedures already in place	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
MONTREAL FIR					
Charlevoix	Charlevoix (ML)	Decommission NDB	Revoke: NDB RWY 33 NDB A R22 RI-ML V341 YYY-ML V360 YBC-ML-YQB V383 ML-VBS	GNSS Procedures already in place	Replace R22, V341, V360, V383 with T Routes if required
Chevery	Chevery (YHR)	Decommission NDB	Revoke: NDB/DME RWY 07 NDB/DME RWY 25 NDB RWY 07 NDB RWY 25 BR1 BX-YHR BR4 YR-YHR-JT RR2 YIF-YHR- YNA	GNSS Procedures already in place	Replace BR1, BR4, and RR2 with L Routes
Chute-des-Passes	Chute-des-Passes (DG)	Decommission NDB	Revoke: AR13 VBS-DG-YFM AR44 RJ-DG	N/A	Replace AR13, AR44, with L Routes if required.
Eastmain	Eastmain (ZEM)	Decommission NDB	Revoke: NDB RWY 02 NDB RWY 20 BR14 MM-ZFM-YN AR18 YKQ-ZEM-GL AR20 MO-ZEM	GNSS Procedures already in place	Replace BR 14, AR18, AR 20 with L Routes
Gaspé	Gaspé (GP)	Decommission NDB	Revoke: NDB RWY 28 AR1 GP-PN-YGV B14 GP-YY BR1 GP-CL-YY	GNSS Procedures already in place	Replace AR1, and BR1 with L Routes Replace B14 with T Route
Havre St-Pierre	Havre St-Pierre (YGV)	Decommission NDB	Revoke: NDB RWY A AR1 GP-PN-YGV RR2 YZV-YGV-YNA	GNSS Procedures already in place	Replace AR1 and RR2 with L Routes

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
MONTREAL FIR					
Inukjuak	Inukjuak (YPH)	Decommission NDB	Revoke: NDB RWY 07 NDB RWY 25 AR16 YSK-YPH-YPX AR17 GW-YPH-YPX RR13 YMU-YPH	GNSS Procedures already in place	Replace AR16, AR17 and RR13 with L Route

Kangiqsualujuaq	Kangiqsualujuaq (YLU)	Decommission NDB	Revoke: NDB RWY 16 AR39 VP-YLU	GNSS Procedures already in place	Replace AR39 with L Route
Kangiqsujuaq	Kangiqsujuaq (YKG)	Decommission NDB	Revoke: NDB RWY 33 GR7 YZG-YKG-UHA AR17 YPX-YKG-YLC	GNSS Procedures already in place	Replace GR7 and AR17 with L Routes
Kimmirut	Kimmirut (YLC)	Decommission NDB	Revoke: AR17 YKG-YLC-YFY	GNSS Procedures already in place	Replace AR17 with L Route
Kingston	Kingston (YGK)	Decommission NDB	Revoke: NDB RWY 19 R76 YGK-YSH	GNSS Procedures already in place ILS RWY 19 Revise FAF, MA, MSA and transition based on GNSS. LOC(BC) RWY 01 Revise MA, MSA and transition based on GNSS	R76 not required by customers

Aeronautical Study – NAVAID Modernization

Kuujuaq	Kujack (VP)	Decommission NDB	Revoke: NDB/DME RWY 07 VOR/NDB RWY 13 NDB A AR39 YLU-VP-YTQ-YAS AR13YFM-VP-YLA-YAS AR10/BR20 VP-UHA-YFY	GNSS Procedures already in place	Replace AR39, AR13 and AR10/BR20 (VP-UHA) with L Routes
La Grande Rivière	La Grande Rivière (GL)	Decommission NDB	Revoke: NDB RWY 13 AR16/AR17 GW-GL AR16 GL-YNC-YMO AR18 GL-ZEM-YKQ AR17 GL-MM AR4 GL-K8-YMT	GNSS Procedures already in place	Replace AR16, AR17 AR18 and AR4 with L Routes
La Grande-4	La Grande (YFM)	Decommission NDB	Revoke: NDB A RR13 YFM-GW BR18 MM-K8-YFM RR23 MT-YFM-KR AR13 DG-YFM AR42 YFM-5Q	GNSS Procedures already in place	Replace RR13, BR18, RR23, AR13, AR42 with L Routes
La Tuque	La Tuque (YLQ)	Decommission NDB	Revoke: R17 UFX-YLQ R32 YLQ-RJ V383 YLQ-VBS V314 YLQ-YQB	N/A	Replace R17 and R32 with T Routes Replace V383 and V314 with T Routes if required.
Lourdes-de-Blanc-Sablon	Blanc-Sablon (BX)	Decommission NDB	Revoke: NDB/DME RWY 05 NDB/DME A NDB RWY 05 RR2 YHR-YIF-BX-AY BR12 DF-BX BR1 YHR-BX BR21 YR-BX-QX	GNSS Procedures already in place	Replace RR2, BR1 and BR21 (YR-BX) with L Routes. BR12 not required by customers
Lourdes-de-Joliette	St-Felix-de-Valois (UFX)	Decommission NDB	Revoke: R17 UFX-YLQ R8 YRQ-UFX	N/A	Replace R17 and R8 with T Routes.
Maniwaki	Maniwaki (YMW)	Decommission NDB	Revoke: NDB A B7 YMW-YUY V348 YMW-YYB V487 YUL-YMW-YVO	GNSS Procedures already in place	Replace B7, V348, and V487 with T Routes

Aeronautical Study – NAVAID Modernization

Matagami	Matagami (NM)	Decommission NDB	Revoke: NDB RWY 33 AR17 YVO-NM-GL BR18 YUY-NM-K8 AR18 NM-YKQ BR14 MT-NM-ZEM	GNSS Procedure already in place for RWY 15. GNSS procedure required for RWY 33	Replace AR17, BR18, AR18, BR14 with L Routes if required
Matane	Matane (ME)	Decommission NDB	Revoke: NDB A R25 ME-BUBIX AR3 ME-YY V341 ME-YYY-ML V340 ME-YBC	NDB A procedure supported until Aug 2018	Replace R25, AR3, V341, and V340 T Routes.
Mont-Joli	Mont-Joli (YY)	Decommission NDB	Revoke: NDB A BR1 CL-YY AR3 YY-ME-PN	GNSS Procedures already in place	Replace BR1 and AR3 with T Routes.
Mont-Joli	Mont-Joli (YYY)	Decommission VOR Retain DME (if required for ILS and DDI support)	Revoke: VOR/DME RWY 15 VOR/DME RWY 24 CYXK VOR/DME B V382 YGR-YGP-YYY- IPTAL-VBS V341 ME-YYY-ML V98 YZV-YYY-YRI V39 YWK-YBC-YYY	GNSS Procedures already in place LOC/DME RWY 06 revise MA, MSA, FAF and Transitions	Replace V382, V341, V98 and V39 with T Routes.
Montréal (PET)	Montréal (UL)	Decommission NDB	Revoke: NDB/DME RWY 28	GNSS Procedures already in place	N/A
Montréal (Mirabel)	Joly (ZMM)	Decommission NDB	N/A	GNSS Procedures already in place ILS RWY 11 Revise MA, MSA, FAF and transition.	N/A
Montréal (Mirabel)	Janvier (ZMX)	Decommission NDB	Revoke: NDB RWY 24	GNSS Procedures already in place ILS RWY 24 Revise MA, MSA, FAF, and hold.	N/A

Aeronautical Study – NAVAID Modernization

Montréal (Mirabel)	Hermas (ZMR)	Decommission NDB	Revoke: NDB RWY 06	GNSS Procedures already in place ILS RWY 06 Revise MSA, and FAF. ILS CAT II RWY 06 Revise MSA and FAF	N/A
Montréal (Mirabel)	Mirabel (YMX)	Decommission VOR Retain DME for DDI and ILS support.	Revoke: VOR/DME RWY 11	All revisions to be based on DME which may be required to move to the Mirabel airfield ILS RWY 06 Revise MA, MSA, FAF, and hold. ILS RWY 11 Revise MA, MSA, FAF and transition. ILS RWY 24 Revise MA, MSA, FAF, hold and transition.	N/A
Montréal (St Hubert)	Haut-Bois (ZHU)	Decommission NDB	Revoke: NDB RWY 24R	GNSS Procedures already in place ILS RWY 24R Revise MA, and MSA.	N/A
Ottawa	Ottawa (OW)	Decommission NDB	Revoke: NDB RWY 25	GNSS Procedures already in place. ILS RWY 07 Revise MA, MSA, FAF, hold and transition. ILS RWY 32 Revise MA, MSA, FAF and hold.	N/A
Ottawa	Greely (YRR)	Decommission NDB	Revoke: NDB RWY 32	ILS RWY 07 Revise MA, MSA, FAF, hold and transition. ILS RWY 32 Revise MA, MSA, FAF and hold.	N/A

Aeronautical Study – NAVAID Modernization

Ottawa	Ottawa (YOW)	Decommission VOR Retain DME for DDI and ILS support.	Revoke: VOR/DME RWY 11 CNP3 VOR/DME RWY 28 V370 YOW-YXI V300 YOW-VIE	Possible move of the DME to the airport ILS RWY 07 Revise MA, MSA, FAF, hold and transition. ILS RWY 32 Revise MA, MSA, FAF and hold.	Replace V370 with T route if required
Port-Menier	Port Menier (PN)	Decommission NDB	Revoke: NDB RWY 11 AR1 GP-PN-YGV AR3 PN-ME-YY RR5 PN-ZV	GNSS Procedures already in place	Replace AR1, AR3, and RR5 with T routes if required.
Poste Montagnais	Eric (UAC)	Decommission NDB	Revoke: NDB RWY 17 NDB RWY 35 R1 ZV-UAC BR11 UAC-UM V360 YZV-UAC- YWK	GNSS Procedures already in place	Replace BR11 with an L route. Replace V360 with a T route. R1 parallels V360
Quaqtaq	Quaqtaq (UHA)	Decommission NDB	Revoke: NDB RWY 18 NDB RWY 36 AR10/BR20 YFY-UHA- VP AR13 UHA-YAS-YLA GR7 UHA-YKG-YZG- YIK	GNSS Procedures already in place	Replace AR10/BR20, AR13, and GR7 with L routes if required.
Québec	Champlain (BV)	Decommission NDB	Revoke: NDB RWY 06 NDB RWY 24 V386 BV-VBS	GNSS Procedures already in place ILS RWY 06 Revise MA, MSA, FAF, hold and transitions	Replace V386 with a T routes if required
Québec	Ste-Foy (OU)	Decommission NDB	Revoke: NDB RWY 29	GNSS Procedures already in place	N/A
Québec	Québec (QB)	Decommission NDB	Revoke: NDB RWY 06 R9 QB-RI	GNSS Procedures already in place ILS RWY 06 Revise MA, MSA, FAF, hold and transitions	Replace R9 with a T route if required

Aeronautical Study – NAVAID Modernization

Québec	Québec (YQB)	Decommission VOR Retain DME for DDI and ILS support.	Revoke: VOR/DME RWY 06 V314 ATENE-YQB-YLQ V318 PINTE-YQB V316 YRI-YQB-PESAC V3 LABRE-YQB V98 YQB-YRI V360 YBC-YQB-PESAC V447 YQB-ODLAS	Possible move of DME to the Airport GNSS Procedures already in place	Replace V314, V318, V316, V3, V98, V360 and V447 with T routes if required
Rouyn	Rouyn (YUY)	Decommission NDB	Revoke: NDB RWY 08 NDB/DME RWY 26 RR16 YTS-YUY AR36 YUY-YKQ BR18 YUY-NM-K8 B7 YUY-YMW G2 YXR-YUY V365 YYB-YUY-YVO V487 YUY-YVO	GNSS Procedures already in place	Replace RR16, AR36 and BR18 with L routes. Replace B7, G2, V365 and V487 with T routes.
Rimouski	Rimouski (YXK)	Decommission NDB	Revoke: NDB A BR25 YXK-CL V488 YXK-OLOKA	GNSS Procedures already in place	Replace V488 with T routes if required. BR25 no replacement required. IFR to Charlo can navigate on replacement for BR1 at Mont Joli.
Rivière-Du-Loup	Rivière-Du-Loup (RI)	Decommission NDB	Revoke: NDB A R9 RI-QB R22 ML-RI RR22 RI-CL	GNSS Procedures already in place	Replace RR22 with a L Route
Rivière-Du-Loup	Rivière-Du-Loup (YRI)	Decommission VOR	Revoke: VOR RWY 23 VOR B V316 YRI-YQB V98 YYY-YRI-FLEUR-YQB V383 YRI-ML-VBS-YLQ	GNSS Procedures already in place	Replace V98 and V383 with T routes. V316 YRI-YQB is coincident with T608
Salluit	Salluit (YZG)	Decommission NDB	Revoke: NDB RWY 21 GR7 YIK-YZG-YKG-UAH BR26 YPX-YZG-YFB BR40 YAS-YZG-YTE	GNSS Procedures already in place	Replace GR7, BR26 and BR40 YAS-YZG with L routes

Aeronautical Study – NAVAID Modernization

Saguenay	Saguenay (VBS)	Decommission VOR Retain DME for DDI and ILS support if required.	Revoke: V382 YYY-VBS-YJN V383 YRI-ML-VBS- YLQ V386 BV-VBS-RJ AR13 VBS-DG	DND to complete the following prior to decommission: CYBG ILS Z RWY 11 revise transition CYBG ILS Z RWY 29 revise transition	Replace V382, V383, V386 and a portion of AR13 with T routes. Portion of AR13 in uncontrolled airspace to be replaced with a L route
St-Augustine	St-Augustine (YIF)	Decommission NDB	Revoke: NDB/DME RWY 02 NDB RWY 02 RR2 AY-BX-YIF-YHR	GNSS Procedures already in place LOC/DME RWY 20 Revise MA and MSA	Replace RR2 with L route.
St-Georges	Beauce (VLV)	Decommission VOR Retain DME for DDI and ILS support if required.	Revoke: VOR/DME RWY 06 V400 VLV-DCLNK V352 YUL-LV-DCDGG V346 VLV-BBYKC	GNSS Procedures already in place	Replace V400, V352, and V346 with T routes.
St-Honoré	St -Honoré (YRC)	Decommission NDB	Revoke: NDB RWY 12	GNSS Procedures already in place DND to complete the following prior to decommission:CY BG ILS Z RWY 11 revise transition CYBG ILS Z RWY 29 revise transition	N/A
St-Jean	St-Jean (YJN)	Decommission VOR Retain DME for DDI and ILS support if required	Revoke: VOR RWY 06 (GNSS) V98 YJN-OMBRE V487 YUL-YJN- WARDS	GNSS Procedures to be developed. Revise CYUL STARs	Replace V98 and V487 with T routes. T608 connects with V98 at OMBRE
Sanikiluaq	Sanikiluaq (YSK)	Decommission NDB	Revoke: NDB RWY 27 (GNSS) AR16 YPA-YSK-GW- GL AR41 YSK-YMU	GNSS Procedures already in place	Replace AR16 and AR41 with L routes.
Schefferville	Squaw (KR)	Decommission NDB	Revoke: NDB RWY 17 NDB Z RWY 35 NDB Y RWY 35 RR23 YFM-KR-UM	GNSS Procedures already in place	Replace RR23 with L routes.

Aeronautical Study – NAVAID Modernization

Schefferville	Schefferville YKL	Decommission VOR Retain DME for DDI support if required	Revoke AR11 YVP-YKL-YWK	GNSS Procedures already in place	Replace AR11 with an L route.
Sept-Îles	Sept-Îles (ZV)	Decommission NDB	Revoke: NDB RWY 31 RR5 ZV-PN R1 ZV-UAC	GNSS Procedures already in place	Replace RR5 with an L route. R1 parallels V360
Sept-Îles	Sept-Îles (YZV)	Decommission VOR Retain DME for DDI and ILS support if required	Revoke: VOR RWY 13 VOR/DME RWY 13 V380 YZV-YGP-YGR V360 YBC-YZV-UAC- YWK V316 YBC-YZV-YWK V98 YYY-YZV	GNSS Procedures already in place	Replace V380, V360, V316 and V98 with T routes.
Sherbrooke	Sherbrooke (SC)	Decommission NDB	Revoke: NDB RWY 13	GNSS Procedures already in place	N/A
Sherbrooke	Sherbrooke (YSC)	Decommission VOR Retain DME for DDI support if required	Revoke: VOR A VOR/DME B V447 YQB-YSC- LIAND-RNPCY V322 YSC-RNPSB V300 YJN-YSC-RNSLL	GNSS Procedures already in place	Replace V447, V322, and V300 with T routes.
Smiths Falls	Smiths Falls (YSH)	Decommission NDB	Revoke: NDB RWY 06 R76 YGK-YSH	GNSS Procedure already in place	R76 not required by customers
Tasijuaq	Tasijuaq (YTQ)	Decommission NDB	Revoke: NDB RWY 23 AR39 VP-YTQ-YAS AR40 YTQ-YLA	GNSS Procedures already in place	Replace AR39 and AR40 with L routes.
Umiujaq	Umiujaq (YMU)	Decommission NDB	Revoke: NDB A RR13 YPH-YMU-GW- YFM AR41 YMU-YSQ	GNSS Procedures already in place	Replace RR13 and AR41 with L routes.
Victoriaville	Victoriaville (F8)	Decommission NDB	Revoke: NDB RWY 06 NDB RWY 24	GNSS Procedures already in place	N/A

Aeronautical Study – NAVAID Modernization

Wemindji	Wemindji (YNC)	Decommission NDB	Revoke: NDB RWY 10 (GNSS) AR16 YMO-YNC-YGL BR14 YNC-ZEM-NM-MT	GNSS Procedures already in place	Replace AR16 and BR14 with L routes
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LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
TORONTO FIR					
Aylmer	Aylmer (YQO)	Decommission VOR Retain DME if required for DDI support	Revoke: V2 BUF-YQO-SVM V464 DKK-YQO-SVM V443 DJB-YQO	N/A	Replace V2, V464, and V443 with T routes.
Brantford	Brantford (FD)	Decommission NDB	Revoke: NDB RWY 05	GNSS Procedures already in place	N/A
Campbellford	Campbellford (YCF)	Decommission VOR Retain DME if required for DDI support	N/A	N/A	N/A
Chapleau	Chapleau (YLD)	Decommission NDB	Revoke: NDB RWY 05 RR10 YXZ-YLD-YSB AR16 YSP-YLD-YTS AR45 YAN-YLD AR20 SSM-YLD-YYU AR31 YLD-YEL	GNSS procedures to be developed prior to decommission.	Replace RR10, AR16, AR45, AR20, and AR31 with L routes
Cochrane	Cochrane (CN)	Decommission NDB	Revoke: NDB RWY 31	GNSS Procedures already in place	N/A
Coehill	Coehill (VIE)	Decommission VOR Retain DME if required for DDI support	Revoke: V300 VIE-YOW	N/A	Replace V300 with T route if required
Earlton	Earlton (YXR)	Decommission NDB	Revoke: NDB RWY 26 G2 YXR-YUY AR14 YXR-YKX V37 YYV-YXR-YTS	GNSS Procedures already in place	Replace AR14 with L routes if required. Replace V37 and G2 with T routes.

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
TORONTO FIR					
Elliot Lake	Elliot Lake (YEL)	Decommission NDB	Revoke: NDB A (GNSS) AR30 YEL-YXZ AR31 YEL-YLD V36 YVV-YEL-SSM V316 YSB-YEL-SSM	GNSS Procedure already in place	Replace AR30 and AR31 with L routes if required. Replace V36 and V316 with T routes if required
Fort Albany	Fort Albany (YFA)	Decommission NDB	Revoke: NDB RWY 28	GNSS Procedures to be developed prior to decommission.	N/A
Gore Bay	Gore Bay (YZE)	Decommission NDB	Revoke NDB A R23 YZE-YVV	GNSS Procedures already in place	R23 not required by customers
Hamilton	Ancaster (ZHA)	Decommission NDB	Revoke: NDB RWY12	GNSS Procedures already in place ILS RWY 12 revise MA, MSA, FAF and hold. ILS CAT II RWY 12 revise MA, MSA, FAF and hold.	N/A
Hamilton	Binbrook (ZHM)	Decommission NDB	Revoke: NDB RWY 30	GNSS Procedures already in place LOC RWY 30 revise MA, MSA, FAF and hold Hamilton Nine Departure RWY 12 revise.	N/A
Hamilton	Hamilton (HM)	Decommission NDB	Revoke: NDB RWY 06	GNSS Procedures already in place	N/A
Hearst	Hearst (HF)	Decommission NDB	N/A	GNSS Procedures already in place	N/A
Hornepayne	Hornepayne (YHN)	Decommission NDB	Revoke: NDB RWY 25	GNSS Procedures already in place	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
TORONTO FIR					
Kapuskasing	Kasing (YYU)	Decommission NDB	Revoke: NDB RWY 17 NDB/DME RWY 35 AR20 YLD-YYU RR1 YYU-QN-YYW- YXL GR8 YYU-YAN V5 YTS-YYU V4 YMO-YYU-YXZ	GNSS Procedures already in place	Replace AR20, RR1 and GR8 with L routes if required. Replace V5 and V4 with T routes if required
Killaloe	Killaloe (YXI)	Decommission VOR Retain DME if required for DDI support	Revoke: V316 YXI-YYB V370 YXI-YOW	N/A	Replace V316 and V370 with T routes if required
Kirkland Lake	Kirkland Lake (YKX)	Decommission NDB	Revoke: NDB RWY 26 AR14 YKX-YXR	GNSS Procedures already in place	AR14 not required by customers.
London	Thames (ZXU)	Decommission NDB	Revoke: NDB RWY 15 NDB RWY 33	GNSS Procedures already in place ILS RWY 15 revise MA, MSA, FAF, and hold	N/A
London	London (XU)	Decommission NDB	Revoke: NDB RWY 15 NDB RWY 33	GNSS Procedures already in place	N/A
London	London (YXU)	Decommission VOR Retain DME for ILS and possible DDI support	Revoke: VOR/DME RWY 09 VOR/DME RWY 27 V406 YXU-DCTYP	GNSS Procedures already in place	Replace V406 with T route if required.
Mans	Mans (YMS)	Decommission VOR Retain DME for possible DDI support	Revoke: V300 YMS-YVV-SSM V164 YMS-MONKK- YSB	N/A	Replace V300 and V164 with T routes if required
Midland	Midland (YEE)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR/DME A CNY3 (Collingwood) V34 YEE-BURWA-YSB V332 YYB-YEE V360 YEE-PAIRY- WALAC	GNSS Procedures already in place	Replace V332, V34 and V360 with T routes if required

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
TORONTO FIR					
Moosonee	Moosonee (MO)	Decommission NDB	Revoke: NDB A AR24 MO-YKQ-K8 AR20 MO-ZEM AR16 MO-YNC-GL AR9 MO-YAT-YPO-YER	GNSS Procedures already in place	Replace AR24, AR20, AR16, and AR9 with L routes if required.
Muskoka	Muskoka (YQA)	Decommission NDB	Revoke: NDB RWY 18	GNSS Procedures already in place	N/A
North Bay	North Bay (YYB)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: VOR/DME RWY 08 VOR/DME RWY 18 VOR/DME RWY 26 VOR/DME RWY 36 V348 YYB-YMW V316 YYB-YXI V348/V316 YYB-YSB V37 YTS-YXR-YYB-YSO V332 YVO-YYB-YEE V365 YUY-YYB V13 YXZ-YTS-YYB	GNSS Procedures already in place ILS RWY 08 revise MA, MSA, FAF and hold.	Replace V348, V316, V37, V332, V365 and V13 with T routes if required
Oshawa	Oshawa (OO)	Decommission NDB	Revoke: NDB/DME RWY 05 NDB RWY 05 AR21 OO-SN	GNSS Procedures already in place.	Replace AR21 with a T route if required.
Pelee Island	Pelee Island (PT)	Decommission NDB	Revoke: NDB RWY 10 NDB RWY 28	GNSS Procedures already in place	N/A
St-Bruno-De-Guiges	St-Bruno-De-Guiges (YBM)	Decommission NDB	Revoke: NDB RWY 10	GNSS Procedure already in place	N/A
St. Catharines	St. Catharines (SN)	Decommission NDB	Revoke: NDB RWY 06 AR21 OO-SN	GNSS Procedures already in place	Replace AR21 with a T route if required
Sarnia	Sarnia (ZR)	Decommission NDB	Revoke: NDB RWY 33 A20 ZR-DESDN	GNSS Procedures already in place ILS RWY 33 revise MA, MSA, FAF and hold LOC (BC) RWY 15 revise MA, MSA and hold.	A20 ZR-DESDN.

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
TORONTO FIR					
Simcoe	Lindsay (YSO)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR/DME A at Kawartha Lakes CNF4 V37 YSO-YYB	Retain until April 2021	Replace V37 with T route if required
Sudbury	Noranda (ZSB)	Decommission NDB	Revoke: NDB RWY 22	GNSS Procedures already in place ILS RWY 22 revise MA, MSA, FAF, hold and transition	N/A
Sudbury	Sudbury (SB)	Decommission NDB	Revoke: NDB RWY 12	GNSS Procedures already in place ILS RWY 22 revise MA, MSA, FAF, hold and transition	N/A
Sudbury	Sudbury (YSB)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: VOR/DME or VOR/NDB RWY 04 VOR/DME RWY 12 VOR/DME or VOR/NDB RWY 22 VOR/DME or VOR/NDB RWY 30 V316/V348 YYB-YSB V316 YSB-YEL V348 YSB-BEPUP-SSM V164 YSB-PERKO-YTS V5 YVV-YSB-YTS V34 YEE-YSB-MONKK-YMS	GNSS Procedures already in place ILS RWY 22 revise MA, MSA, FAF, hold and transition	Replace V316, V348, V164, V5, and V34 with T routes if required
Toronto/Billy Bishop Toronto City Airport	Gibraltar Point (TZ)	Decommission NDB	Revoke: NDB/DME B	GNSS Procedures already in place ILS RWY 08 revise MSA LOC/DME RWY 26 revise MSA	N/A
Toronto/Buttontville	Buttontville (KZ)	Decommission NDB	Revoke: NDB RWY 21	GNSS Procedures already in place LOC RWY 15 revise MA, MSA, hold and transition	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
TORONTO FIR					
Toronto	Woodhill (ZTO)	Decommission NDB	N/A	GNSS Procedures already in place ILS RWY 15L revise FAF	N/A
Toronto	Meadowvale (ZLB)	Decommission NDB	N/A	GNSS Procedures already in place	N/A
Toronto	Queensway (ZYZ)	Decommission NDB	N/A	GNSS Procedures already in place ILS RWY 33R revise FAF	N/A
Waterloo	Wellington (ZKF)	Decommission NDB	Revoke: NDB/DME RWY 26	GNSS Procedures already in place ILS RWY 26 revise MA, MSA, FAF and hold	N/A
Wawa	Wawa (YXZ)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR/DME RWY 21 RR10 SB-YLD-YXZ AR30 YEL-YXZ V36 SSM-YXZ-YQT V13 YTS-YXZ-YSP- BILII-YQT V9 YXZ-YAN V4 YMO-YYU-YXZ	GNSS Procedures already in place	Replace RR10 and AR30 with L routes if required Replace V36, V13, V9, and V4 with T routes if required
Warton	Warton (VV)	Decommission NDB	Revoke: NDB RWY 05 R23 VV-YZE	GNSS Procedures already in place	R23 not required by customers
Windsor	Windsor (QG)	Decommission NDB	Revoke: NDB RWY 25	GNSS Procedures already in place ILS RWY 25 revise MA, MSA, FAF and hold	N/A

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Ameson	Ameson (YAN)	Decommission VOR Retain DME for possible DDI support	Revoke: V6 YSP-YAN-YMO V7 YGQ-YAN-YTS V9 YXZ-YAN	N/A	Replace V6, V7, and V9 with T Routes.

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Armstrong	Armstrong (YYW)	Decommission NDB	Revoke: RR1 YXL-YYW-QN-YYU BR9 QT-YYW-YTL RR11 RL-YPL-YYW	N/A	Replace RR1, BR9 and RR11 with L Routes if required.
Atikokan	Atikokan (IB)	Decommission NDB	Revoke: NDB RWY 22 R23 YQK-IB-QT A4 RL-YHD-IB V242 CIVLU-IB	GNSS Procedures already in place	Replace R23, and A4 with T Routes if required. Replace V242 with T Route.
Attawapiskat	Wapisk (YAT)	Decommission NDB	Revoke: NDB RWY 06 NDB RWY 24 AR9 MO-YAT-YPO-YER	GNSS Procedures already in place	Replace AR9 MO-YAT-YPO with L Route.
Bearskin Lake	Bearskin Lake (XBE)	Decommission NDB	Revoke: NDB RWY 25	GNSS Procedures already in place	N/A
Beechy	Beechy (BY)	Decommission NDB	Revoke: V304 YEA-BY-VLN	N/A	Replace V304 with T Route if required.
Berens River	Berens River (YBV)	Decommission NDB	Revoke: NDB RWY 27 BR27 WG-YBV-YNE	GNSS Procedures already in place	Replace BR27 with L Route.
Brandon	Brandon (BR)	Decommission NDB	Revoke: NDB RWY 08 R24 BR-QV	GNSS Procedures already in place. ILS RWY 08 Redesign MA, MSA, and hold.	R24 coincident with V353 and will become a T route.
Brandon	Brandon (YBR)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: VOR RWY 08 VOR/DME RWY 08 VOR/DME RWY 26 V304 YDR-YBR-UDE-YWG V353 YQV-YBR-VLR V327 YBR-YDN-YQD	GNSS Procedures already in place.	Replace V304, V353 and V327 with T Routes
Broadview	Broadview (YDR)	Decommission VOR Retain DME for possible DDI support	Revoke: V304 YBR-YDR-VLN V300 VLR-YDR-VLN V345 YDR-QR	N/A	Replace V304, V300 and V345 with T Routes

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Buffalo Narrows	Buffalo Narrows (VT)	Decommission NDB	Revoke: NDB A RR6 VC-VT-MM	GNSS Procedures already in place.	Replace RR6 VT-VC with L Route
Cat Lake	Cat Lake (YAC)	Decommission NDB	Revoke: NDB RWY 29	GNSS Procedures already in place.	N/A
Churchill	Churchill (YQ)	Decommission NDB	Revoke: NDB RWY 25 B1 YGX-YQ B23 TH-YQ BR10 YQ-YZS BR28 YQ-RT AR7/BR3 YQ-YEQ	GNSS Procedures already in place. ILS RWY 33 redesign MA and Hold	Replace B1 and B23 with T Routes. Replace BR10, BR28 and AR7/BR3 with L Routes.
Dafoe	Dafoe (VX)	Decommission NDB	Revoke: R6 QV-VX-XE	N/A	R6 coincident with V302 which will be replaced with a T Route.
Dauphin	Dauphin (DN)	Decommission NDB	Revoke: NDB RWY 14 A11 DN-QD	GNSS Procedures already in place.	A11 coincident with V327 which will be replaced with a T Route.
Dauphin	Dauphin (YDN)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR RWY 14 VOR/DME RWY14 V306 VLR-YDN-YQV V327 YBD-YDN-YQD	GNSS Procedures already in place.	Replace V306 and V327 with T Routes
Deer Lake	Deer Lake (YVZ)	Decommission NDB	Revoke: NDB RWY 13 RR10 RL-YVZ-YIV AR30 YVZ-ZSJ	GNSS Procedures already in place.	Replace RR10 and AR30 with L Routes
Dryden	Barclay (ZDH)	Decommission NDB	Revoke: NDB RWY 30	GNSS Procedures already in place.	N/A
Dryden	Dryden (YHD)	Decommission NDB	Revoke: NDB RWY 12 A4 IB-YHD-RL G1 QT-YHD-YQK R34 YXL-YHD V180 YHD-INL	GNSS Procedures already in place. ILS RWY 12 redesign MA, MSA and Hold	Replace A4, G1, R34, and V180 with T Routes,
Fond-du-Lac	Fond-du-Lac (ZFD)	Decommission NDB	Revoke: NDB RWY 10	GNSS Procedures already in place.	Publish L Route YSF to ZFD

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Fort Frances	Fort Frances (YAG)	Decommission NDB	Revoke: NDB RWY 12	GNSS Procedures already in place.	N/A
Fort Hope	Fort Hope (YFD)	Decommission NDB	Revoke: NDB RWY 27	GNSS procedures scheduled for publication May 24, 2018	N/A
Gods Lake Narrows	Gods Lake Narrows (YGO)	Decommission NDB	Revoke: NDB RWY 14	GNSS Procedures already in place.	N/A
Ignace	Ignace (ZUC)	Decommission NDB	N/A	N/A	N/A
Kasabonika	Kasabonika (YAQ)	Decommission NDB	Revoke: NDB RWY 03	GNSS Procedures already in place.	N/A
Kenora	Kenora (YQK)	Decommission NDB	Revoke: NDB RWY 08 G1 WG-YQK-YHD A19 YQK-RL R23 YQK-IB-QT V129 YQK-VBI-INL	GNSS Procedures already in place.	Replace G1, A19, R23 and V129 with T Routes.
Key Lake	Key Lake (YKJ)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR/DME RWY 03 VOR/DME RWY 21 AR2 YVC-YKJ-YSF GR11 YMM-YKJ-YYL BR19 PY-YKJ L701 CYKL-CYBE	GNSS Procedures already in place.	Replace AR2, with L Route and extend to ZFD
Langruth	Langruth (VLR)	Decommission VOR Retain DME for possible DDI support	Revoke: V300 YWG-VLR-YDR V302 YQK-VLR-YQV V306 VLR-YDN V353 VLR-YBR-YQV	N/A	Replace V300, V302, V306 and V353 with T Routes
Lansdowne House	Lansdowne House (YLH)	Decommission NDB	N/A	N/A	N/A
La Ronge	La Ronge (VC)	Decommission NDB	Revoke: NDB RWY 36 A14 FO-VC-YL B2 PA-VC-TH A13 VC-QD RR6 VC-VT-MM	GNSS Procedures already in place.	Replace A14 FO-VC with T Route. Replace RR6 with an L Route.

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Lynn Lake	Lynn Lake (YL)	Decommission NDB	Revoke: NDB A A14 VC-YL AR6 ZWL-YL B15 YL-TH-YNE B12 YL-QD-QV A11 FO-YL	GNSS Procedures already in place.	Replace A11 with a T Route. Remainder are coincident with VICTOR airways.
Meadow Lake	Meadow Lake (YLJ)	Decommission NDB	Revoke: NDB RWY 09	GNSS Procedures already in place.	N/A
Manitouwadge	Manitouwadge (YMG)	Decommission NDB	Revoke: NDB RWY 05	GNSS Procedures already in place.	N/A
Marathon	Marathon (YSP)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR/DME B VOR A CYMG VOR/DME RWY 05 V13 YQT-BILII-YSP-YXZ-YTS V242 YQT-YSP V8 YGQ-YSP V6 YSP-YAN-YMO	GNSS Procedures to be developed and published.	Replace V13, V242, V8 and V6 with T Routes
Nakina	Nakina (QN)	Decommission NDB	Revoke: NDB RWY 27 AR10 YQG-QN RR1 YXL-YYW-QN-YYU	GNSS Procedures already in place.	Replace AR10 and RR1 with L Routes.
North Battleford	North Battleford (QW)	Decommission NDB	Revoke: NDB RWY 12 R6 XD-VG-QW-XE-VX-QV G7 VG-YLL-QW B23 QW-PA-QD	GNSS Procedures already in place.	Replace R6, G7 and B23 QW-PA with T Routes.
Norway House	Norway House (YNE)	Decommission NDB Retain DME for possible DDI support	Revoke: NDB A R10 XE-QD-YNE B15 YYL-TH-YNE BR6 WG-YNE-YGX BR5 YNE-YIV-ZSJ RR11 YNE-RL BR27 YNE-YBV	GNSS Procedures already in place.	Replace R10 and B15 TH-YNE with T Routes. Replace BR6, BR5, and BR27 with L Routes.

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Ogoki Post	Ogoki Post (YOG)	Decommission NDB	N/A	GNSS Procedures already in place.	N/A
Pikangikum	Pikangikum (YPM)	Decommission NDB	Revoke: NDB RWY 27 RR10 RL-YPM-YVZ-YIV	GNSS Procedures already in place.	Replace RR10 with L Route.
Prince Albert	Glass (ZPA)	Decommission NDB	Revoke: NDB RWY 26	GNSS Procedures already in place.	N/A
Prince Albert	Prince Albert (PA)	Decommission NDB	Revoke: NDB RWY 08 B23 QW-PA-QD B2 XE-PA-VC B6 FO-PA-QR R24 PA-QV-BR	GNSS Procedures already in place. ILS RWY 08 redesign the MSA, MA and Hold.	Replace B6 FO-PA and B23 QW-PA with T Routes. All other routes are coincident with airways from the VOR which will be replaced with T Routes
Prince Albert	Prince Albert (YPA)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: VOR/DME RWY 08 VOR/DME RWY 26 VOR RWY 26 V303 YYN-YXE-YPA-YVC V356 VLN-YPA V353 YPA-YQV-YBR V328 YPA-YQD V41 YPA-VOKUL V74 YPA-ALSES	GNSS Procedures already in place	Replace V303, V356, V353, V328, V41 and V74 with T Routes
Red Lake	Red Lake (RL)	Decommission NDB	Revoke: NDB RWY 08 A19 YQK-RL R6 WG-RL-YXL-QT A4 RL-YHD-IB RR11 YNE-RL-YPL-YYW BR13 TH-RL RR10 YIV-YVZ-YPM-RL BR5 ZSJ-RL A19 RL-ZRJ	GNSS Procedures already in place.	Replace A19, R6 RL-YXL-QT and A4 with T Routes. Replace RR11 RL-YPL-YYW RR10, BR5 and A19 with L Routes. No customer requirement for BR13
Regina	Findlay (ZQR)	Decommission NDB	Revoke: NDB RWY 26	GNSS Procedures already in place.	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Regina	Regina (QR)	Decommission NDB	Revoke: NDB RWY 31 B6 FO-PA-QR B12 QR-QV-QD V345 QR-YDR	GNSS Procedures already in place.	Replace B6 FO-PA, B12 QR-QV and V345 with T Routes,
Regina	Ajax (ZRS)	Decommission NDB	Revoke: NDB RWY 13	GNSS Procedures already in place. ILS Z RWY 13 redesign the MSA, MA and Hold.	N/A
Regina	Lumsden (VLN)	Decommission VOR. Retain DME for possible ILS and DDI support	Revoke: V300 YYN-VLN-YDR-VLR V304 YEA-BY-VLN-YDR-YBR V306 YXE-VLN-YQV-YDN V356 YPA-VLN	GNSS Procedures already in place.	Replace V300, V304, V306 and V356 with T Routes.
Sachigo Lake	Sachigo Lake (ZPB)	Decommission NDB	N/A	GNSS Procedures already in place.	N/A
St. Andrews	St. Andrews (AV)	Decommission NDB	Revoke: NDB RWY 31	GNSS Procedures already in place.	N/A
Saskatoon	Yellowhead (ZSS)	Decommission NDB	Revoke: NDB RWY 15	GNSS Procedures already in place.	N/A
Saskatoon	Saskatoon (XE)	Decommission NDB	Revoke: NDB RWY 09 R6 YLL-QW-XE-VX-QV B2 XE-YPA-VC R10 XE-QD	GNSS Procedures already in place.	Replace R6, and R10 with T Routes. B2 coincident with V303 which will be replaced by a T route
Saskatoon	Barnes (ZXE)	Decommission NDB	Revoke: NDB RWY 27	GNSS Procedures already in place. Redesign ILS RWY 09 MSA, MA and Hold.	N/A
Saskatoon	Saskatoon (YXE)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: VOR/DME RWY 33 V302 YWV-YXE-YQV V303 YYN-YXE-YPA V306 YEA-YXR-VLN	GNSS Procedures already in place	Replace V302, V303 and V306 with T Routes

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Sioux Narrows	Sioux Narrows (VBI)	Decommission VOR Retain DME for possible DDI support	Revoke: V129 INL-VBI-YQK V304 YRL-VBI-PRADA-YWG V300 YQT-VBI-YWG-VLR-YDR-VLN-YYN V302 VBI-VLR	N/A	Replace V129, V304, V300 and V302 with T Routes
Swift Current	Swift Current (YYN)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR/DME RWY 12 VOR/DME RWY 30 VOR RWY 30 V345 YEA-YYN V300 YQT-VBI-YWG-VLR-YDR-VLN-YYN V303 YYN-YXE-YPA-YVC	GNSS Procedures already in place	Replace V345, V300 and V303 with T Routes
The Pas	The Pas (QD)	Decommission NDB	Revoke: NDB A A11 DN-QD-FO-YL B12 QV-QD-YL R10 XE-QD-YNE B23 PA-QD-TH-YQ A13 VC-QD-WG	GNSS Procedures already in place.	Replace R10 and A13 (QD-WG) with T Routes. Remaining routes coincident with VICTOR airway which will be replaced by T routes.
The Pas	The Pas (YQD)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR/DME RWY 13 VOR/DME RWY 31 CJR3 VOR/DME RWY 17 V328 YPA-YQD-YTH-YYQ V325 YVC-YQD V327 YDN-YQD-FO V344 YQV-YQD-YYL	GNSS Procedures already in place.	Replace V328, V325, V327 and V344 with T Routes.
Thompson	Thompson (TH)	Decommission NDB	Revoke: B2 VC-TH B15 YL-TH-YNE B23 QD-TH-YQ B1 TH-YGX-YQ BR2 TH-YIV-ZRJ BR13 TH-RL	GNSS Procedures already in place.	Replace B15 (TH-YNE) with T Routes Remaining routes coincident with VICTOR airway which will be replaced by T routes. Replace BR2 with L Routes

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Thompson	Headframe (ZTH)	Decommission NDB	Revoke: NDB RWY 24	GNSS Procedures already in place.	N/A
Thunder Bay	Superior (ZQT)	Decommission NDB	Revoke: NDB RWY 25	GNSS Procedures already in place.	N/A
Thunder Bay	Thunder Bay (QT)	Decommission NDB	Revoke: NDB RWY 07 R23 QT-IB-YQK G1 QT-ZHD-YQK R6 QT-YXL-RL-WG BR9 QT-YYW-YTL	GNSS Procedures already in place. Redesign ILS RWY 07 MSA, MA and Hold	Replace, G1 and R6 QT-YXL-RL with T Routes. Replace BR9 with L Route.
Thunder Bay	Thunder Bay (YQT)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: V133 TAGUC-YQT-CMX V13 MECNU-YQT-BILII-YGQ-YSP-YXZ V300 VBI-YQT-SSM V348 YQT-GRIBY-SSM V36 YQT-YXZ-SSM V242 YQT-YSP	GNSS Procedures already in place.	Replace V133, V13, V300, V348, V36 and V242 with T Routes
Weagamow Lake	Round Lake (ZRJ)	Decommission NDB	Revoke: NDB RWY 03 AR19 RL-ZRJ-YTL RR3 ZSJ-ZRJ BR2 TH-YIV-ZRJ	GNSS Procedures already in place.	Replace AR19, RR3 and BR2 with L Routes.
Webequie	Webequie (YWP)	Decommission NDB	Revoke: NDB RWY 02 NDB RWY 20	GNSS Procedures already in place.	N/A
Winnipeg	Winnipeg (YWG)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: VOR/DME RWY 18 VOR/DME Z RWY 36 V181 ZOMTA-YWG-YRL V175 ROX-YWG V161 YWG-PRADA-KRANG V217 YWG-PRADA-VOKUV V300 YDR-VLR-YWG-VBI-YQT V304 YWG-UDE-YBR	GNSS Procedures already in place.	Replace V181, V175, V161, V217, V300, and V304 with T Routes
Winnipeg	Downs (ZWN)	Decommission NDB	Revoke: NDB RWY 13	GNSS Procedures already in place. Redesign ILS Z RWY 13 MSA	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Winnipeg	Stoney (ZWG)	Decommission NDB	Revoke: NDB RWY 18	GNSS Procedures already in place.	N/A
Winnipeg	La Salle (LF)	Decommission NDB	N/A	GNSS Procedures already in place. Redesign ILS Z RWY 13 MA and Hold	N/A
Winnipeg	Forks (ZHT)	Decommission NDB	Revoke: NDB RWY 31	GNSS Procedures already in place.	N/A
Winnipeg	Balmoral (BM)	Decommission NDB	N/A	GNSS Procedures already in place ILS Z RWY 31 redesign MA and Hold ILS Z RWY 36 redesign MSA, MA and Hold ILS CAT II RWY 36 redesign MSA, MA and Hold	N/A
Winnipeg	Boine (ZWW)	Decommission NDB	Revoke: NDB RWY 36	GNSS Procedures already in place.	N/A
Winnipeg	Winnipeg (WG)	Decommission NDB	Revoke: A13 QD-WG R6 WG-RL-YXL-QT G1 WG-YQK-YHD-QT BR6 YNE-WG BR27 YNE-YBV-WG AR7 YIV-WG	GNSS Procedures already in place.	Replace A13, and G1 with T Routes Replace BR6, BR27 and AR7 with L Routes
Wollaston Lake	Wollaston Lake (ZWL)	Decommission NDB	Revoke: NDB RWY 17 AR6 YSF-ZWL-YL	GNSS Procedures already in place.	Replace AR6 YSF-ZWL with an L Route.
Yorkton	Yorkton (QV)	Decommission NDB	Revoke: NDB RWY 03 B12 QR-QV-QD R6 QW-XE-VX-QV-UDE R24 PA-QV-BR	GNSS Procedures already in place.	All routes coincident with VICTOR airway which will be replaced by T routes.

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Winnipeg FIR					
Yorkton	Yorkton (YQV)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR/DME RWY 21 VOR RWY 03 V306 YXE-VLN-YQV-YDN V302 YWV-YXE-YQV-VLR V353 YPA-YQV-YBR V344 YQV-YQD	GNSS Procedures already in place.	Replace V306, V302, V353, and V344 with T Routes.

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Edmonton FIR					
Aklavik	Aklavik (KD)	Decommission NDB	Revoke: NDB RWY 31	GNSS Procedures already in place.	N/A
Atlin	Atlin (YSQ)	Decommission NDB	Revoke: NDB B BR29 YDL-YSQ-PJ BR36 ZW-YSQ-QH	GNSS Procedures already in place.	Replace BR29 with L Route if required.
Beaver Creek	Beaver Creek (YXQ)	Decommission NDB	Revoke: NDB A V444 ORT-YXQ A2/A15 AES-YXQ AR2-AR15 YXQ-DB	GNSS Procedures to be developed.	Replace V444 with a T Route Replace AR2AR15 with a L Route
Burwash	Burwash (DB)	Decommission NDB	Revoke: NDB A AR2-AR15 YXQ-DB AR15 DB-HNS BR44 DB-YXY	GNSS Procedures to be developed.	Replace AR2, AR15 and BR44 with L Routes
Calgary	Calgary (YC)	Decommission NDB	Revoke: NDB RWY 29 NDB/DME RWY 11 NDB RWY 17R	GNSS Procedures already in place. ILS/DME RWY 11 Redesign MA. ILS RWY 29 Redesign MA	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Edmonton FIR					
Calgary	Pigeon (JW)	Decommission NDB	N/A	GNSS Procedures already in place.	N/A
Calgary	Sarcee (ZYC)	Decommission NDB	N/A	GNSS Procedures already in place. Redesign ILS RWY 17R FAF and MSA	N/A
Calgary	Turner Valley (TV)	Decommission NDB	N/A	GNSS Procedures already in place.	N/A
Springbank	Springbank (YBW)	Decommission VOR	N/A	GNSS Procedures already in place.	N/A
Cambridge Bay	West Arm (MG)	Decommission NDB	Revoke: NDB RWY 31 TRUE AR7 BK-CB-HI AR14 CB-YCO RR30 YHK-CB BR84 CB-RB R6 QV-VX-XE	GNSS Procedures already in place.	Replace AR7 BK-CB, AR14, RR30 and BR84 with L Routes
Chesterfield Inlet	Chesterfield Inlet (YCS)	Decommission NDB	Revoke: NDB A TRUE RR4 BK-YCS-YZS BR3 YEK-RT-YCS-YUT-UX	GNSS Procedures to be developed.	Replace RR4 and BR3 with L Routes if required.
Dawson Creek	Dawson Creek (DQ)	Decommission NDB	Revoke: NDB RWY 24 A2 YE-XJ-DQ-QU-ZU R30 XS-DQ V325 DQ-YPE	GNSS Procedures already in place.	All routes coincident with VICTOR airway which will be replaced by T routes.
Déline	Déline (WJ)	Decommission NDB	Revoke: NDB A	GNSS Procedures already in place.	N/A
Edmonton	Edmonton (XD)	Decommission NDB	Revoke: B84 XD-MM R6 VG-XD-YZH-OJ A7 XD-PE A2 XD-ZU V336 XD-YPE	GNSS Procedures already in place.	Replace R6, and V336 with T Routes if required. A2 is coincident with V301 and will be replaced by a T Route

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Edmonton FIR					
Edmonton	Devon (ZET)	Decommission NDB	Revoke: NDB RWY 12	GNSS Procedures already in place. ILS RWY 12 redesign FAF, MA, Hold and MSA,	N/A
Edmonton	Calmar (ZZD)	Decommission NDB	Revoke: NDB RWY 02	GNSS Procedures already in place. ILS RWY 02 redesign FAF, MA, Hold and MSA,	N/A
Edmonton	Leduc (ZAB)	Decommission NDB	Revoke: NDB RWY 30	GNSS Procedures already in place. ILS RWY 30 redesign FAF, MA, Hold and MSA,	N/A
Edmonton	Edmonton (YEG)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: V301 YEG-YZU V112 YEG – YMM V350 YEG-YVW V302 YEG-YVW	GNSS Procedures already in place.	Replace V301, V112, V350 and V302 with T Routes
Empress	Empress (YEA)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR A V345 YEA-YYN V304 YEA-BY-VLN V306 YEA-YXE	VOR A supported by NAV CANADA until May 2018	Replace V345, V304 and V306 with T Routes as required.
Fort Chipewyan	Fort Chipewyan (PY)	Decommission NDB	Revoke: NDB RWY 04 V112 YMM-PY-YSM B84 MM-PY-SM BR19 YJK-PY	GNSS Procedures already in place.	Replace V112 with T Route as required. B84 is coincident. Replace BR19 with an L Route as required.
Fort Good Hope	Fort Good Hope (YGH)	Decommission VOR Retain DME for possible DDI support	Revoke: VOR/DME RWY 07 VOR RWY 07	GNSS Procedures already in place.	N/A
Fort Good Hope	Fort Good Hope (GH)	Decommission NDB	Revoke: NDB A BR33 YFS-YWY-VQ-GH-EV BR17 GH-ZFM	GNSS Procedures already in place.	Replace BR33, with L Route
Fort Liard	Fort Liard (YJF)	Decommission NDB	Revoke: NDB RWY 21	GNSS Procedures already in place.	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Edmonton FIR					
Fort MacPherson	Fort MacPherson (ZFM)	Decommission NDB	Revoke: NDB RWY 30 BR17 YGH-ZFM-YEV	GNSS Procedures already in place.	Replace BR17 with L Route
Fort McMurray	Fort McMurray VOR (YMM)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: V21 YMM-YSM V112 YEG-YMM-PY V325 YMM-YPE GR11 YKJ-YMM	GNSS Procedures already in place. Redesign ILS/DME RWY 25	Replace V21, V112, and V325 with T Routes
Fort McMurray	Fort McMurray (MM)	Decommission NDB	Revoke: NDB RWY 07 B84 XD-MM-PY R12 MM-PE RR6 VT-MM	GNSS Procedures already in place.	B84 and R12 coincident with VICTOR airways and will be replaced by T routes.
Fort Nelson	Fort Nelson (YE)	Decommission NDB	Revoke: NDB RWY 04 A2 YE-XJ A17 YE-FS AR5 YE-YOP	GNSS Procedures already in place. Redesign ILS RWY 04 FAF, MA, MSA and Hold	Air routes coincident with VICTOR airways and will be replaced by T routes.
Fort St. John	Fort St. John (XJ)	Decommission NDB	Revoke: A2 YE-XJ-DQ BR43 OJ-XJ	GNSS Procedures already in place.	Air routes coincident with VICTOR airways and will be replaced by T routes.
Fort St. John	Taylor (ZXJ)	Decommission NDB	Revoke: NDB RWY 29	GNSS Procedures already in place.	N/A
Fort Resolution	Fort Resolution (FR)	Decommission NDB	Revoke: NDB RWY 31 B84 XD-MM-PY-SM-FR-ZF V112 YMM-PY-YSM-FR-YHY	GNSS Procedures already in place.	Replace B84 FR-ZF and V112 with T Routes.
Fort Simpson	Fort Simpson (FS)	Decommission NDB	Revoke: NDB A A17 ZF-FS-YE BR33 FS-WY B42 OJ-FS BR16 QH-FS V112 FS-YHY	GNSS Procedures already in place.	Replace V112, A17 and B42 with T Routes. Replace BR33 with L Route.

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Edmonton FIR					
Fort Smith	Fort Smith (SM)	Decommission NDB	Revoke: NDB RWY 30 B84 XD-MM-PY-SM- FR-ZF	GNSS Procedures already in place.	Air route coincident with VICTOR airways and will be replaced by T routes.
Gjoa Haven	Gjoa Haven (YHK)	Decommission NDB	Revoke: NDB A TRUE RR30 YBB-YHK-CB AR22 BK-YHK	GNSS Procedures already in place.	Replace RR30 and AR22 with L Routes
Grande Prairie	Grande Prairie (QU)	Decommission NDB	Revoke: NDB RWY 30 A2 ZU-QU-DQ R12 PE-QU-XS	GNSS Procedures already in place. Redesign ILS RWY 30 FAF and MSA	Air route coincident with VICTOR airways and will be replaced by T routes
Grise Fiord	Grise Fiord (YGZ)	Decommission NDB	N/A	GNSS Procedure already in place.	N/A
High Level	High Level (OJ)	Decommission NDB	Revoke: NDB RWY 31 B42 OJ-FS B3 PE-OJ R6 YZH-OJ AR12 OJ-YOP BR43 OJ-XJ	GNSS Procedures already in place.	Replace R6 with a T Route. Replace AR12 and BR43 with L Routes.
Igloolik	Igloolik (YGT)	Decommission NDB	Revoke: NDB RWY 33 TRUE	GNSS Procedures to be developed.	N/A
Kugaaruk	Kugaaruk (YBB)	Decommission NDB	Revoke: NDB A TRUE AR33 YUT-YBB-YYH RR30 UX-YBB-YHK- CB	GNSS Procedures already in place	Replace AR33 and RR30 with L Routes
Lac La Biche	Lac La Biche (YLB)	Decommission NDB	N/A	GNSS Procedures already in place,	N/A
Lethbridge	Lethbridge (QL)	Decommission NDB	Revoke: NDB RWY 05	GNSS Procedures already in place. ILS RWY 05 redesign the FAF, MSA, MA and Hold	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Edmonton FIR					
Naujaat	Naujaat (YUT)	Decommission NDB	Revoke: NDB RWY 34 (TRUE) (GNSS) BR3 YEK-YXN-RT- YCS-YUT-YUX AR33 ZS-YUT-YBB- YYH-RB	GNSS Procedures to be developed.	Replace AR33 and BR3 YEK- YXN-RT-YCS- YUT-YUX with L Routes.
Peace River	Peace River (PE)	Decommission NDB	Revoke: NDB RWY 04 B3 ZU-PE-OJ R12 XS-QU-PE-MM A7 PE-XD AR5 YE-YOP-PE	GNSS Procedures to be developed.	Replace AR5 with an L Route.
Rainbow Lake	Rainbow Lake (YOP)	Decommission NDB	Revoke: NDB RWY 27 AR5 YE-YOP-PE AR12 OJ-YOP	GNSS Procedures already in place.	Replace AR5 YOP-PE and AR12 with L Routes.
Sachs Harbour	Sachs Harbour (YSY)	Decommission NDB	Revoke: NDB RWY 08 TRUE AR8 YSY-YUB	GNSS Procedures already in place.	Replace AR8 with an L Route.
Slave Lake	Slave Lake (YZH)	Decommission NDB	Revoke: NDB RWY 28 R6 XD-YZH-OJ V371 YZH-YZU	GNSS Procedures already in place.	Replace R6 and V371 with T Routes.
Teslin	Teslin (ZW)	Decommission NDB	Revoke: NDB A R5 QH-ZW R36 PJ-ZW AR27 ZW-YDL BR36 ZW-YSQ	GNSS Procedures already in place.	N/A
Tuktoyaktuk	Tuktoyaktuk (YUB)	Decommission NDB	Revoke: NDB RWY 10 NDB RWY 28 AR8 YEV-YUB-YSY AR7 YUB-HI BR22 YUB-YPC-YCO	GNSS Procedures already in place. Publish RNAV(GNSS) RWY 28	Replace AR8, and BR22 with L Routes
Tulita	Tulita (ZFN)	Decommission NDB	N/A	GNSS Procedures already in place.	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Edmonton FIR					
Vermillion	Vermillion (VG)	Decommission NDB	Revoke: R6 QV-VX-XE-QW-VG- XD G7 YLL-VG-QW	N/A	Replace R6 and G7 with T Routes as required
Wainwright	Wainwright (YVW)	Decommission VOR	Revoke: VOR/DME A (DND) Wainwright AF21 to be revoked by DND. V302 YXE-YWY-YEG V350 YLL-YWV-YEG	DND GNSS Procedure already in place	Replace V302 and V350 with T Routes
Watson Lake	Watson Lake (QH)	Decommission NDB	Revoke: NDB A R5 QH-ZW BR36 YDL-QH-YSQ BR16 QH-FS	GNSS Procedures already in place. Revise ILS/DME RWY 09 transition.	Replace BR16 with L Route.
Whale Cove	Whale Cove (YXN)	Decommission NDB	Revoke: NDB RWY 15 TRUE	GNSS Procedures to be developed.	N/A
Whitecourt	Whitecourt (ZU)	Decommission NDB	Revoke: NDB A A2 XD-ZU-QU B3 ZU-PE	GNSS Procedures to be developed.	Replace A2 (XD- ZU) with a T Route
Whitecourt	McLeod (FH)	Decommission NDB	N/A	GNSS Procedures to be developed.	N/A
Whitehorse	Robinson (PJ)	Decommission NDB	Revoke: R36 PJ-ZW B40 PJ-HNS BR7 PJ-MA BR29 PJ-YSQ	GNSS Procedures already in place.	Replace BR7 and BR29 with L Routes
Whitehorse	Klondike (ZXY)	Decommission NDB	N/A	GNSS Procedures already in place. Redesign ILS/DME or LOC/DME RWY 32L FAF, MA, MSA and Hold	N/A
Whitehorse	Laberge (JB)	Decommission NDB	Revoke: NDB/DME RWY 14R	GNSS Procedures already in place. Redesign ILS/DME or LOC/DME RWY 32L MA	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Edmonton FIR					
Wrigley	Wrigley (WY)	Decommission NDB	Revoke: NDB RWY 29 BR33 FS-WY-VQ RR4 ZF-WY	GNSS Procedures to be developed for RWY 29	Replace BR33 and RR4 with L Routes
Wrigley	Wrigley (YWY)	Decommission VOR Retain DME for DDI support	N/A	N/A	N/A

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Vancouver FIR					
Abbotsford	Abbotsford (XX)	Decommission NDB	Revoke: NDB RWY 07 R10-B22 VR-WC-XX-LU A1 XX-YJ-CD-QQ-ZT	GNSS Procedures already in place. Redesign ILS RWY 07 FAF, MSA and Hold	Replace R10-B22 with T Route if required.
Abbotsford	White Rock (WC)	Decommission NDB	Revoke: R10-B22 VR-WC-XX A16 WC-AP	GNSS Procedures already in place. Redesign ILS RWY 07 IAF	Replace R10-B22 with a T Route if required.
Abbotsford	Cultus (LU)	Decommission NDB	Revoke: R10-B22 VR-WC-XX-LU Revoke B22 LU-HE Revoke B4 LU-DC BOOTH 1 ARR at CYVR	GNSS Procedures already in place.	Replace B22 and B4 with T Routes if required.
Anahim Lake	Anahim Lake (UAB)	Decommission NDB	Revoke: NDB RWY 31 AR35 WL-UAB AR34 XS-UAB-YJQ BR30 TRENA-UAB BR23 QQ-UAB-YD	GNSS Procedures already in place (RCAP)	Replace AR35, AR34, BR30 and BR23 with L Routes.
Ashcroft	Ashcroft (YZA)	Decommission NDB	Revoke: B22 WL-YZA-HE-LU B27 YZA-DURAN R19 YZA-YKA V338 YZA-VR V325 YZA-YWL	N/A	Replace B22 YZA-HE-LU, B27, R19, V338 and V325 with T Routes if required.

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Vancouver FIR					
Castlegar	Castlegar (CG)	Decommission NDB	Revoke: G1 XC-CG-YYF B4 CG-LW R19 CG-YNY	GNSS Procedure already in place.	Replace G1, B4 and R19 with T Routes
Castlegar	Brilliant (YK)	Decommission NDB	N/A	GNSS Procedure already in place.	N/A
Castlegar	Champion (EF)	Decommission NDB	N/A	GNSS Procedure already in place.	N/A
Comox	Comox (QQ)	Decommission NDB	Revoke: NDB RWY 12 (DND) R20 QQ-YAZ A1 YCD-QQ-ZT V317-440 QQ-YZT A16 QQ-YPW	DND GNSS Procedures already in place. Redesign ILS RWY 12 (DND) and ILS DME RWY 30 (DND)	Replace R20, A1 and V317-440 with T Routes
Cranbrook	Cranbrook (XC)	Decommission NDB	Revoke: NDB A G1 XC-CG-YYF	GNSS Procedures to be developed for RWY 16. Redesign ILS Z RWY 16 FAF, MSA, MA and Hold. Redesign ILS Y RWY 16 FAF, MA and Hold	Air route coincident with VICTOR airways and will be replaced by T routes.
Cranbrook	Skookum (SX)	Decommission NDB	Revoke: V359 SX-YNV B18 FIRNI-SX-LW-GABIN	GNSS Procedures to be developed for RWY 16 Redesign ILS Y RWY 16 IF, MSA and Hold	Replace V359 and B18 with T Routes.
Enderby	Enderby (NY)	Decommission NDB	Revoke: R19 CG-YNV-YKA	N/A	N/A
Enderby	Enderby (YNY)	Decommission VOR	Revoke: V323 YKA-YNV-WHATS V317 YVR-LYTON-YNV V304 YVR-YNV-YYC V302 YDC-YNV V354 YDC-LW-YNV-YXC V359 YNY-SX	Redesign Kamloops ILS RWY 09 MA (RCAP)	Replace V323, V317, V304, V303, V354 and V359 with T Routes as required.

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Vancouver FIR					
Hope	Hope (HE)	Decommission NDB	Revoke: B22 YZA-HE-LU G1 YYF-DC-HE-VR B13 LW-HE B9 KA-HE	N/A	Replace B22, G1, B13 and B9 with T Routes as required.
Kamloops	Kamloops (YKA)	Decommission NDB	Revoke: NDB B B8 DC-KA-WL B5 KA-LW R19 NY-KA-YZA B9 KA-HE B10 KA-LYTON B26 KA-YYF V324 YWL-YKA-YDC V323 YKA-YNV	GNSS Procedures already in place. Redesign LOC C, FAF MSA, MA and Hold Redesign LOC D, FAF, MSA, MA and Hold	Replace V324, V323, B5, B9, B10 and B26 with T Routes as required.
Kamloops	Harper Ranch (ZYK)	Decommission NDB	N/A	GNSS Procedures already in place. Redesign ILS RWY 09 MA (RCAP)	N/A
Kelowna	Kelowna (LW)	Decommission NDB	Revoke: NDB B B18 HO-GABIN-LW-SX B4 DC-LW-CG B27 WHATS-LW-ICOLA B5 YKA-LW-YYF B13 HE-LW V354 YNY-LW-YDC	GNSS Procedures already in place.	Replace B18, B4, B27, B13 B5 and V354 with T Routes if required
Kelowna	Rutland(EX)	Decommission NDB	N/A	GNSS Procedures already in place. Redesign ILS Z RWY 16 and ILS Y RWY 16	N/A
Kelowna	Westbank (YWB)	Decommission NDB	N/A	GNSS Procedures already in place. Redesign ILS Z RWY 16 and ILS Y RWY 16	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Vancouver FIR					
Nanaimo	Nanaimo (YCD)	Decommission NDB	Revoke: NDB/DME RWY 16 NDB RWY 16 G1 YAZ-YCD-VR A1 YJ-YCD-YPW A16 AP-YCD-YPW-QQ	GNSS Procedures already in place.	Replace G1, A1 and A16 with T Routes as required.
Penticton	Penticton (YYF)	Decommission NDB	Revoke: NDB/NDB A G1 XC-CG-YYF-DC B5 YYF-LW B26 KA-YYF	GNSS Procedures already in place.	Replace G1, B5 and BR19 with T Routes as required
Penticton	Naramata (UNT)	Decommission NDB	N/A	GNSS Procedures already in place.	N/A
Penticton	Okanagan (ON)	Decommission NDB	N/A	GNSS Procedures already in place.	N/A
Pitt Meadows	Pitt Meadows (YPK)	Decommission VOR	Revoke: VOR A	GNSS Procedures already in place. CYVR Redesign ILS RWY 08L MAP Redesign ILS CAT II or CAT III RWY 08L MAP Redesign ILS RWY 26R MAP Redesign ILS CAT II or CAT III RWY 26R MAP Redesign KEINN ONE ARR	N/A
Port Hardy	Port Hardy (ZT)	Decommission NDB	Revoke: A1 YCD-QQ-ZT-ZP	GNSS Procedures already in place. Redesign ILS RWY 11	Replace A1 with a T Route as required
Powell River	Powell River (YPW)	Decommission NDB	Revoke: NDB/DME RWY 09 NDB RWY 09 A16 QQ-YPW-YCD	GNSS Procedures already in place.	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Vancouver FIR					
Prince George	Prince George (XS)	Decommission NDB	Revoke: NDB RWY 33 R30 XS-DQ R12 XS-QU B22 XS-YQZ AR34 XS-UAB	GNSS Procedures already in place.	Replace R30, R12 and B22 with T Routes. Replace AR34 with an L Route.
Prince George	Northwood (ZXS)	Decommission NDB	Revoke: NDB RWY 15	GNSS Procedures already in place. Redesign ILS RWY 15	N/A
Quesnel	Quesnel (YQZ)	Decommission NDB	Revoke: NDB A B22 XS-YQZ-WL	GNSS Procedures already in place.	Replace B22 with a T Route.
Sandspit	Sandspit (ZP)	Decommission NDB	Revoke: A1 ZT-ZP-SIT B79 YJQ-ZP-ICK R4 ZP-PR	GNSS Procedures already in place.	Replace A1, B79 and R4 with T Routes
Sandspit	Dead Tree (ZZP)	Decommission NDB	N/A	GNSS Procedures already in place. Redesign ILS RWY 13	N/A
Smithers	Smithers (YD)	Decommission NDB	Revoke: NDB/DME or NDB A R4 YD-XT R35 YX-ZKI BR23 YD-UAB	GNSS Procedures already in place.	Replace R4 and R35 with T Routes. Replace BR23 with a L Routes if required
Smithers	Telkwa (TK)	Decommission NDB	N/A	GNSS Procedures already in place.	N/A
Tofino	Tofino (YAZ)	Decommission NDB	Revoke: NDB RWY 29 G1 YAZ-YCD R20 YAZ-QQ	GNSS Procedures already in place.	Replace G1 and R20 with T Routes.
Vancouver	Vancouver (VR)	Decommission NDB	Revoke: NDB RWY 26L G1 HE-VR-YCD R10-B22 VR-WC B20 VR-AP	GNSS Procedures already in place.	Replace G1, R10 and B20 with T Routes.
Vancouver	Sea Island (ZVR)	Decommission NDB	Revoke: NDB/DME RWY 08R	GNSS Procedures already in place.	N/A

Aeronautical Study – NAVAID Modernization

LOCATION	NAVAID to be DECOMMISSIONED	PROPOSED ACTION	IMPACTS	IAP MITIGATION	ENROUTE MITIGATION
Vancouver FIR					
Victoria	Victoria (YJ)	Decommission NDB	Revoke: NDB/DME RWY 27 NDB RWY 27 B20 AP-YJ A1 XX-YJ-YCD	GNSS Procedures already in place	Replace B20 and A1 with T Routes.
Victoria	Active Pass (AP)	Decommission NDB	Revoke: B20 VR-AP-YJ A16 WC-AP-YCD	GNSS Procedures already in place Redesign LOC RWY 27 Redesign LOC/DME RWY 27 Redesign FASBO FIVE ARR and APASS FIVE ARR	Replace B20 and A16 with T Routes.
Victoria	Mill Bay (MB)	Decommission NDB	N/A	GNSS Procedures already in place Redesign ILS RWY 09 Redesign ILS RWY 27	N/A
Victoria	Victoria (YYJ)	Decommission VOR Retain DME for possible ILS and DDI support	Revoke: V495 HUH-YYJ V300 YVR-YYJ V321 YWL-YYJ V440 UQQ-YYJ	GNSS Procedures already in place	Replace V495, V300, V321 and V440 with T Routes.
Williams Lake	Williams Lake (WL)	Decommission NDB	Revoke: NDB RWY 30 B22 YQZ-WL-YZA B8 WL-YKA	GNSS Procedures already in place	Replace B22 and B8 with T Routes.

Appendix B

RECOVERY NETWORK

Aeronautical Study – NAVAID Modernization

Recovery Navigation Aids

In combination with surveillance coverage and dead-reckoning, the table below identifies the notional recovery NAVAID selected to support the recovery airports. At locations where one recovery NAVAID is identified it serves as both the enroute and approach NAVAID, or radar vectors are available to the ILS. At locations with two NAVAID, one serves as the enroute recovery NAVAID and the other as the approach NAVAID. The availability of NAV CANADA aviation weather observations, aerodrome forecasts, the availability of aviation fuel and a minimum runway length of 3500 feet are also normally required; however, some exceptions were made at remote locations as noted in the table. These exceptions would normally be used by aircraft equipped for gravel runway operations.

Gander FIR

Aerodrome	Ident	NAVAID	Within 10K Surveillance Cov.	METAR/TAF	Fuel	Designated Mountainous Region	Rwy 3500 ft
CARTWRIGHT	CYCA	NDB	N	H24	Y	Y	Y
DEER LAKE	CYDF	VOR/DME, ILS	Y	H24	Y	Y	Y
GANDER	CYQX	VOR/DME, ILS/DME	Y	H24	Y	Y	Y
GOOSE BAY	CYYR	VOR, ILS	Y	H24	Y	Y	Y
MARY'S HARBOUR	CYMH	NDB	N	H24/H18	Y	Y	2545 Gravel
NAIN	CYDP	NDB	N	H15/H13	N	Y	1986 Gravel
ST. ANTHONY	CYAY	VOR	Y	H24	JA-1	Y	Y
ST. JOHN'S	CYYT	VOR, ILS/DME	Y	H24	Y	Y	Y

Moncton FIR

Aerodrome	Ident	NAVAID	Within 10K Surveillance Cov.	METAR/TAF	Fuel	Designated Mountainous Region	Rwy 3500 ft
CHARLOTTETOWN	CYYG	ILS/DME	Y	H24	Y	N	Y
FREDRICKTON	CYFC	ILS/DME	Y	H24	Y	N	Y
HALIFAX	CYHZ	ILS/DME	Y	H24	Y	N	Y
MONCTON	CYQM	ILS/DME	Y	H24	Y	N	Y
SAINT JOHN	CYSJ	ILS	Y	H24	Y	N	Y
SYDNEY	CYQY	ILS/DME	Y	H24	Y	N	Y

Aeronautical Study – NAVAID Modernization

Montreal FIR

Aerodrome	Ident	NAVAID	Within 10K Surveillance Coverage	METAR/TAF	Fuel	Designated Mountainous Region	Rwy 3500 ft
BAIE-COMEAU	CYBC	VOR/DME, ILS/DME	Y	H24	Y	Y	Y
CHIBOUGAMAU	CYMT	NDB/DME	Y	H24/H12	Y	N	Y
GASPÉ	CYGP	VOR/DME, LOC/DME	Y	H24	Y	Y	Y
IQUALUIT	CYFB	VOR, NDB, ILS/DME	Y	H24	Y	Y	Y
KANGIRSUK	CYAS	NDB	Y	H10/H7	Y	N	Y
KUUJJUARAPIK	CYGW	NDB	N	H24	Y	N	Y
KUUJJUAQ	CYVP	VOR, ILS/DME	Y	H24	Y	N	Y
LA GRANDE RIVIÈRE	CYGL	VOR	Y	H24	Y	N	Y
MONTRÉAL	CYUL	ILS/DME	Y	H24	Y	N	Y
MONTRÉAL/ST-HUBERT	CYHU	ILS	Y	H24	Y	N	Y
NATASHQUAN	CYNA	VOR	Y	H24	Y	Y	Y
OTTAWA	CYOW	ILS/DME	Y	H24	Y	N	Y
PUVIRNITUQ	CYPX	NDB	N	H24/H17	Y	N	Y
QUÉBEC	CYQB	ILS/DME	Y	H24	Y	N	Y
ROBERVAL	CYRJ	NDB	Y	H24/H14	Y	Y	Y
SEPT-ÎLES	CYZV	ILS/DME	Y	H24	Y	N	Y
TROIS-RIVIÈRES	CYRQ	NDB	Y	H24	Y	N	Y
VAL-D'OR	CYVO	VOR/DME, ILS/DME	N	H24	Y	N	Y
WABUSH	CYWK	VOR/DME, ILS/DME	N	H24	Y	Y	Y

Aeronautical Study – NAVAID Modernization

Toronto FIR

Aerodrome	Ident	NAVAID	Within 10K Surveillance Coverage	METAR/TAF	Fuel	Designated Mountainous Region	Rwy 3500 ft
HAMILTON	CYHM	ILS/DME	Y	H24	Y	N	Y
KITCHENER/WATERLO	CYKF	ILS/DME	Y	H24	Y	N	Y
LONDON	CYXU	ILS/DME	Y	H24	Y	N	Y
MOOSONEE	CYMO	VOR	N	H24	Y	N	Y
NORTH BAY	CYYB	ILS/DME	Y	H24	Y	N	Y
PETERBOROUGH	CYPQ	NDB	Y	H24/H16	Y	N	Y
SAULT STE. MARIE	CYAM	ILS/DME	Y	H24	Y	N	Y
SUDBURY	CYSB	ILS/DME	Y	H24	Y	N	Y
TIMMINS	CYTS	VOR/DME ILS/DME	Y	H24	Y	N	Y
TORONTO/BB CITY	CYTZ	ILS/DME	Y	H24	Y	N	Y
TORONTO/LBP INT'L	CYYZ	VOR, ILS/DME	Y	H24	Y	N	Y
WIARTON	CYVV	VOR	Y	H24/H12	Y	N	Y
WINDSOR	CYQG	ILS/DME	Y	H24	Y	N	Y

Aeronautical Study – NAVAID Modernization

Winnipeg FIR

Aerodrome	Ident	NAVAID	Within 10K Surveillance Coverage	METAR/TAF	Fuel	Designated Mountainous Region	Rwy 3500 ft
BIG TROUT LAKE	CYTL	NDB	Y	H24	Y	N	Y
CHURCHILL	CYYQ	VOR, ILS/DME	N	H24	Y	N	Y
DRYDEN	CYHD	ILS	Y	H24	Y	N	Y
FLIN FLON	CYFO	NDB	N	H12/N	Y	N	Y
FORT SEVERN	CYER	NDB	N	H24/H10	Y	N	Y
GEARLDTON	CYGQ	VOR/DME	Y	H24	Y	N	Y
GILLAM	CYGX	NDB	N	H24	Y	N	Y
ISLAND LAKE	CYIV	NDB	N	H24	Y	N	Y
LA RONGE	CYVC	VOR	Y	H24	Y	N	Y
LYNN LAKE	CYYL	VOR	N	H24	Y	N	Y
PICKLE LAKE	CYPL	NDB	N	H15/H12	Y	N	Y
PRINCE ALBERT	CYPA	ILS/DME	Y	H24	Y	N	Y
RED LAKE	CYRL	VOR	Y	H17/H16	Y	N	Y
REGINA	CYQR	ILS	Y	H24	Y	N	Y
SASKATOON	CYXE	ILS	Y	H24	Y	N	Y
SANDY LAKE	CSZJ	NDB	N	H24/H12	Y	N	Y
STONY RAPIDS	CYSF	NDB	Y	H24	Y	N	Y
THOMPSON	CYTH	VOR, ILS/DME	Y	H24	Y	N	Y
THUNDER BAY	CYQT	ILS/DME	Y	H24	Y	N	Y
WINNIPEG	CYWG	ILS	Y	H24	Y	N	Y

Aeronautical Study – NAVAID Modernization

Edmonton FIR

Aerodrome	Ident	NAVAID	Within 10K Surveillance Coverage	METAR/TAF	Fuel	Designated Mountainous Region	Rwy 3500 ft
BAKER LAKE	CYBK	NDB,VOR	N	H24	Y	N	Y
CALGARY	CYYC	VOR, ILS/DME	Y	H24	Y	Y	Y
CAMBRIDGE BAY	CYCB	NDB,VOR	N	H24	Y	N	Y
CAPE DORSET	CYTE	NDB	N	H24	JA-1	Y	Y
CLYDE RIVER	CYCY	NDB	N	H24	JA-1	Y	Y
CORAL HARBOUR	CYZS	NDB	N	H24	JA-1	N	Y
DAWSON CITY	CYDA	NDB	N	H09/H08	Y	N	Y
DEASE LAKE	CYDL	NDB	N	H24/H10	Y	Y	Y
EDMONTON	CYEG	ILS	Y	H24	Y	N	Y
EUREKA	CYEU	NDB	N	H21/H15	N	Y	Y
FORT NELSON	CYYE	VOR, ILS	N	H24	Y	Y	Y
FORT ST. JOHN	CYXJ	VOR, ILS	Y	H24	Y	Y	Y
FORT SIMPSON	CYFS	VOR	N	H24	Y	N	Y
FORT SMITH	CYSM	VOR	N	H24	Y	N	Y
GRANDE PRAIRIE	CYQU	VOR, ILS	Y	H24	Y	N	Y
HALL BEACH	CYUX	NDB, VOR	N	H24	JA-1	N	Y
HAY RIVER	CYHY	VOR, ILS	Y	H24	Y	Y	Y
HIGH LEVEL	CYOJ	VOR	N	H24	Y	N	Y
INUVIK	CYEV	NDB,VOR ILS/ DME	N	H24	Y	N	Y
LETHBRIDGE	CYQL	VOR, ILS	Y	H24	Y	N	Y
LLOYDMINSTER	CYLL	NDB	N	H24	Y	N	Y
MAYO	CYMA	NDB	N	H24	JB	N	Y
NORMAN WELLS	CYVQ	VOR	N	H24	Y	N	Y
OLD CROW	CYOC	NDB	N	H12/H10	Y	Y	Y
PAULATUK	CYPC	NDB	N	H10/H08	JA	N	Y
PEACE RIVER	CYPE	VOR	Y	H24	Y	Y	Y
POND INLET	CYIO	NDB	N	H24	JA-1	Y	Y
RANKIN INLET	CYRT	NDB,VOR	N	H24	Y	N	Y
RED DEER	CYQF	NDB	Y	H24	Y	Y	Y
RESOLUTE BAY	CYRB	NDB, VOR, ILS	N	H24	Y	N	Y
TALOYOAK	CYYH	NDB	N	H24	JA-1	N	Y
ULUKHAKTOK	CYHI	NDB	N	Y	JA	N	Y
WATSON LAKE	CYQH	VOR, ILS	N	H24	Y	Y	Y
WHITECOURT	CYZU	VOR	Y	H16/ H09	Y	N	Y

Aeronautical Study – NAVAID Modernization

Aerodrome	Ident	NAVAID	Within 10K Surveillance Coverage	METAR/TAF	Fuel	Designated Mountainous Region	Rwy 3500 ft
WHITEHORSE	CYXY	VOR, ILS	N	H24	Y	Y	Y
YELLOWKNIFE	CYZF	NDB, VOR, ILS	Y	H24	Y	N	Y

Vancouver FIR

Aerodrome	Ident	NAVAID	Within 10K Surveillance Coverage	METAR/TAF	Fuel	Designated Mountainous Region	Rwy 3500 ft
ABBOTSFORD	CYXX	ILS/DME	Y	H24	Y	Y	Y
BELLA BELLA	CBBC	NDB	Y	H24/H16	Y	Y	Y
CAMPBELL RIVER	CYBL	NDB, ILS/DME	Y	H15/H13	Y	Y	Y
CRANBROOK	CYXC	VOR, ILS/DME	N	H24	Y	Y	Y
PORT HARDY	CYZT	VOR, ILS/DME	Y	H24	Y	Y	Y
PRINCE GEORGE	CYXS	VOR, ILS/DME	Y	H24	Y	Y	Y
PRINCE RUPERT	CYPR	NDB/DME ILS/DME	Y	H24	Y	Y	Y
SANDSPIT	CYZP	VORDME, ILS/DME	Y	H24	Y	Y	Y
TERRACE	CYXT	NDB/DME ILS/DME	Y	H24	Y	Y	Y
WILLIAMS LAKE	CYWL	VOR	Y	H24	Y	Y	Y
VANCOUVER	CYVR	VOR, ILS/DME	Y	H24	Y	Y	Y
VICTORIA	CYYJ	ILS/DME	Y	H24	Y	Y	Y

Appendix C

STAKEHOLDER LIST

AAA Aviation Flight Academy

Air Borealis*

Air Canada *

Air Creebec

Air Inuit

Air Georgian*

Air Liason

Air North*

Air Nunavut*

Air St. Pierre

Air Tindi*

Air Transport Association of Canada (ATAC)

Airco Charters*

Alberta Central Airways

Alkan Air*

Aklak Air*

Atlantic Charters*

Bearskin Airlines

Blue Bird Flight Academy

Buffalo Airways

Calm Air *

Can-west Air

Canadian Business Aircraft Owners Association (CBAA)

Canadian Flight Centre

Canadian North*

Canadian Owners and Pilots Association (COPA)*

Carson Air*

Cargojet *

Central Mountain Airlines*

Aeronautical Study – NAVAID Modernization

Chronos Aviation
Coastal Pacific Aviation
Cougar Helicopters*
Department of National Defence (DND)*
Edmonton Flying Club*
Excel Flight Training*
Exploits Valley Air Service (EVAS)
Evasion Air
First Air*
Flair Airlines*
Guardian Aerospace
Integra Air*
Island Coastal Aviation
Island Express Air
Harv's Air *
Jazz*
Keewatin Air
Kenn Borek Air*
KF Aerospace*
KD Air*
Langley Flying School
Manitoba Gov't Air Service *
McMurray Aviation
Missinippi Airways *
Moncton Flight College*
Morningstar Air Express*
Mount Royal University*
Nakina Air Service
North Cariboo Air Service*
North Star Air
Northern Air Charters*
Northern Thunderbird Airlines*
Northway Aviation*
Northwestern Air Lease*
North-Wright Air*

Aeronautical Study – NAVAID Modernization

Pacific Coastal Airlines*
Pacific Flying Club
Pacific Rim Aviation Academy
Pacific Sky Aviation
Pascan Aviation
Principal Air
Perimeter Aviation *
Porter Airlines*
Professional Flight Centre
Propair
Orca Airways
Manitoba Aviation Council (MAC)*
Saskatchewan Aviation Council (SAC)*
Saskatchewan Gov't Air Services *
Sky Regional Airlines
Sky Quest Aviation
Springbank Air Training College
Summit Air*
Sunwest Aviation*
Thunder Airlines*
Tintina Air
Transwest Air*
Victoria Flying Club
Villers Air Service
Wasaya Airways *
WestJet
WestJet Encore*
Westwind Aviation
Wings Over Kississing *
Winnipeg Aviation *

Appendix D

HAZARD IDENTIFICATION AND RISK ASSESSMENT TABLE

Aeronautical Study – NAVAID Modernization

HIRA Summary

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
<p>Issue</p> <p>Some aircraft operators design their Engine Failure Procedures (EFP) based on the NDB, particularly in mountainous areas. Decommissioning the NDB may result in these operators being unable to operate to these airports.</p>	<p>Sections 704.47 and 705.57 of the CAR are the Part VII regulations applicable to Net Take-off Flight Path. These regulations require that the weight of an aeroplane be limited during take-off to ensure that obstacles are cleared by the prescribed margins and that engine out departures are planned in accordance with the criteria provided in these regulations.</p> <p>The Standard for Take-off Minima - Sections 723.30, 724.26 and 725.34 of the <i>Commercial Air Service Standards (CASS)</i> requires that the Company Operations Manual shall contain guidance on how to determine one engine inoperative climb gradient and obstacle clearance.</p> <p>Advisory Circular (AC) No. 700-016 - Compliance with Regulations and Standards for Engine-Inoperative Obstacle Avoidance provides information and guidance to aircraft</p>	<p>The probability of aircraft operators being unable to operate into an airport they currently use unless their EFP are based on GNSS is high.</p> <p>The risk of aircraft operators being unable to operate into an airport that they currently use due to the decommissioning of an NDB is assessed to be high.</p>	<p>AC No. 700-016 states that the “Use of a Flight Director track guidance based on LNAV may reduce the pilot effort in following a ground track.”</p> <p>Aircraft performance companies have developed RNAV-based EFP. These RNAV EFP are in use today and coded for the Universal and Collins FMS. These have been available for use since 2015.</p> <p>Mitigation is required.</p>	<p>Aircraft operators will have to have their EFP revised to be based on GNSS rather than on the NDB. This should be done prior to the decommissioning of the NDB.</p> <p>Advising aircraft operators that routinely operate into an airport well in advance of the planned date of decommissioning an NDB will allow them to have their EFP revised.</p>	<p>Having their EFP revised to be based on GNSS rather than on the NDB prior to the decommissioning of the NDB and providing advance notice to allow this to occur will reduce the risk of reduced airport accessibility to ALARP.</p>

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
	operators on demonstrating compliance with the regulations and standards.				
Issue If NDB are decommissioned in the north, pilots will be unable to reset their gyroscope or magnetic compass to a true track prior to commencing their approach as required by regulation.	CAR 605.15 (1) (g), CAR 605.16 (1) (g) and, CAR 605.18 (1) (a) and (b), require pilots flying under Night VFR, VFR OTT, or IFR to have a means of establishing direction that is not dependent on a magnetic source when operating NDA. This can either be done using an astrocompass or a GPS bearing to a NDB.	The probability of pilots being unable to set their compass if a NDB signal is not sufficiently strong is high. The risk of pilots being unable to set their compass due to great distances between NDB is assessed to be high.	The NDB signal used does not have to emanate from a NDB at the destination airport, but signal used must be sufficiently strong to provide a stable bearing when setting the compass prior to descent. The greater the distance between the position of the aircraft the NDB being used, the lower power of the NDB, the more mountainous the terrain, or the lower the altitude of the aircraft will reduce the ability of the NDB signal to provide a stable bearing. Mitigation is required.	Retain NDB at major centres North of 60 with high-powered facilities (Inuvik, Yellowknife, Rankin Inlet, Iqaluit) and at other sites as required to provide NDB signal reception to all registered or certified aerodromes to allow pilots to meet the regulatory requirement to reset their compass prior to descent	Retaining NDB at major centres North of 60 with high-powered facilities (Inuvik, Yellowknife, Rankin Inlet, Iqaluit) and at other sites as required to provide NDB signal reception to all registered or certified aerodromes to allow pilots to meet the regulatory requirement to reset their compass prior to descent when flying in NDA. This will reduce the risk of pilots being unable to reset their compass to ALARP.
Issue The lack of surveillance in the north, combined with the great distances in many cases between suitable airports may result in pilots being unable to locate a suitable recovery airport in the event of decreased performance of the GNSS.	CAR 602.88(4) and 602.88(5) and for commercial airlines CAR 703.20, 704.20, 705.25 (1) and 705.25(2) contain the fuel requirements for aircraft operated for IFR flight.. NAV CANADA has weather observing programs and issues aerodrome forecasts (TAF) at all principle airports and several secondary airports	The probability of decreased GNSS performance is low. The risk of pilots being unable to locate a suitable recovery airport in the event of decreased GNSS performance is assessed to be moderate.	Surveillance is provided by the radar at Yellowknife, Iqaluit, Kuujuaq and Goose Bay. Pilots are able to fly by dead-reckoning for 100 NM to enter an area of surveillance coverage. There are a number of airports in northern and remote areas outside of surveillance coverage and beyond the 100 NM dead-reckoning limit. Mitigation is required.	Retain NAVAID at major centres North of 60 and at other sites as required to provide NDB or VOR signal reception to all airports with 24 hour aviation weather observations (METAR) and aerodrome forecasts (TAF) as well as additional airports in northern and remote regions suitable to the needs of the operators serving the area.	Retaining NAVAID at major centres North of 60 and at other sites as required to provide NDB or VOR signal reception to all airports with 24 hour aviation weather observations (METAR) and aerodrome forecasts (TAF) as well as additional airports in northern and remote regions suitable to the needs of the operators serving the area will allow pilots more choices in the event of large-scale decreased GNSS performance.

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
	in northern and remote regions to provide pilots with options for alternate and diversionary airports.				This will reduce the risk of pilots being unable to locate a suitable recovery airport in the event of decreased GNSS performance to ALARP.
<p>Issue</p> <p>Decommissioning ground-based NAVAID at airports located less than 100 NM distance from other airports with RNAV (GNSS) approaches only will not allow these airports to be held as IFR alternate airports.</p>	<p>CAR 602.122 requires that a pilot on an IFR flight must include an alternate aerodrome having a landing area suitable for use by the aircraft being flown.</p> <p>CAR 602.123 requires that a pilot on an IFR flight must include an alternate aerodrome in an IFR flight plan or IFR flight itinerary unless available weather information indicates that the ceiling and visibility at the alternate aerodrome will, at the expected time of arrival, be at or above the alternate aerodrome weather minima specified in the <i>Canada Air Pilot</i> (CAP).</p> <p>In accordance with CAR 705.34 pilots select an alternate airport within one hour cruise on a single engine to use as a take-off alternate when the weather at the departure airport is below landing limits specified in the CAP.</p>	<p>The probability of a pilot being unable to select an airport as a cost-efficient alternate airport in some areas is high.</p> <p>The risk of pilots being unable to select an airport as a cost-efficient alternate airport in some areas is assessed to be high.</p>	<p>NAV CANADA has weather observing programs and issues aerodrome forecasts (TAF) at all principle airports and several secondary airports in northern and remote regions to provide pilots with options for alternate airports.</p> <p>An airport for which a TAF is issued and could therefore be used as an alternate airport if the both the destination airport and alternate airport only have RNAV (GNSS) approaches and are separated by less than 100 NM.</p> <p>An airport for which a TAF is issued and could therefore be used as a departure alternate airports cannot be used as an alternate airport if the both the departure airport and alternate airport only have RNAV (GNSS) approaches and are separated by less than 100 NM.</p> <p>Mitigation is required.</p>	<p>Retain ground-based NAVAID at airports for which a TAF is issued and have other airports within 100 NM.</p>	<p>Retaining ground-based NAVAID at airports for which a TAF is issued and have other airports within 100 NM, will provide for choices for alternate airports that are less than 100 NM from the destination airport.</p> <p>This will reduce the risk of pilots being unable to select an airport as a cost-efficient alternate airport to ALARP.</p>

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
<p>Issue</p> <p>Decommissioning ground-based NAVAID will result in the airway and air route segments that are based on them to be revoked. There is a requirement for an air route for commercial flight in uncontrolled airspace.</p>	<p>CAR 703.34 makes provision for an air operator to establish a route in uncontrolled airspace in accordance with the <i>Commercial Air Service Standards</i>.</p>	<p>The probability of companies having to create their own routes between airports located in areas of uncontrolled airspace is high.</p> <p>The risk of companies having to create their own routes between airports located in areas of uncontrolled airspace is assessed to be high.</p>	<p>Commercial operators of non-pressurised aircraft and those operating between airports separated by short distances (<250 NM) are not able, or it is not efficient to fly above uncontrolled airspace will be unable to fly unless they develop their own route. Multiple operators flying between two locations would create multiple routes.</p> <p>Mitigation is required.</p>	<p>Establish low-level RNAV airways (L-routes) where required between airports to replace the LF air route segments that are revoked when the NAVAID are decommissioned.</p>	<p>Establishing low-level RNAV airways (L-routes) where required between airports to replace the LF air route segments will permit commercial IFR flight between the airports.</p> <p>This will reduce the risk of commercial aircraft operators having to create their own routes to ALARP.</p>
<p>Issue</p> <p>Pilots of non-DME equipped aircraft would be unable to access a recovery airport if the recovery instrument procedure required the use of a DME.</p>	<p>CAR 605.18 states in part that “No person shall conduct a take-off in a power-driven aircraft for the purpose of IFR flight unless it is equipped with sufficient radio navigation equipment to permit the pilot, in the event of the failure at any stage of the flight of any item of that equipment, including any associated flight instrument display,</p> <ul style="list-style-type: none"> • to proceed to the destination aerodrome or proceed to another aerodrome that is suitable for landing, and • where the aircraft is operated in IMC, to 	<p>The probability of a pilot of a non-DME equipped aircraft being unable to select an airport as a recovery airport is moderate.</p> <p>The risk of pilots of non-DME equipped aircraft being unable to select an airport as a recovery airport is assessed to be moderate.</p>	<p>DME is a common installation in aircraft used for IFR flight. All VOR in Canada are coupled with DME. Most ILS and VOR instrument procedures in Canada require a DME, where one is available.</p> <p>Pilots and aircraft operators are responsible for ensuring that their aircraft are suitably equipped for IFR flight in the areas in which they intend to operate.</p> <p>At recovery airports where terminal radar service as provided, the air traffic controllers could provide radar assistance to pilots of non-DME equipped aircraft to identify the FAF.</p> <p>Mitigation is required.</p>	<p>Where possible, at airports for which the VOR is the recovery NAVAID and there is a VOR procedure it will be retained as the recovery instrument procedure and the VOR/DME procedure revoked.</p>	<p>Retaining the VOR procedure, where one is published at a recovery airport for which the VOR is the recovery NAVAID and revoking the VOR/DME procedure will increase the number of recovery airports available to the greatest number of IFR pilots.</p> <p>This will reduce the risk of pilots’ non-DME equipped aircraft being unable to use a recovery airport to ALARP.</p>

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
	complete an instrument approach and, if necessary, conduct a missed approach procedure.”				
Issue If the NAVAID on which the missed approach (MA) portion of an instrument procedure is decommissioned, the minima for that procedure may be raised. This may reduce airport accessibility.	Instrument procedures at airports are designed in accordance with the criteria and methods in <i>Criteria for the Development of Instrument Procedures</i> (TP308).	The probability of increased minima is low. The risk of reduced airport accessibility due to increase limits is assessed to be moderate.	(TP308) makes for the provision of the use of distance measuring equipment (DME) to support the missed approach segment. Mitigation is required.	Relocate the DME if the VOR is decommissioned or install a DME to replace a NDB to support the MA segment of an IFR procedure.	Relocating a DME if the VOR is decommissioned or installing a DME to replace a NDB to support the MA segment of an IFR procedure should maintain the minima at, or near the current limits. This will lower the risk reduced airport accessibility to ALARP.
Issue GNSS signals can be interrupted by illegal GPS jammers. If the instrument procedure based on the VOR or NDB is revoked because of the decommissioning of the NAVAID the airport will be inaccessible for IFR operations.	The GPS constellation is managed by an executive board, chaired by the US departments of Defense and Transportation, and is comprised of representatives from several other departments to ensure that civil users' requirements are considered in the management of the system. The US Secretary of Defense has statutory authority to sustain and operate GPS for military and civil purposes and to provide civil GPS service on a continuous, worldwide	The probability of a pilot being unable to conduct an RNAV (GNSS) approach due to illegal signal jamming is low. The risk of reduced airport accessibility due to illegal GPS signal jamming is assessed to be low.	The primary concern is radio communication jammers designed to defeat vehicle tracking and fee-collecting systems which are transient in nature and inadvertently inhibit aircraft in the vicinity overhead from receiving GNSS signals. The pilots of aircraft for which the GNSS signal is temporarily unavailable could request radar assistance from ATC and conduct a landing approach to the airport by either a visual approach or by using the ILS or other NAVAID if available. Mitigation is not required.	N/A	N/A

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
	<p>basis, free of direct user fees.</p> <p>The importation, manufacturing, distribution, offering for sale, possession and use of radio communication jamming devices, are prohibited under the <i>Radiocommunication Act</i>.</p> <p>The Transport Canada Aeronautical Information Manual (AIM) (TP14371) COM 5.10 tells pilots to advise air traffic services of any GNSS signal interference and request that they complete a <i>GNSS Anomaly Report</i> to assist in the identification and elimination of the sources of interference or signal degradation.</p>				
<p>Issue</p> <p>Some IFR aircraft may not be able to maintain flight at 10,000 Ft ASL, or may have to use additional fuel to climb to 10,000 Ft ASL to be within surveillance airspace or receive a signal from a NAVAID.</p>	<p>CAR 605.30 requires in part that an aircraft be adequately equipped to operate in icing conditions in accordance with the standards of airworthiness under which the type certificate for that aircraft was issued.</p> <p>CAR 605.32 requires aircraft that operated above a cabin-pressure altitude above 10,000 Ft ASL must be equipped</p>	<p>The probability of a pilot of a non-pressurised aircraft being unable to climb to sufficient altitude to receive radar assistance or a NAVAID signal to enable navigation to a recovery airport is low.</p> <p>The risk of pilots of non-pressurised aircraft being unable</p>	<p>While the surveillance area at 9,000 FT ASL is reduced from that at 10,000 FT ASL, significant areas of the country, particularly those with the highest numbers of IFR flights.</p> <p>Pilots are expected to be able to navigate by dead-reckoning for 100 NM to enable them to enter surveillance airspace or receive a signal from a NAVAID.</p> <p>Mitigation is required.</p>	<p>Retain sufficient NAVAID to provide signal coverage to serve as recovery NAVAID to support the recovery airport network and supplement the areas of radar surveillance.</p>	<p>Retaining sufficient NAVAID to provide signal coverage to serve as recovery NAVAID to support the recovery airport network and supplement the areas of radar surveillance will lower the risk of a pilot being unable to receive a signal from a recovery NAVAID to ALARP.</p>

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
	with oxygen masks and supplemental oxygen.	to climb to sufficient altitude to receive radar assistance or a NAVAID signal to enable navigation to a recovery airport is assessed to be moderate.			
<p>Issue</p> <p>Some aircraft have only one GNSS receiver and a VOR/DME which means that they have to have a secondary navigation source available if the GPS should fail.</p>	<p>CAR 605.18 states in part that “No person shall conduct a take-off in a power-driven aircraft for the purpose of IFR flight unless it is equipped with sufficient radio navigation equipment to permit the pilot, in the event of the failure at any stage of the flight of any item of that equipment, including any associated flight instrument display,</p> <ul style="list-style-type: none"> • to proceed to the destination aerodrome or proceed to another aerodrome that is suitable for landing, and • where the aircraft is operated in IMC, to complete an instrument approach and, if necessary, conduct a missed approach procedure.” <p>The MEL identifies the minimum serviceable equipment level required</p>	<p>The probability of a pilot of an aircraft equipped with a single GNSS receiver being unable to operate is moderate.</p> <p>The risk of pilots of aircraft equipped with a single GNSS receiver being unable to operate is assessed to be moderate.</p>	<p>Although many VOR and NDB are proposed to be decommissioned, a number will be retained as part of the recovery network, or to meet other CAR requirements and can be used to navigate to an airport.</p> <p>Existing enroute DME will be retained and may be used by suitably equipped aircraft for DME/DME or DME/DME/IRU navigation.</p> <p>Mitigation is required.</p>	<p>Retain NAVAID to serve the recovery network and to meet other CAR requirements.</p> <p>Retain enroute DME to support DDI network.</p> <p>Coordinate the decommissioning of NAVAID with aircraft operators in the area to allow them sufficient time to upgrade their aircraft if required.</p>	<p>Retaining NAVAID to serve the recovery network and to meet other CAR requirements, DME to support the DDI network and coordinating the decommissioning of NAVAID with aircraft operators to allow for aircraft equipment upgrades will reduce the risk that aircraft will be unable to operate due to a lack of secondary navigation source to ALARP.</p>

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
	onboard the aircraft to plan an IFR flight.				
Issue ATC cannot provide vectors to a recovery airport if the pilot is flying in uncontrolled airspace and the airport is in an area of uncontrolled airspace.	ATC service is provided in Class A, B, C, D and E airspace. ATC service is not provided in Class G airspace. The Manual of ATS provides guidance to air traffic controllers which allows them to provide vectors to an aircraft into Class G airspace provided that they inform the pilot and obtain the pilot's approval.	The probability of a pilot being unable to navigate to a recovery airport in uncontrolled surveillance airspace is low. The risk of pilots being unable to navigate to a recovery airport in uncontrolled surveillance airspace is assessed to be moderate.	There are several radar installations at airports which are identified as recovery airports and are located in areas of Class G (uncontrolled) airspace below 18,000 Ft ASL. There are several airports identified as recovery airports that are within surveillance airspace at 10,000 Ft ASL which are located in areas of Class G (uncontrolled) airspace below 18,000 Ft ASL. Mitigation is required.	Retain ground-based NAVAID to enable pilots flying in uncontrolled surveillance airspace to navigate to the airport in the event of a significant GNSS outage.	Retaining ground-based NAVAID will enable pilots flying in uncontrolled surveillance airspace to navigate to the airport in the event of a significant GNSS outage and they are unable to receive vectors from an air traffic controller. This will reduce the risk of pilots being unable to navigate to a recovery airport to ALARP.
Issue If the NAVAID is an NDB only, at a recovery airport, many aircraft, especially new ones may not be able to use the airport as a recovery airport.	CAR 605.18 states in part that "No person shall conduct a take-off in a power-driven aircraft for the purpose of IFR flight unless it is equipped with sufficient radio navigation equipment to permit the pilot, in the event of the failure at any stage of the flight of any item of that equipment, including any associated flight instrument display, <ul style="list-style-type: none"> • to proceed to the destination aerodrome or proceed to another aerodrome that is suitable for 	The probability of a pilot being unable to navigate to a recovery airport in uncontrolled surveillance airspace is moderate. The risk of pilots being unable to navigate to a recovery airport in uncontrolled surveillance airspace is assessed to be moderate.	Many aircraft today are not ADF equipped. It is expected that the number of ADF-equipped will diminish. There is no regulatory for aircraft operating within SDA to be ADF-equipped. Mitigation is required.	Retain the VOR as the recovery enroute or approach NAVAID where possible.	Retaining the VOR as the recovery enroute or approach NAVAID where possible and decommissioning the NDB will enable pilots to navigate to and land at a recovery airport. This will reduce the risk pilots will be unable to navigate to, or land at a recovery airport to ALARP.

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
	<p>landing, and</p> <ul style="list-style-type: none"> where the aircraft is operated in IMC, to complete an instrument approach and, if necessary, conduct a missed approach procedure.” 				
<p>Issue</p> <p>With the decommissioning of VOR and NDB, there will be less opportunity for flight schools to train students on the use of these NAVAID, for both enroute and approach navigation.</p>	<p>The Transport Canada Flight Test Guide (TP 9939) 10th Edition contains the aircraft and equipment requirements for aircraft used for IFR flight training.</p> <p>TP 9939 10th Ed. contains the requirements that a pilot candidate must meet to successfully qualify as an IFR pilot.</p>	<p>The probability of a student pilot being unable to train on ground-based NAVAID is low.</p> <p>The risk of pilots being unable to train on ground-based NAVAID is assessed to be low.</p>	<p>Some flight schools continue to train students on VOR and NDB tracking, holds and approaches.</p> <p>Flight schools are increasingly using flight simulators to train students on the use of VOR and NDB as these NAVAID become less accessible for flight training.</p> <p>Transport Canada requires that an aircraft used for IFR flight training must “(b) be equipped with GNSS receiving equipment that is a certified and approved installation for RNP APCH approaches to LNAV/VNAV, LNAV minima or any other function, such as use in lieu of a DME or an NDB.”</p> <p>Transport Canada no longer requires the completion of a VOR or NDB approach during an initial or recurrent flight test. A flight test candidate can meet the examination requirements by satisfactorily performing two GNSS based procedures: a LNAV procedure (non-precision without vertical guidance) and a LPV (APV).</p>	<p>N/A</p>	<p>N/A</p>

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
			Mitigation is not required.		
<p>Issue</p> <p>Operators of non-RNAV equipped aircraft will not be able to fly IFR if the majority of VOR and NDB are decommissioned.</p>	<p>CAR 605.18 states in part that “No person shall conduct a take-off in a power-driven aircraft for the purpose of IFR flight unless it is equipped with sufficient radio navigation equipment to permit the pilot, in the event of the failure at any stage of the flight of any item of that equipment, including any associated flight instrument display,</p> <ul style="list-style-type: none"> • to proceed to the destination aerodrome or proceed to another aerodrome that is suitable for landing, and • where the aircraft is operated in IMC, to complete an instrument approach and, if necessary, conduct a missed approach procedure.” 	<p>The probability of aircraft operators being unable to operate in a RNAV (GNSS) environment in the future is low.</p> <p>The risk of aircraft operators being unable to in a GNSS-based ANS is assessed to be low.</p>	<p>NAV CANADA is following the ICAO lead in modernizing Canada’s airspace. The transition to a Space Based Air Navigation System is part of the NAV CANADA’ Operations Plan for the implementation of PBN in Canadian airspace.</p> <p>The implementation of the proposed decommissioning of NAVAID will occur over several years.</p> <p>Mitigation is not required.</p>	N/A	N/A
<p>Issue</p> <p>In the event of a significant GNSS outage pilots operating IFR will have to fly to an airport with a ground-</p>	<p>When pilots select an alternate from a location for which a TAF is not available, they must use the graphic area forecast (GFA). The alternate</p>	<p>The probability of pilots having to fly to an airport with a ground-based NAVAID which may be other than their</p>	<p>The availability of a TAF for recovery airports would provide pilots and dispatchers with more flexibility in the choice of recovery airports.</p>	<p>Select airports as recovery airports from those which have at least limited hour METAR and TAF.</p>	<p>Selecting airports as recovery airports from those which have at least limited hour METAR and TAF will provide pilots and dispatchers with more information when selecting a suitable recovery</p>

Aeronautical Study – NAVAID Modernization

Hazard/Issue	Existing mitigation (defence) in the system	Risk Estimations	Risk Evaluation	Mitigation	Evaluation (of mitigation)
<p>based NAVAID which may be other than their planned destination or alternate. They therefore may not be aware of the weather conditions at the recovery airport.</p>	<p>weather minima are higher and more restrictive when using the GFA than when selecting an airport for which a TAF is issued.</p>	<p>planned destination or alternate is low.</p> <p>The risk of a pilot being unable to land at a recovery airport due to weather conditions is assessed to be moderate.</p>	<p>Mitigation is required.</p>		<p>airport</p> <p>This will reduce the likelihood of selecting a recovery airport that is below landing minima to ALARP.</p>

Appendix E

SUPPLEMENTARY INSTRUMENT PROCEDURES TO BE REVOKED

Aeronautical Study – NAVAID Modernization

Supplementary Instrument Procedures to be Revoked

In combination with the reduction in NDB and VOR NAVAIDs the study also considered the remaining inventory of instrument approach procedures available at Canadian airports and aerodromes. In addition to the instrument approach procedures to be revoked as a result of NAVAID decommission as described at Annex A, the following instrument approach procedures are assessed to be supplemental and can be revoked without reducing airport access.

Aerodrome	Ident	Procedures to be Revoked	Procedures Remaining
DEER LAKE	CYDF	VOR/DME A	ILS RWY 25 RNAV (GNSS) RWY 07 RNAV (GNSS) RWY 25
BAIE-COMEAU	CYBC	VOR/DME RWY 10 VOR/DME RWY 28 VOR RWY 28	ILS RWY 10 RNAV (GNSS) RWY 10 RNAV (GNSS) RWY 28
GASPÉ	CYGP	VOR/DME RWY 10	LOC RWY 10 VOR RWY 28 RNAV (GNSS) RWY 10 RNAV (GNSS) RWY 28
IQALUIT	CYFB	NDB A	ILS RWY 34 RNAV (GNSS) RWY 16 RNAV (GNSS) RWY 34
LA GRANDE RIVIÈRE	CYGL	VOR/DME RWY 13 VOR/DME RWY 31	VOR RWY 13 RNAV (GNSS) RWY 13 RNAV (GNSS) RWY 31
NATASHQUAN	CYNA	VOR/DME RWY 14 VOR/DME RWY 32	VOR RWY 32 RNAV (GNSS) RWY 14
PUVIRNITUQ	CYPX	NDB/DME RWY 01 NDB/DME RWY 19	NDB RWY 19 RNAV (GNSS) RWY 01 RNAV (GNSS) RWY 19
VAL-D'OR	CYVO	VOR/DME RWY 36	ILS/DME RWY 18 VOR RWY 18 (GNSS) RNAV (GNSS) RWY 36
WABUSH	CYWK	VOR/DME RWY 36	ILS/DME RWY 36 RNAV (GNSS) RWY 18 RNAV (GNSS) RWY 36
KITCHENER/WATERLOO	CYKF	NDB/DME RWY 26	ILS/DME RWY 26 RNAV (GNSS) RWY 08 RNAV (GNSS) RWY 26 RNAV (GNSS) RWY 32
MOOSONEE	CYMO	VOR/DME RWY 06 VOR/DME RWY 24	VOR RWY 06 VOR RWY 24 VOR RWY 32 (GNSS) RNAV (GNSS) RWY 06 RNAV (GNSS) RWY 24
SAULT STE. MARIE	CYAM	VOR/DME RWY 30	ILS RWY 12 VOR RWY 30 RNAV (GNSS) RWY 30
BAKER LAKE	CYBK	NDB A (TRUE)	VOR/DME RWY 34 (TRUE) VOR B (TRUE)
CAMBRIDGE BAY	CYCB	VOR/DME RWY 13 (True) VOR/DME RWY 31 (True)	VOR RWY 13 (True) RNAV (GNSS) Rwy 13 (True) RNAV (GNSS) Rwy 31 (True)

Aeronautical Study – NAVAID Modernization

Aerodrome	Ident	Procedures to be Revoked	Procedures Remaining
CHURCHILL	CYYQ	VOR/DME RWY 25	ILS RWY 33 VOR RWY 07 RNAV (GNSS) RWY 07 RNAV (GNSS) RWY 15 RNAV (GNSS) RWY 25 RNAV (GNSS) RWY 33
GILLAM	CYGX	NDB/DME RWY 05 NDB/DME RWY 23	To be developed RNAV (GNSS) RWY 05 RNAV (GNSS) RWY 23 Currently in place NDB RWY 05 NDB RWY 23
LA RONGE	CYVC	VOR/DME RWY 18 VOR/DME RWY 36	VOR RWY 18 RNAV (GNSS) RWY 18 RNAV (GNSS) RWY 36
LYNN LAKE	CYYL	VOR/DME RWY 17 VOR/DME RWY 35	VOR RWY 17 RNAV (GNSS) RWY 17 RNAV (GNSS) RWY 35
RED LAKE	CYRL	VOR/DME RWY 08 VOR/DME RWY 26	VOR RWY 08 RNAV (GNSS) RWY 08 RNAV (GNSS) RWY 26
FORT SMITH	CYSM	VOR/DME RWY 12 VOR/DME RWY 30	VOR RWY 12 RNAV (GNSS) RWY 12 RNAV (GNSS) RWY 30
GRANDE PRAIRIE	CYQU	VOR/DME RWY 25	ILS RWY 30 VOR RWY 07 RNAV(GNSS) Z RWY 07 RNAV(GNSS) Z RWY 12 RNAV(GNSS) Z RWY 25 RNAV(GNSS) Z RWY 30
HALL BEACH	CYUX	VOR/DME RWY 12 (TRUE) VOR/DME RWY 30 (TRUE) NDB RWY 12 (TRUE) NDB RWY 30 (TRUE)	VOR RWY 12 (TRUE) VOR RWY 30 (TRUE) RNAV (GNSS) RWY 12 (TRUE) RNAV (GNSS) RWY 30 (TRUE)
INUVIK	CYEV	NDB A	VOR/DME RWY 24 ILS/DME RWY 06 RNAV (GNSS) RWY 24 RNAV (GNSS) RWY 06
NORMAN WELLS	CYVQ	VOR B NDB RWY 28	VOR/DME RWY 01 VOR/DME RWY 28 RNAV(GNSS) RWY 10 RNAV(GNSS) RWY 28
PEACE RIVER	CYPE	VOR A	VOR/DME RWY 04 VOR/DME RWY 22
RANKIN INLET	CYRT	VOR/DME RWY 13 (TRUE) NDB RWY 31 (TRUE)	VOR RWY 13 (TRUE) VOR/DME RWY 31 (TRUE) RNAV (GNSS) RWY 13 (TRUE) RNAV (GNSS) RWY 31 (TRUE)
WHITECOURT	CYZU	VOR/DME RWY 11	VOR RWY 11 VOR/DME RWY 29

Aeronautical Study – NAVAID Modernization

Aerodrome	Ident	Procedures to be Revoked	Procedures Remaining
YELLOWKNIFE	CYZF	VOR/DME RWY 10 VOR/DME RWY 16 NDB RWY 34	ILS RWY 34 VOR RWY 10 VOR RWY 16 RNAV(GNSS) RWY 10 RNAV(GNSS) RWY 16 RNAV(GNSS) RWY 28 RNAV(GNSS) RWY 34
CAMPBELL RIVER	CYBL	NDB A	ILS RWY 12 RNAV (GNSS) RWY 12 RNAV (GNSS) RWY 30
TERRACE	CYXT	NDB/DME A	ILS Z RWY 33 RNAV (GNSS) Z RWY 33
THOMPSON	CYTH	VOR/DME RWY 06	ILS RWY 06 RNAV(GNSS) RWY 06 RNAV(GNSS) RWY 24

Appendix F

DME LOCATIONS

Aeronautical Study – NAVAID Modernization

Name	Identification	Channel	Latitude	Longitude
Koala (Ekati)	4A	55X	644153N	1103633W
Fox Creek	5F	37X	542245N	1164534W
Fort Vermilion	5U	25X	582412N	1155645W
Red Deer	6G	85X	521052.2667N	1135257.5729W
Powell River	9S	30X	495008N	1242957W
Kincardine	D7	20X	441209.1904N	0813610.0360W
Wabasca	E3	41X	555748N	1134924W
Gillam	GX	91X	562126.93N	0944213.78W
Norway House	NE	98X	535819N	0975030W
Wetaskiwin	P2	74X	525801.2775N	1132440.0039W
Pickle Lake	PL	84X	512637.38N	0901322.26W
Alert	ULT	44X	823102N	0621843W
Salmon Arm	V6	27X	504107.998N	1191403.396W
Sioux Narrows (Kenora)	VBI	99X	492836.9248N	0940248.2458W
Saguenay	VBS	89X	480101.66N	0711609.41W
Coehill	VIE	98X	443939N	0775317W
Langruth	VLR	59X	502520.48N	0984325.26W
Beauce (St-Georges)	VLV	119X	455530.2026N	0705045.7384W
Waterloo	WT	97X	432730.9035N	0802245.7814W
Castlegar	XCG	38X	491509.0905N	1173947.6667W
Sioux Lookout	XL	78X	500703.7902N	0915354.9715W
Kamloops	XPP	36X	504223.4362N	1202736.5006W
Penticton	XYF	40X	492709.2186N	1193613.5478W
Ameson	YAN	71X	494641N	0843528W
St. Anthony	YAY	84X	512338.1064N	0560501.4980W
Baie-Comeau	YBC	124X	490802.4778N	0681319.3084W
Baker Lake	YBK	92X	641917.1637N	0960616.7106W
Brandon	YBR	85X	495435.5999N	0995644.433W
Cambridge Bay	YCB	74X	690702.8128N	1051021.7779W
Campbellford	YCF	82X	441959.1322N	0774216.5306W
Princeton	YDC	86X	492253.55N	1202225.60W
Deer Lake	YDF	80X	491356.5100N	0571247.8125W
Dauphin	YDN	108X	510617.7625N	1000308.4260W
Broadview	YDR	122X	502146.6044N	1023225.1444W
Empress	YEA	106X	505534.0886N	1095922.3721W
Midland	YEE	75X	443454.4752N	0794735.5507W
Edmonton	YEG	123X	531108.0935N	1135200.6258W
Inuvik	YEV	72X	681829.0467N	1333253.7414W
Fredericton	YFC	77X	455341.2227N	0662508.0456W
Fort Simpson	YFS	126X	614625.9452N	1211755.5534W
Fort Good Hope	YGH	70X	661410.5531N	1283722.9788W
La Grande Riviere	YGL	59X	533731.8411N	0774258.4442W
Gaspe	YGP	101X	484547.3N	0642416.8W
Geraldton	YGQ	89X	494610.9897N	0865903.5575W
Grindstone (Iles-De-La-Madeleine)	YGR	57X	472548.5994N	0614626.1487W
Hay River	YHY	86X	605010.5552N	1154811.7690W
Halifax	YHZ	98X	445523N	0632407W
St-Jean	YJN	105X	451520.8859N	0731916.7036W
Stephenville	YJT	78X	483456.9104N	0584009.1225W
Key Lake	YKJ	100X	571002.01N	1055027.68W
Schefferville	YKL	74X	544852.1667N	0664517.6218W
Fort McMurray	YMM	57X	563850N	1110720W
Moosonee	YMO	76X	511729N	0803626W
Mans	YMS	92X	440835.3938N	0800847.1073W

Aeronautical Study – NAVAID Modernization

Name	Identification	Channel	Latitude	Longitude
Chiboo (Chapais)	YMT	58X	494800.1829N	0742944.4559W
Mirabel	YMX	114X	455317.4895N	0742232.5215W
Natash	YNA	83X	501101.0008N	0614651.1719W
Enderby	YNY	99X	504040.1818N	1185619.6415W
Oshawa	YO	50Y	435507.1832N	0785308.2616W
High Level	YOJ	80X	583315.3440N	1170534.8554W
Ottawa	YOW	93X	452630.28N	0755348.71W
Prince Albert	YPA	77X	531259.0513N	1053959.3419W
Peace River	YPE	119X	561224.9177N	1173042.4787W
Portage (Southport)	YPG	93X	495358.8N	0981602.1W
Puvirnitug	YPX	82X	600332.1522N	0771748.2507W
The Pas	YQD	83X	535824.5237N	1010559.6657W
Windsor	YQG	85X	421458.9581N	0824944.1659W
Watson Lake	YQH	96X	600511.4936N	1285127.2920W
Yarmouth	YQI	80X	434930.4083N	0660456.9084W
Lethbridge	YQL	104X	493803.86N	1124004.38W
Moncton	YQM	120X	461119.80N	0643416.60W
Aylmer (St. Thomas Muni)	YQO	89X	424224.5100N	0805316.6378W
Thunder Bay	YQT	88X	481513.60N	0892614.60W
Grande Prairie	YQU	78X	551027.15N	1190148.74W
Yorkton	YQV	105X	511550.5975N	1022807.3996W
Gander	YQX	74X	485358.7288N	0543206.0426W
Sydney	YQY	96X	460912.16N	0600320.76W
Resolute Bay	YRB	58X	744340.5610N	0945521.8302W
Red Lake	YRL	87X	510417.5934N	0934543.3342W
Rocky Mtn. House	YRM	90X	523007.9010N	1151924.8324W
Rankin Inlet	YRT	71X	624850.2923N	0920702.4158W
Sudbury	YSB	70X	463744.9153N	0804753.6343W
Sherbrooke	YSC	79X	451858.7476N	0714717.1867W
Saint John	YSJ	82X	452426N	0655215W
Fort Smith	YSM	71X	600112.3179N	1115809.6537W
Simcoe (Lindsay)	YSO	120Y	441418.4704N	0791017.9369W
Marathon	YSP	106X	484436.3259N	0861939.2941W
Thompson	YTH	76X	554839.5674N	0974930.6568W
Pearson (Toronto/LBP Intl)	YTP	112Y	434018.0555N	0793950.454W
Timmins	YTS	77X	483419.5N	0812212.2W
Kapuskasing	YU	30X	492442.4339N	0822754.3292W
Montreal	YUL	110X	453656.6680N	0735815.3403W
Hall Beach	YUX	120X	684641.9725N	0811421.8442W
La Ronge	YVC	70X	550929.7978N	1051600.5247W
Val-D'or	YVO	84X	481030.97N	0774913W
Kujack (Kuujuuaq)	YVP	72X	580546.1320N	0682537.9279W
Norman Wells	YVQ	74X	651553.8783N	1264326.7733W
Vancouver	YVR	106X	490438.4306N	1230856.6325W
Wiaraton	YVV	124X	444441.3909N	0810617.9047W
Wabush	YWK	70X	525736.3410N	0665112.7043W
Williams Lake	YWL	83X	521413.60N	1221007.90W
Wainwright	YWV	92X	525853N	1104959.79W
Wrigley	YWY	78X	631108.2729N	1232149.4545W
Cranbrook	YXC	58X	493315.3904N	1160517.8863W
Killaloe	YXI	103X	453946.7781N	0773608.6040W
Fort St. John	YXJ	89X	561703N	1205344W
Prince George	YXS	70X	535339.4466N	1222723.2676W
London	YXU	119X	430216.4780N	0810856.1466W
Whitehorse	YXY	113X	603708N	1350820W
Wawa	YXZ	74X	475702.4221N	0844922.1302W
North Bay	YYB	101X	462150.0735N	0792611.0567W
Calgary	YYC	114X	510654.10N	1135255.20W

Aeronautical Study – NAVAID Modernization

Name	Identification	Channel	Latitude	Longitude
Houston	YYD	94X	542708.44N	1263903.17W
Fort Nelson	YYE	76X	585330.8720N	1230057.5534W
Charlottetown	YYG	85X	461751.5045N	0630710.8613W
Victoria	YYJ	84X	484337.3803N	1232904.1604W
Lynn Lake	YYL	73X	565150.1519N	1010431.2331W
Swift Current	YYN	121X	501749.3534N	1074127.2495W
Churchill	YYQ	88X	584430.2848N	0940807.1245W
Goose	YYR	120X	531911N	0601741W
Torbay (St. John's Intl)	YYT	82X	472907.35N	0525107.93W
Mont-Joli	YYY	106X	483643.6661N	0681231.8954W
Toronto	YYZ	58Y	433928.8735N	0793753.1527W
Sandspit	YZP	88X	531507.8518N	1314825.6549W
Port Hardy	YZT	57X	504102.9041N	1272155.0957W
Whitecourt	YZU	72X	540844.3517N	1154749.9412W
Sept-Iles	YZV	92X	501355.65N	0661625.87W
Rainbow Lake	Z2	54X	582942N	1192446W
Coral Harbour	ZS	34X	640857N	0831810W

Appendix G

NDB AND VOR RETAINED

Aeronautical Study – NAVAID Modernization

NAVAID Remaining Post-NMP Implementation

Aerodrome	Ident	NAVAID
ALERT	LT	NDB
SAINT JOHN (ALPINE)	ZST	NDB
ARVIAT	YEK	NDB
ASHCROFT	YZA	NDB
AYLESFORD	GF	NDB
BAGOTVILLE	XBG	VORTAC
BAGOTVILLE	YBG	NDB
BAIE-COMEAU	YBC	VOR
BAKER LAKE	BK	NDB
BAKER LAKE	YBK	VOR
BELLA BELLA	YJQ	NDB
BIG TROUT LAKE	YTL	NDB
BLANC-SABLON	BX	NDB
QIKIQTARJUAQ (BROUGHTON)	YJI	NDB
CALGARY	YYC	VOR
CAMBRIDGE BAY	CB	NDB
CAMBRIDGE BAY	YCB	VOR
CAMPBELL RIVER	YBL	NDB
CAPE DORSET	YTE	NDB
CARTWRIGHT	CA	NDB
CHURCHILL	YYQ	VOR
CHIBOUGAMAU (CHIBOO)	MT	NDB
CLYDE RIVER	YCY	NDB
COLD LAKE	YOD	NDB
COPPERMINE	YCO	NDB
CORAL HARBOUR	YZS	NDB
CRANBROOK	YXC	VOR
DAWSON CITY	DA	NDB
DEASE LAKE	YDL	NDB
DEER LAKE	YDF	VOR
DELTA	UDE	NDB
EUREKA	YEU	NDB

Aeronautical Study – NAVAID Modernization

FLIN FLON	FO	NDB
FORT NELSON	YYE	VOR
FORT SEVERN	YER	NDB
FORT SIMPSON	YFS	VOR
FORT SMITH	YSM	VOR
FORT ST. JOHN	XJ	NDB
FORT ST. JOHN	YXJ	VOR
IQUALUIT (FROBAY)	YFY	NDB
IQUALUIT (FROBAY)	YFB	VOR
GANDER	YQX	VOR
GASPE	YGP	VOR
GERALDTON	YGQ	VOR
GILLAM	YGX	NDB
GOOSE BAY (GOOSE)	YR	NDB
GOOSE BAY (GOOSE)	YYR	VOR
GRANDE PRARIE	YQU	VOR
GREENWOOD	YZX	NDB
HALIFAX	YHZ	VOR
HALL BEACH	UX	NDB
HALL BEACH	YUX	VOR
HAY RIVER	YHY	VOR
HIGH LEVEL	YOJ	VOR
ULUKHAKTOK / HOLMAN	HI	NDB
HOUSTON	YYD	VOR
INUVIK	EV	NDB
INUVIK	YEV	VOR
ISLAND LAKE	YIV	NDB
IVUJIVIK	YIK	NDB
KUUJJUARAPIK (JARPIK)	GW	NDB
KANGIRSUK	YAS	NDB
KITIMAT	ZKI	NDB
KUUJJUAQ	YVP	VOR
LA GRAND RIVIERE	YGL	VOR
LA RONGE	YVC	VOR
LETHBRIDGE	YQL	VOR
LLOYDMINSTER	YLL	NDB
REGINA (LUMSDEN)	VLN	VORTAC
LYNN LAKE	YYL	VOR
MARY'S HARBOUR	YMH	NDB

Aeronautical Study – NAVAID Modernization

MAYO	MA	NDB
MONTREAL	YUL	VOR
MOOSE JAW	YMJ	VORTAC
MOOSONEE	YMO	VOR
NAIN	YDP	NDB
NAMAO	EB	NDB
NATSHQUAN (NATASH)	YNA	VOR
NORMAN WELLS	VQ	NDB
NORMAN WELLS	YVQ	VOR
OLD CROW	YOC	NDB
PANGNIRTUNG	YXP	NDB
PAULATUK	YPC	NDB
PEACE RIVER	YPE	VOR
PEAWANUCK	YPO	NDB
PEMBROKE	YTA	NDB
PETAWAWA	YWA	NDB
PETERBOROUGH	YPQ	NDB
PICKLE LAKE	YPL	NDB
POND INLET	YIO	NDB
PORT HARDY	YZT	VOR
PORTAGE LA PRAIRIE/SOUTHPORT (PORTAGE)	YPG	VOR
PRINCE GEORGE	YXS	VOR
PRINCE RUPERT	PR	NDB
PRINCETON	DC	NDB
PRINCETON	YDC	VORTAC
PUVIRNITUQ	YPX	NDB
RANKIN INLET	RT	NDB
RANKIN INLET	YRT	VOR
RED DEER	YQF	NDB
RED LAKE	YRL	VOR
REPULSE BAY	YUT	NDB
RESOLUTE BAY	RB	NDB
RESOLUTE BAY	YRB	VOR
ROBERVAL	RJ	NDB
ROCKY MTN. HOUSE	YRM	VOR
SANDSPIT	YZP	VOR
SEVERN	ZZR	NDB
SIOUX LOOKOUT	YXL	NDB
ST. ANTHONY	YAY	VOR

Aeronautical Study – NAVAID Modernization

ST. JEAN	YJN	VORTAC
ST. HONORE	YRC	NDB
STONY RAPIDS	YSF	NDB
TALOYOAK	YYH	NDB
TERRACE	XT	NDB
THOMPSON	YTH	VOR
TIMMINS	YTS	VOR
ST. JOHN'S (TORBAY)	YYT	VOR
TORONTO	YYZ	VOR
TORONTO (PEARSON)	YTP	VOR
TRENTON	YTR	NDB
TROIS-RIVIERES	YRQ	NDB
VAL-D'OR	YVO	VOR
VANCOUVER	YVR	VOR
WABUSH	YWK	VOR
ATTAWAPISKAT (WAPISK)	YAT	NDB
WASKAGANISH	YKQ	NDB
WATSON LAKE	YQH	VOR
WHITCOURT	YZU	VOR
WHITEHORSE	YXY	VOR
WIARTON	YVV	VOR
WILLIAMS LAKE	YWL	VOR
WINDSOR	YZR	VOR
YELLOWKNIFE	ZF	NDB
YELLOWKNIFE	YZF	VOR