Communication Navigation Surveillance (CNS) Operations Plan

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Foreward

Advances in communication, navigation and surveillance (CNS) technologies have enabled many changes in airspace design, separation minima, airport access, procedure design and air traffic management. These changes will enable the air navigation system to evolve in important ways that will improve the overall safety and operational efficiency for all stakeholders.

Following up on the success of the Performance-based Navigation (PBN) Working Group involving customers and NAV CANADA staff, a request was made of the Air Transport Operations Consultation Committee (ATOOCC), to stand up a group to look at the Communications, Navigation and Surveillance environment for Canada as a whole. That new group had as its first task the development of the CNS Operations Plan.

This document outlines the near and medium-term goals that will continue to advance the use of CNS technologies in Canadian domestic airspace. NAV CANADA's CNS Operations Plan has been developed collaboratively with our customers and stakeholders in recognition of the shared role, responsibility and benefits that advances in CNS technology represent.

Regards,

Jeff Dawson
Director, ATS Standards

Outline

New operational Communication, Navigation and Surveillance (CNS) initiatives will be explored to help:

- improve the safety of departure, enroute, terminal and approach operations,
- improve operational efficiency by reducing track miles flown,
- reduce infrastructure costs,
- increase airspace capacity, and
- reduce the environmental impact through reduced emissions and potential to reduce exposure to noise.

The development of this plan follows the guidance outlined in Canada's Performance-based Navigation (PBN) State Plan, published by Transport Canada, and leverages NAV CANADA's Air Traffic Management (ATM) advances as well as customer investments in capabilities, to improve service delivery.

NAV CANADA's CNS Operations Plan is designed to assist the aviation community in planning future transition and investment strategies. Aircraft operators can use this plan to forecast future CNS equipage and capability investments. Aircraft operators falling behind on upgrades may temporarily be accommodated but will not fully realize efficiencies and could face delays and/or future restrictions. As customers upgrade their avionics, greater ATM opportunities will be presented with the potential for future seamless gate-to-gate operations. During transitions, there will be periods of mixed mode operations that will be necessary as new technologies are deployed to existing operations. NAV CANADA's goal is to move towards a CNS service philosophy of "most capable, best served". This philosophy allows for early return on investment in CNS technology by customers, while avoiding being overly punitive to customers who choose to equip later in the transition.

The CNS Operations Plan describes NAV CANADA's initiatives aimed at meeting customers' requirements. New initiatives are applied when justified by safety and/or financial considerations in areas where the appropriate regulatory and local environment exists.

This plan was drafted in collaboration with our customers and stakeholders and we thank all those who together have helped develop our plan.

Timeframe

This document details NAV CANADA's CNS goals from now until the end of 2025, and will be updated at a minimum every three years to ensure it remains current and continues to meet our customers' requirements.

Operational Communication Goals

Operational communications are key to any navigation and/or surveillance initiative. Very High Frequency (VHF) voice radiotelephony continues to remain the predominant method of communications across domestic airspace, but the next generation of communication will focus on increased use of SATVOICE and data link, with the benefits of high speed/high integrity data transfers, reduced frequency congestion and improved message clarity. The following goals will help us develop our operational communication capabilities:

Dial-up Remote Communication Outlets (DRCO) connect pilots, on-request, with a flight information centre through use of a commercial telephone line. **Replacing the few remaining DRCO in Canada with standard Remote Communications Outlets (RCO) would simplify pilot procedures and standardize the communication process.**
Goal: Carry out a review to determine the continued requirement of DRCOs.

The number of available Very High Frequency (VHF) assignments has increased over the years by splitting the radio spectrum into narrower bandwidths: from 50 kHz to 25 kHz channels and eventually to 8.33 kHz**. In North America, interdependencies in communications requirements are linked between Canada and the US, and while 8.33 kHz channel spacing may have been implemented in some European airspace not all VHF radios can use these new frequencies.**
Goal: Research if the FAA plans to implement 8.33KHz VHF frequency spacing.

Canadian and foreign military aircraft previously communicated with air traffic service using Ultra High Frequency (UHF) radios. **Many of these aircraft are nowadays also equipped with VHF radios.**
Goal: Carry out a review to determine the continued requirement for UHF voice communication.

Selective Calling (SELCAL) replaces voice calling with the transmission of code tones to the aircraft over international radiotelephony channels. **On 30 Nov 2022 ICAO will expand the SELCAL code tone pool from 16 to 32, therefore NAV CANADA may need to modify systems that support SELCAL.**
Goal: Develop a Concept of Operations to implement SELCAL 32 by 30 NOV 2022.

The aeronautical satellite voice communications system (SATVOICE) uses the public switched telephone network and/or dedicated networks to route calls between aircraft, and SATVOICE may be used for any communication service when operating in Canada or in the Gander oceanic control area. **Taking greater advantage of SATVOICE capabilities as a reliable communications system, especially in remote airspace, will provide key operational safety benefits.**
Goal: Explore the possibility to futher expand the use of SATVOICE.

Required Communication Performance (RCP) is a label that defines the performance standard type for operational communication transactions in the number of seconds, such as RCP 240. **Implementation of new reduced separation minimum is predicated on communication performance, and a new RCP type should be prescribed that is commensurate with improvements to SATVOICE technology.**
Goal: Develop an RCP appropriate to SATVOICE capability in coordination with ICAO.

Controller Pilot Data Link Communication Departure Clearance Services (CPDLC-DCL) provides appropriately equipped aircraft the delivery of departure clearances and revised departure clearances by data link**. CPDLC-DCL capable aircraft can receive initial clearances and revisions, as well as verify clearances with their dispatch faster and more efficiently.**
Goal: Trial the capability to use CPDLC-DCL clearances prior to departure and determine a list of sites for deployment.

Pre-Departure Clearances (PDC) using the Aeronautical Radio Incorporated (ARINC)620/622 protocol, can deliver an initial IFR clearance electronically via air-ground data link to qualified air operators who have an on-site computer capable of interfacing with ATC and the data link service provider. **PDC 620/622 clearances are in use at thirteen airports listed in AIP Canada GEN 3.4.**
Goal: Maintain PDC 620/622 clearances at existing airports.

Pre-Departure Clearances (PDC) using the ARINC623 protocol can deliver an initial IFR clearance electronically, directly to appropriately equipped aircraft. **Expanding the number of airports that offer this service would benefit customers who are unable to use the CPDLC-DCL service.**
Goal: Maintain PDC 623 clearances and investigate if additional sites could be added.

Controller Pilot Data Link Communication (CPDLC) systems exchange standardized text-based messages between aircraft and controllers, instead of having to rely on voice communication. **Air operators equipped and using CPDLC when airborne may be able to benefit from reduced separation and preferred routes/flight levels if the domestic airborne datalink service was expanded.**
Goal: Develop a Concept of Operations to expand airborne CPDLC deployment in Canada.

VHF Data Link (VDL) is a means of sending information between aircraft and VHF ground stations**. The next-generation VDL Mode 2 network is a high-speed digital communications network offering increased message capacity and could be more cost efficient than today's VHF Aircraft Communications Addressing and Reporting Systems (ACARS).**
Goal: Investigate the possibility of NAV CANADA implementing VDL Mode 2.

The Aeronautical Telecommunication Network (ATN) is a digital data communications network linking the diverse networks and technologies within the aeronautical environment into an internetwork**. The ATN was developed specifically for the aeronautical community and could initially supplement, and eventually replace, North America's legacy data link communication systems.**
Goal: Investigate the feasibility and benefits of implementing new ATN B2 messages.

Navigation Goals

The International Civil Aviation Organization (ICAO) laid out the performance-based navigation concept in the ICAO PBN Manual (Doc 9613) and urged all States to outline their strategies to implement PBN as expeditiously as practicable. Completion of the following navigation goals will help fulfil that assignment:

The development of necessary ATS routes ensures airspace capacity can be achieved where it is required, while maximizing the use of customer preferred trajectories elsewhere**. A PBN route structure can enhance airspace capacity through the further construction of closely spaced parallel routes offering opportunities for fewer restrictions in climb, descent and overtake scenarios in congested airspace.**
Goal: Where a route structure continues to be required, replace the existing Jet, Victor and Low Frequency (LF) airway structure with PBN routes.
Goal: By the end of 2022, the remaining ATS fixed route structure will be predominantly based on PBN.

Unique Canadian airspace designations of Canadian Minimum Navigation Performance Specifications (CMNPS) and Required Navigation Performance Capability (RNPC) predate the PBN concept yet contain some of the types of performance parameters found in ICAO's PBN Navigation Specifications. **To become ICAO PBN compliant, CMNPS and RNPC airspace need to be redesignated with appropriate Navigation Specifications.**
Goal: Develop a Concept of Operations to replace CMNPS with a PBN Navigation Specification.
Goal: Develop a Concept of Operations to replace RNPC with a PBN Navigation Specification.

Current track-to-track separations published in ICAO's Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM; Doc 4444) may not provide sufficient opportunities for service improvements in remote areas, and further investigation of using the "airspace to be protected" concept, based on derived protected airspaces for PBN, will need to be pursued. **The PBN Navigation Specification RNP 4 was specifically developed for operations in oceanic and remote airspace, therefore does not require a robust ground-based NAVAID infrastructure and could satisfy Canada's remote procedural airspace requirements.**
Goal: Investigate the use of RNP 4 for opportunities to increase efficiency in procedural airspaces.

Area navigation (RNAV) has been in use in terminal areas for many years; with most major terminal airspaces already using area navigation exclusively for Standard Terminal Arrivals (STAR) procedures. **Greater use of terminal procedures with PBN Navigation Specifications could result in a reduced need for airspace to be protected, and potentially narrower obstacle clearance areas, enabling more efficient use of terminal airspace.**

Goal: As terminal areas continue to redesign their arrival and departure routes for regulatory compliance or to improve efficiencies, more PBN Standard Instrument Departures (SIDs) will be introduced, some vector SIDs will remain, and all non-PBN STARs will be withdrawn.
ICAO recommends that States implement the most appropriate PBN Navigation Specification needed to meet the demands of the airspace. **Defining the level of accuracy needed by publishing an appropriate navigation specification can offer increases in efficiency in terminal areas.**
Goal: Navigation Specifications will be published on departure procedures, SIDs, STARs and approach procedures, where required, to increase airport capacity and/or efficiency.

Hybrid SIDs offer a balance between tactical efficiency and PBN structure, thereby making best use of the separation standards available, while RNAV or RNP SIDs are used when guidance off the ground is necessary or beneficial**. Operational requirements predicate the use of hybrid, RNAV or RNP SIDs, but future efficiencies could be gained by designing SIDs with crossing restrictions.**
Goal: More SIDs will be developed that are procedurally separated from STARs.
Goal: Procedure-design based separation will be implemented at some airports to support continuous climb and descent operations.

4D Trajectory Based Operations (TBO) is a concept for optimizing flights through the use of time-based management, information exchange between air and ground systems, and the aircrafts ability to fly precise paths in time and space**. TBO is expected to result in maximal utilization of available airspace with near optimal flight efficiency.**
Goal: Further investigate concepts and technology that could support the evolution of 4D TBO.

ICAO laid out the global concept of performance-based navigation in the PBN Manual (Doc 9613) and they have urged all States to develop plans for the implementation of PBN approach procedures as a priority. **In accordance with Canada's PBN State Plan, NAV CANADA is meeting the global objective of transitioning to a full PBN approach environment with necessary system redundancies.**
Goal: PBN approach procedures titled "RNAV (GNSS)" will be widely available and, where practical, developed with at least two distinct minima; one lateral-only minimum descent altitude (LNAV) and one lateral and vertical decision altitude (LNAV/VNAV and/or LPV).

Required Navigation Performance (RNP) Authorization Required (AR) approach procedures normally have segments with RNP values ranging from 1.00 to 0.30 NM, although lower lines of minima can be added where operational and financial considerations demonstrate a material benefit. **RNP AR approach procedures were originally intended for airports that otherwise would not have suitable access owing to the obstacle environment but, due to their unique design criteria, these procedures can also provide significant fuel, noise and environmental benefits at other airports frequented by enough suitably authorized air operators.**
Goal: Continue implementation of RNP AR approach procedures, titled “RNAV (RNP)”, based on a priority list provided by customers.
Goal: PBN approaches titled “RNAV (GNSS)” and titled “RNAV (RNP)” will become primary use approaches.

In a PBN approach environment, Instrument Landing Systems (ILS) are relied upon only when the weather is limiting, but since aircraft are typically vectored to the final approach it can be more challenging for flight crews to plan an appropriate descent. **PBN transitions to final can increase the ease of linking PBN STARs to ILS approaches and improve the effectiveness of continuous descent operations.**
Goal: Incorporate PBN transitions to ILS approaches where operationally beneficial.

Ground Based Augmentation System (GBAS) Landing System (GLS) technology can offer instrument approaches with minima equivalent to Instrument Landing Systems (ILS), supplementing precision approach operations. **Based on a positive business case, installation of GBAS and publication of GLS approaches at some airports could offer increased airport accessibility for appropriately equipped aircraft.**
Goal: Investigate the feasibility and benefits of introducing GBAS Landing Systems (GLS).

ILS, GLS and LPV approaches are flown using geometric final approach vertical paths and can offer relatively low decision altitudes. **Combining the flexibility of PBN flight path design with the final approach segment benefits of these procedures at more airports across the air navigation system could increase airport accessibility and benefit air operators.**
Goal: Investigate the feasibility and benefits of increasing the availability of geometric approach paths (xLS and LPV)

A PBN Radius to Fix (RF) leg can be used when there is a requirement for a specific curved path segment in a procedure, and is defined by radius, arc length and fix. **Navigation systems supporting RF legs provide the same ability to conform to the track-keeping accuracy during the turn as in straight line segments, thus can execute highly predictable and repeatable trajectories.**
Goal: Investigate the feasibility and benefits of using RF legs to final approach.

NAV CANADA and the Canadian Airports Council have outlined their commitment to transparency and effective engagement with communities potentially affected by proposed changes to airspace in the Airspace Change Communications and Consultation Protocol (ACCCP). **Recognizing that airspace changes can impact communities in material ways, our aim is to minimize these impacts while ensuring we continue to provide the necessary critical infrastructure as the demand for air travel continues to grow.**
Goal: Consider aircraft noise and potential environmental impacts when designing PBN approaches to ensure the procedures are as environmentally responsible as practical.

Established on RNP AR (EoR) is a new concept for parallel approach operations that integrates RNP AR approaches into busy parallel runways**. This concept is in use at Calgary International and leverages the accuracy of the approach to allow greater flexibility when managing the final approach segment, leading to significant reduction in track miles for both equipped and non-equipped aircraft.**
Goal: Implement EoR at additional major airports with parallel runways and explore expanding the concept to incorporate other approach types.

Traditional helicopter Point-In-Space Approaches (PINSA) allow for missed approach points (MAP) that are located a fair distance from the associated helicopter landing area. **Fixed wing aircraft able to safely maneuver at very slow speeds would benefit from increased aerodrome accessibility if they could also be authorized for PINSA.**
Goal: Explore the concept of Point-In-Space Approaches (PINSA) for fixed wing operations.

Instrument Landing System Special Authorization Category II (ILS SA CAT II) approaches are ILS CAT I approaches that under certain conditions can safely permit a lower decision height of 100 feet and Runway Visual Range (RVR) values as low as 1200 feet. **Air operators authorized to fly ILS SA CAT II approaches may benefit from increased airport accessibility during poor weather conditions.**
Goal: Continue to investigate the feasibility and benefits for ILS SA CAT II approaches.

ILS CAT III approaches are classified according to the minimum RVR values required and currently only ILS CAT IIIA has been authorized for use in Canada. **Air operators who are capable of safe operations when the RVR is between 600 feet and 150 feet (classified as ILS CAT IIIB) may benefit from increased airport accessibility during poor weather conditions.**
Goal: Explore the use of ILS CAT IIIB approaches.

The introduction of PBN has allowed for advances in system design, and satellite-based navigation presents opportunities to maintain or enhance safety while improving efficiency. **Maintaining the current network of ground-based NAVAIDs is no longer necessary, and not cost-effective for current-day operations.**
Goal: Implement the NAVAID Modernization Program to meet customer operational needs while maintaining an appropriate contingency structure.

The ICAO navigation specification Advanced RNP (A-RNP) provides for a single assessment of aircraft eligibility that will apply to more than one navigation accuracy requirement and multiple applications across all phases of flight**. The advantage in utilizing a designation of A-RNP for a flight operation is the combined performance and functionality of a range of Navigation Specifications encompassing all phases of flight.**
Goal: Investigate the feasibility and benefits of introducing the navigation specification A-RNP.

ICAO recognized a need for a navigation specification that has a single accuracy of 0.3 NM, primarily intended for all phases of helicopter flight (RNP 0.3). **Use of the navigation specification RNP 0.3 could enable a part of the IFR helicopter fleet to obtain greater benefits from PBN.**
Goal: Explore the implementation of the navigation specification RNP 0.3 for rotary-wing aircraft.

RNP AR Departure Procedures have highly predictable and repeatable trajectories and have recently been added to the procedure design criteria used in Canada. **Allowing reductions to lateral protection areas, RNP AR Departure Procedures could reduce and/or eliminate the departure divergence currently required at airports with parallel runways.**
Goal: Investigate the feasibility and benefits of introducing RNP AR Departure Procedures.

Magnetic heading references are no longer required in aircraft that use True North in navigational computations. **True North heading reference in a PBN operation would simplify aircraft operation and reduce costs going forward, eliminating legacy work from air navigation service providers, aircraft operators, airport operators, certification and database providers and greatly simplifying the navigation systems.**
Goal: Assist ICAO develop the True North concept.

Airport construction can impact instrument approach procedures and it can be challenging to align construction activities with AIRAC publication dates. **Based on a positive business case, the design and publication of Temporary Relocated Instrument Approach Procedures (TRIAP) during construction at some airports could maintain a minimum level of airport accessibility.**
Goal: Investigate the feasibility and benefits of introducing Temporary Relocated Instrument Approach Procedures (TRIAP).

Surveillance Goals

Today's surveillance technology includes radar, airport surface detection equipment, Automatic Dependent Surveillance-Broadcast (ADS-B), multilateration and video images, increasing safety and incrementally allowing customers to take advantage of improved separation standards. The following goals have been established to help harmonize the available sources of surveillance:

VHF Direction Finding (VHF DF) equipment is designed to provide emergency navigation assistance to VFR aircraft. **Due to the increased areas of surveillance coverage and the increase in percentage of transponder-equipped aircraft, providing emergency navigation assistance using VHF DF may no longer be the most effective means to assist pilots in times of difficulty.**
Goal: Carry out a review to determine the continued requirement for VHF DF.

There are four types of airborne surveillance systems currently used by ATC: primary surveillance radar, secondary surveillance radar, multilateration and ADS-B. **Maintaining the full legacy network of primary and secondary surveillance radars may no longer be necessary, and there may be opportunities to consolidate operations when multiple surveillance sources are available.**
Goal: Conduct aeronautical studies of the requirement for individual primary and secondary surveillance radar systems as required.

According to the PBN State Plan, Canada will plan for the mandatory use of ADS-B in designated airspace between 2018 and 2022. **NAV CANADA and Transport Canada responded to stakeholder feedback and valued industry input that indicates additional time is required to prepare for an ADS-B Out Performance Requirements Mandate.**
Goal: Use space-based ADS-B on a priority basis for surveillance in Class A airspace beginning 25 February 2021.
Goal: Use space-based ADS-B on a priority basis for surveillance in Class B airspace beginning 27 January 2022.
Goal: Use space-based ADS-B on a priority basis for surveillance in certain volumes of Class C,D and E airspace at future dates to be determined based on requirements, no sooner than January 2023.
Goal: Accomodate non ADS-B Out equipped aircraft within the airspace until a performance requirements mandate can be implemented.
Goal: Work closely with Transport Canada to develop the regulatory framework to support the implementation of an effective ADS-B mandate by January 2023.

The introduction of more widely available ATS surveillance capabilities through space-based ADS-B will provide opportunities to use ATS surveillance separation standards in conjunction with PBN to improve efficiencies, particularly in remote and oceanic airspace. **Availability of ADS-B OUT avionics to a broad range of customers and their ability to utilize them without undue restriction will determine the pace of future implementation.**
Goal: Carry out a review to determine the continued requirement for ground-based ADS-B sensors in Hudson's Bay area and the Southern Greenland/Eastern Shore of Labrador/Baffin Island area.
Goal: Carry out a review to determine the requirement for ground-based ADS-B sensors to optimize Spaced Based ADS-B where required.