



# Advisory Circular

**Subject: Performance-based Navigation (PBN) – Enroute**

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## 1.0 INTRODUCTION

- (1) This Advisory Circular (AC) is provided for information and guidance purposes. It describes an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. This AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards.

### 1.1 Purpose

- (1) The purpose of this AC is to inform the aviation industry that air operators and private operators may obtain a Canadian Special Authorization (SA) for Required Navigation Performance 2 (RNP 2) - Continental. This SA will enable Canadian air operators or private operators to operate within airspace designated as RNP 2 (Continental), subject to the applicable requirements in Appendix A of this AC. It will also form the basis upon which a foreign National Aviation Authority (NAA) may authorize, within their jurisdiction, a Canadian air operator or private operator to operate in RNP 2 (Continental) airspace.
- (2) Operators who possess a valid RNP APCH and/or RNP 1 Special Authorization (SA) satisfy most of the conditions required (minus a few training requirements) for the issuance of an RNP 2 (Continental) SA. The possession of an RNP APCH and/or RNP 1 SA does not constitute automatic authority for RNP 2 (Continental) operations. Operators who possess the RNP APCH and/or RNP 1 SA, who are seeking to add the RNP 2 (Continental) SA, shall submit an application, and shall provide proof that all training requirements have been satisfied.

### 1.2 Applicability

- (1) This AC applies to Foreign Air Operations, and to Canadian air operators holding an Air Operator Certificate (AOC) issued under Part VII of the *Canadian Aviation Regulations* (CARs) and to private operators holding a Private Operator Registration Document (PORD) issued under Subpart 604 of the CARs, who wish to operate in continental airspace requiring an RNP 2 navigation specification (NavSpec). They will be commonly referred to as the “operator” in this AC.
- (2) RNP 2 operational authorization in the form of a SA is required for enroute operations within Canadian Domestic Airspace designated as RNP 2 (Continental) airspace.
- (3) This document is also applicable to all Transport Canada Civil Aviation (TCCA) inspectors with surveillance duties, and to individuals and organizations that exercise privileges granted to them under an External Ministerial Delegation of Authority. This document is also aimed at the aviation industry at large for information purposes.

### 1.3 Description of Changes

- (1) Not applicable.

## 2.0 REFERENCES AND REQUIREMENTS

### 2.1 Reference Documents

- (1) It is intended that the following reference materials be used in conjunction with this document:
  - (a) *Aeronautics Act* (R.S., 1985, c. A-2);
  - (b) Part V of the *Canadian Aviation Regulations* (CARs)— *Airworthiness*;
  - (c) Subpart 604 of the CARs — *Private Operator Passenger Transportation*;

- (d) Subpart 702 of the CARs — *Aerial Work*;
- (e) Subpart 703 of the CARs — *Air Taxi*;
- (f) Subpart 704 of the CARs — *Commuter Operations*;
- (g) Subpart 705 of the CARs — *Airline Operations*;
- (h) Standard 624 of the CARs — *Private Operator Passenger Transportation*;
- (i) Standard 722 of the *Commercial Air Services Standards (CASS)* — *Aerial Work*;
- (j) Standard 723 of the CASS — *Air Taxi*;
- (k) Standard 724 of the CASS — *Commuter Operations*;
- (l) Standard 725 of the CASS — *Airline Operations*;
- (m) Transport Canada Publication (TP) 308 — *Criteria for the Development of Instrument Procedures*;
- (n) Federal Aviation Administration Advisory Circular (FAA AC) 90-105— *Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System*;
- (o) FAA AC 20-130() — *Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors*;
- (p) FAA AC 20-138() — *Airworthiness Approval of Positioning and Navigation Systems*;
- (q) International Civil Aviation Organization (ICAO) Doc 4444 — *Procedures for Air Navigation*;
- (r) ICAO Doc. 9613 — *Performance Based Navigation (PBN) Manual, Volume II Part C Chapter 2 Implementing RNP 2*;
- (s) ICAO Doc. 7030 — *Regional Supplementary Procedures*; and
- (t) Services — *Procedures for Air Navigation Services - Air traffic management (PANSATM)*.

## 2.2 Cancelled Documents

- (1) Not applicable.
- (2) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

## 2.3 Definitions and Abbreviations

- (1) The following **definitions** are used in this document:
  - (a) **Advisory Circular:** A document providing an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards.
  - (b) **Aircraft-based Augmentation System:** A system which augments and/or integrates the information obtained from other Global Navigation Satellite System (GNSS) elements with information available on board the aircraft. The most common form of Aircraft based Augmentation System (ABAS) is the receiver autonomous integrity monitoring (RAIM).
  - (c) **Air navigation services:** This term includes air traffic management (ATM), communications, navigation and surveillance systems (CNS); meteorological services for air navigation (MET); search and rescue (SAR); and aeronautical information services (AIS). These services are provided to air traffic during all phases of operations (enroute, terminal and approach).

- (d) **Air navigation services provider:** An independent entity established for the purpose of operating and managing air navigation services, and empowered to manage and use the revenues it generates to cover its costs. In Canada, this function is normally performed by NAV CANADA.
- (e) **Area Navigation:** A navigation system that allows aircraft to operate on any desired flight track within the coverage of ground- or space-based navigation aids, or within the limits of the capability of self-contained aids, or a combination of both methods. Area navigation includes performance-based navigation (PBN) as well as other operations that are not contemplated in the definition of performance-based navigation.
  - (i) **Required Navigation Performance (RNP):** Area navigation system that includes the requirement for on-board performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH.
  - (ii) **Area Navigation (RNAV):** Area navigation system that does not include the requirement for on-board performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1.
- (f) **Global Navigation Satellite System:** A generic term used by the International Civil Aviation Organization (ICAO) to define any global position, speed, and time determination system that includes one or more main satellite constellations, such as Global Positioning System (GPS) and the global navigation satellite system (GLONASS), aircraft receivers and several integrity monitoring systems, including ABAS, satellite-based augmentation systems (SBAS), such as the wide area augmentation systems (WAAS), and ground-based augmentation systems (GBAS), such as the local area augmentation system (LAAS).
- (g) **Global Positioning System:** The global navigation satellite system of the United States is a satellite-based radio navigation system that uses precise distance measurements to determine position, speed, and time in any part of the world. The GPS is made up of three elements: the spatial, the control, and the user elements. The GPS spatial segment nominally consists of at least 24 satellites in 6 orbital planes. The control element consists of 5 monitoring stations, 3 ground antennas, and one main control station. The user element consists of antennas and receivers that provide the user with position, speed, and precise time.
- (h) **Navigation specification:** A set of requirements needed to implement and support performance based navigation within a defined airspace.
- (i) **Performance Based Navigation:** Area navigation based on performance requirements for aircraft operating along an Air Traffic Service (ATS) route, on an instrument approach procedure or in a designated airspace.

**Note.** *The performance requirements of a navigation specification (RNAV specification or RNP specification) are expressed in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept.*

- (j) **RNP operations:** Aircraft operations that use an RNP system for RNP applications.
- (k) **RNP system:** An area navigation system which includes on-board performance monitoring and alerting.
- (l) **Receiver Autonomous Integrity Monitoring:** A form of ABAS whereby a GNSS receiver processor determines the integrity of the GNSS navigation signals using only GPS signals or GPS signals augmented with altitude (baro-aiding). This determination is achieved by a consistency check among redundant pseudo-range measurements. At least one additional satellite with the correct geometry needs to be available, over and

above that needed for the position estimation, for the receiver to perform the RAIM function.

- (m) **Satellite-based augmentation system:** A wide coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter. The WAAS is a form of SBAS.
  - (n) **Technical Standard Order:** A minimum performance standard for specified materials, parts, and appliances used on civil aircraft.
  - (o) **Total System Error:** The difference between the true position and the desired position. This error is equal to the sum of the vectors of the path definition error (PDE), the flight technical error (FTE), and the navigation system error (NSE).
    - (i) **Flight Technical Error (FTE):** The FTE is the accuracy with which an aircraft is controlled as measured by the indicated aircraft position with respect to the indicated command or desired position. It does not include blunder errors.
    - (ii) **Navigation System Error (NSE):** The difference between the true position and the estimated position.
    - (iii) **Path Definition Error (PDE):** The difference between the defined path and the desired path at a given place and time.
  - (p) **World Geodetic System 1984 (WGS 84):** The most recent geocentric reference system definition developed by the United States Department of Defense (World Geodetic System Committee).
- (2) The following **abbreviations** are used in this document:
- (a) **ABAS:** Aircraft-Based Augmentation System;
  - (b) **AC:** Advisory Circular;
  - (c) **AFM:** Aircraft Flight Manual;
  - (d) **AIP:** Aeronautical Information Publication;
  - (e) **AIRAC:** Aeronautical Information Regulation and Control;
  - (f) **AIS:** Aeronautical Information Services;
  - (g) **ANSP:** Air Navigation Service Provider;
  - (h) **AOC:** Air Operator Certificate;
  - (i) **ATM:** Air Traffic Management;
  - (j) **ATS:** Air Traffic Services;
  - (k) **CARs:** Canadian Aviation Regulations;
  - (l) **CASS:** Commercial Air Service Standard;
  - (m) **CNS:** Communications Navigation Surveillance;
  - (n) **EGNOS:** European Geostationary Navigation Overlay Service (Europe);
  - (o) **FAA:** Federal Aviation Administration;
  - (p) **FTE:** Flight Technical Error;
  - (q) **GLONASS:** Globalnaya Navigatsionnaya Sputnikovaya Sistema (Russian);
  - (r) **GNSS:** Global Navigation Satellite System;
  - (s) **GPS:** Global Positioning System;

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(t)	<b>ICAO:</b>	International Civil Aviation Organization;
(u)	<b>IFR:</b>	Instrument Flight Rules;
(v)	<b>LAAS:</b>	Local Area Augmentation System;
(w)	<b>LOA:</b>	Letter of Authorization;
(x)	<b>MEL:</b>	Minimum Equipment List;
(y)	<b>MET:</b>	Meteorological services;
(z)	<b>NAA:</b>	National Aviation Authority;
(aa)	<b>NAT HLA:</b>	North Atlantic High Level Airspace;
(bb)	<b>NAVAID:</b>	Navigational Aid;
(cc)	<b>NavSpec:</b>	Navigation Specification;
(dd)	<b>NM:</b>	Nautical Mile;
(ee)	<b>NOTAM:</b>	Notice to Airmen;
(ff)	<b>NSE:</b>	Navigation System Error;
(gg)	<b>OEM:</b>	Original Equipment Manufacturer;
(hh)	<b>OM:</b>	Operations Manual;
(ii)	<b>PBN:</b>	Performance Based Navigation;
(jj)	<b>PDE:</b>	Path Definition Error;
(kk)	<b>PORD:</b>	Private Operator Registration Document;
(ll)	<b>RNAV:</b>	Area Navigation;
(mm)	<b>RAC:</b>	Rules of the Air (TCCA – Aeronautical Information Manual);
(nn)	<b>RAIM:</b>	Receiver Autonomous Integrity Monitoring;
(oo)	<b>RNP:</b>	Required Navigation Performance;
(pp)	<b>RTCA:</b>	Radio Technical Commission for Aeronautics;
(qq)	<b>SA:</b>	Special Authorization;
(rr)	<b>SAR:</b>	Search and Rescue;
(ss)	<b>SBAS:</b>	Satellite-Based Augmentation System;
(tt)	<b>SIS:</b>	Signal in Space;
(uu)	<b>SOPs:</b>	Standard Operating Procedures;
(vv)	<b>TSE:</b>	Total System Error;
(ww)	<b>TSO:</b>	Technical Standard Order;
(xx)	<b>TCCA:</b>	Transport Canada Civil Aviation;
(yy)	<b>WAAS:</b>	Wide Area Augmentation System; and
(zz)	<b>XTE:</b>	Cross Track Error.

### 3.0 BACKGROUND

- (1) **ICAO PBN Manual** – The material described in this Advisory Circular (AC) has been developed based on International Civil Aviation Organization (ICAO) Doc 9613 — *Performance-based Navigation (PBN) Manual*, Vol. II Part C Chapter 2 Implementing RNP 2 (Required Navigation Performance 2).
- (2) **Requirements** – This AC does not establish all the requirements that may be specified for particular operations. These requirements are established in other documents, such as the Transport Canada Publication (TP) 308 — *Criteria for the Development of Instrument Procedures* and ICAO Doc 7030 — *Regional Supplementary Procedures*. Operational approval is normally related to airspace requirements; operators must consider the operational documents required by Transport Canada Civil Aviation (TCCA) before conducting flights in Canadian RNP 2 (Continental) airspace.
- (3) **RNP 2 (Continental) Operations**
  - (a) **Purpose** – is primarily intended for a diverse set of enroute applications, particularly in geographic areas with little or no ground Navigational Aid (NAVAID) infrastructure, limited or no Air Traffic Services (ATS) surveillance, and low to medium density traffic. The RNP 2 specification is based upon GNSS. Operators relying on Global Navigation Satellite System (GNSS) are required to have the means to predict the availability of GNSS fault detection to support operations along the RNP 2 ATS route. RNP 2 is not to be used in areas of known GNSS signal interference. **RNP 2 (Oceanic/Remote)** – this AC does not establish requirements for RNP 2 (Oceanic/Remote) operations in North Atlantic High Level Airspace (NAT HLA). RNP 2 (Oceanic/Remote) has additional requirements over those for RNP 2 Continental (more stringent system continuity requirements). A separate AC will be published when RNP 2 (Oceanic/Remote) operations are implemented in Canadian-controlled airspace.
  - (b) **Conditions** – Appendix A provides the specific conditions to be entered into the special authorization (SA) for **RNP 2 (Continental)** operations. The intent is to refer to these conditions in the operator's Air Operator Certificate (AOC) or Private Operator Registration Document (PORD). Appendix B contains a compliance checklist that is intended to be used as a tool for both operators and inspectors.
  - (c) Appendix Z of this document provides the specific conditions to be entered into the SA for Foreign Operator Continental RNP 2 operations.

### 4.0 SPECIFIC GUIDANCE – OPERATOR REQUIREMENTS

- (1) Foreign air operators must have RNP 2 authorization from their National Aviation Authority (NAA) in order to obtain a Canadian foreign air operator certificate (FAOC) SA for RNP 2 operations in Canada. Operators must contact the National Operations, Foreign Operations Division at [foa-aoe@tc.gc.ca](mailto:foa-aoe@tc.gc.ca) to initiate the FAOC application/amendment process.
- (2) Guidance material is provided in the form of tables in the main body of this AC. Guidance information in the tables refers directly to specific conditions in Appendix A.
- (3) **Qualification** – Airworthiness certification and recognition of RNP 2 aircraft qualification together do not authorize RNP 2 (Continental) operations. Operational approval is also required to confirm the adequacy of the operator's normal and contingency procedures for the particular equipment installation.
- (4) **Approval** – This document delineates the requirements/criteria that must be addressed by the operator to obtain an RNP 2 (Continental) SA. If the operator already meets the technical and operational criteria, recertification is not required.

(5) **General Operating Procedures**

- (a) **Lateral cross checks** – The pilot does not need to cross-check lateral navigation guidance with conventional NAVAIDs due to automated integrity alerting.
- (b) **Bank limiting** – Manually selecting or use of default aircraft bank limiting functions may reduce the aircraft's ability to maintain desired track and the pilot should not use these functions. Pilots should understand that manual selection of aircraft bank-limiting functions may reduce their ability to satisfy Air Traffic Control (ATC) path expectations, especially when executing large angle turns. However, pilots should not deviate from Aircraft Flight Manual (AFM) procedures and should limit the use of such functions within accepted procedures that meet the requirements for operation on an RNP 2 route.
- (c) **RNP Value** – Pilots of aircraft with RNP input selection capability should select a navigation accuracy value of 2 Nautical Mile (NM), or lower. The selection of the navigation accuracy value should ensure the RNP system offers appropriate lateral deviation scaling permitting the pilot to monitor lateral deviation and meet the requirements of the RNP 2 operation.

(6) **Specific Guidance**

Appendix A Condition	Guidance
1.0 (1) (a)	<b>Equipment</b> – The operator should confirm with the Original Equipment Manufacturer (OEM), or the holder of installation approval for the aircraft, that acceptance of subsequent changes in the aircraft configuration do not invalidate the RNP 2 capability.
1.0 (2) (a) (i)	<b>Flight Plan Suffixes</b> – The appropriate suffixes for use with ICAO Flight Plan forms applicable to RNP 2 (Continental) operations can be found in the AIP (Canada).
1.0 (2) (a) (iii)	<b>Infrastructure</b> – ICAO Annex 10 Aeronautical Telecommunications requires GNSS integrity (Receiver Autonomous Integrity Monitoring (RAIM) or Space-based Augmentation System (SBAS) signal), procedures should determine the availability of these services and functions as appropriate. For aircraft navigating with SBAS capability, operators should check appropriate GNSS RAIM availability in areas where the SBAS signal is unavailable.
1.0 (2) (b)	<b>Failure</b> – Pilots should prepare to assess their capability to navigate in case of failure of GNSS navigation on RNP 2 (Continental).
1.0 (2) (f)	<b>Lateral Deviation</b> – For normal operations, Cross-Track Error (XTE)/ deviation should be limited to $\pm\frac{1}{2}$ the navigation accuracy associated with the route. Brief deviations from this standard during and immediately after turns, up to a maximum of one times the navigation accuracy are allowable. Some aircraft do not display or compute a path during turns, therefore, pilots of these aircraft may not be able to confirm adherence to the $\pm\frac{1}{2}$ lateral navigation accuracy during turns, but must satisfy the standard during intercepts following turns and on straight segments. If ATC issues a heading assignment that takes an aircraft off a route, the pilot should not modify the flight plan in the RNP system until they receive a clearance to rejoin the route or the controller confirms a new route clearance.
1.0 (2) (g)	<b>Contingency</b> – The loss of RNP 2 capability includes any failure or event causing the aircraft to no longer satisfy the RNP 2 requirements.
1.0 (3) (a)	<b>Training</b> – Operators need not establish a separate training programme if they already integrate RNAV training as an element of their training programme. However, the operator should be able to identify the aspects of RNP 2 (Continental) covered within their training programme.
1.0 (3) (a)	<b>Training</b> – Private operators should operate using the practices and procedures identified in the “Pilot knowledge and training” section of ICAO Doc. 9613, <i>Performance Based Navigation (PBN) Manual</i> , Volume II Part C Chapter 2 Implementing RNP 2.

Appendix A Condition	Guidance
1.0 (4)	<b>Database</b> – There may be a slight difference between the navigation information portrayed on the chart and the primary navigation display. Track angular differences of 3 degrees or less may result from the equipment manufacturer’s application of magnetic variation and are operationally acceptable.
1.0 (4) (a)	<b>Data Source</b> – Transport Canada recognizes compliance to the referenced standard using a Letter of Authorization (LOA) or other equivalent document.

## 5.0 SPECIFIC GUIDANCE – AIRCRAFT REQUIREMENTS

- (1) **Purpose** – The purpose of this section is to assist operators in determining if their aircraft are eligible to be considered for approval to conduct RNP 2 (Continental) operations in Canadian-controlled airspace. Aircraft eligibility alone does not authorize RNP 2 (Continental) operations.
- (2) **Compliance** - The aircraft eligibility must be determined through demonstration of compliance against the relevant airworthiness criteria and the criteria contained in Appendix A of this AC. Specifically, the equipment certification and installation must meet:
  - (a) the applicable certification regulations and standards for the aircraft model as identified in the aircraft Type Certificate Data Sheet.
  - (b) the aircraft eligibility and aircraft requirements sections of the ICAO PBN Manual which relate to Implementing RNP 2 Continental (or demonstrated equivalent standards and advisory material).
- (3) **Original Equipment Manufacturer (OEM)** or the holder of installation approval for the aircraft will demonstrate compliance to their State Authority and the approval can be documented in manufacturer documentation. AFM entries are not required provided the State accepts manufacturer documentation.
- (4) **Receiver Autonomous Integrity Monitoring (RAIM)** – Operators can verify the availability of RAIM to support RNP 2 operations via Notice to Airmen (NOTAM) where available or through GNSS prediction services. The operating authority may provide specific guidance on how to comply with this requirement. RAIM is a form of ABAS, and this prediction is only a requirement for aircraft that don't have SBAS. Operators should be familiar with the prediction information available for the intended route. RAIM availability prediction should take into account the latest GNSS constellation NOTAM and avionics model (when available). The Air Navigation Service Provider (ANSP), avionics manufacturer, or the RNP system may provide this service.
- (5) **On-board performance monitoring and alerting** is required This is a Total System Error (TSE) form of performance monitoring and alerting that ensures a consistent evaluation and assessment of compliance for RNP 2 applications.
- (6) **Path Definition Error (PDE)** is considered negligible because a quality assurance process is applied at the navigation database level.

## (7) Specific Guidance

Appendix A Condition	Guidance
2.0 (1)	<b>Navigation System</b> – To the extent operational procedures are used to satisfy this requirement, the crew procedure, equipment characteristics and installation should be evaluated for their effectiveness and equivalence. The navigation system is not required to provide both performance and sensor-based alerts. For example, if a TSE based alert is provided, a GNSS alert may not be necessary.
2.0 (2)	<b>On-Board Performance</b> – The following are examples of systems which meet the accuracy and integrity requirements of the RNP 2 (Continental) NavSpec: (i) E/TSO-C129a sensor (Class B or C), E/TSO-C145() and the requirements of E/TSOC115b FMS, installed for IFR use in accordance with FAA AC 20-130A; (ii) E/TSO-C129a Class A1 or E/TSO-C146() equipment installed for IFR use in accordance with FAA AC 20-138A or AC 20-138B.
2.0 (2)	<b>Integrity:</b> Malfunction of the aircraft navigation equipment is classified as a major failure ( $10^{-5}$ per hour) condition under airworthiness guidance material.
2.0 (2)	<b>Continuity:</b> For RNP 2 continental applications, loss of function is a minor failure condition if the operator can revert to a different navigation system and proceed to a suitable airport. If a single aircraft configuration is to support all potential applications of RNP 2, the more stringent continuity requirement applies. The AFM limitations section must reflect restrictions in capability to aid in operational approvals.
2.0 (2) (a)	<b>Maintain Centreline</b> – Some aircraft do not display or compute a path during turns, but are still expected to satisfy the above standard during intercepts following turns and on straight segments.
2.0 (3)	<b>Flight Technical Error</b> – The demonstration of FTE should account for the aircraft type, the operating envelope, aircraft displays, autopilot performance, and flight guidance characteristics. When this is done, the pilot may use the demonstrated value of FTE to monitor compliance to the RNP requirements. For cross-track containment compliance, the demonstration should account for any inaccuracies in the cross-track error computation in the TSE.
2.0 (4) (b)	<b>Minimum System and Equipment Functions</b> – A means to retrieve and display data stored in the navigation database to enable the pilot to verify the RNP 2 route to be flown. Navigation databases are expected to be current for the duration of the flight or series of flight segments. If the AIRAC cycle is due to change during flight, procedures should be established to ensure the accuracy of the navigation data, including the suitability of navigation facilities used to define the routes and procedures for flight.
2.0 (4) (b)	<b>Retrieve Route</b> – When the waypoints that make up an RNP 2 route are available by name in the aircraft’s onboard navigation database, pilots may manually select and insert individual waypoints to define a published RNP 2 route in their navigation system.

**6.0 SPECIFIC GUIDANCE – AIRPORT AND AIRSPACE REQUIREMENTS**

(1) Reserved.

**7.0 INFORMATION MANAGEMENT**

(1) Not applicable

**8.0 DOCUMENT HISTORY**

(1) Not applicable.

**9.0 CONTACT OFFICE**

For more information, please contact:

Commercial Flight Standards - AARTF

E-mail: [AARTinfodoc@tc.gc.ca](mailto:AARTinfodoc@tc.gc.ca)

Suggestions for amendment to this document are invited, and should be submitted via:  
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*Original signed by*

Robert Sincennes  
Director, Standards  
Transport Canada, Civil Aviation

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**APPENDIX A — CONDITIONS FOR RNP 2 (CONTINENTAL) SPECIAL AUTHORIZATION****1.0 Operator Requirements****(1) Operational approval**

- (a) **Description of aircraft equipment** – Operators must have a configuration list and, if applicable, a Minimum Equipment List (MEL) detailing the required aircraft equipment for RNP 2 operations.
- (b) **Training documentation**
  - (i) **Commercial and Private operators** must have a training programme addressing the operational practices, procedures and training items related to RNP 2 (Continental) operations.
  - (ii) **Private operators** same as commercial operators, must be familiar with the practices and procedures identified in the “Pilot knowledge and training” section of this document.
- (c) **Operations Manual (OM) and checklists**
  - (i) **Commercial and Private operators** must address information/guidance on the Standard Operating Procedures (SOPs) detailed in this document. The appropriate manuals must contain navigation operating instructions and contingency procedures, where specified. The operator must submit their manuals, and checklists to Transport Canada for review as part of the application process.
  - (ii) **Private operators** same as commercial operators, must operate using the practices and procedures, identified in the “Pilot knowledge and training” section of this document.
- (d) **Minimum Equipment List (MEL) considerations** – Any MEL revisions necessary to address RNP 2 provisions must be approved. Operators must adjust the MEL, or equivalent, and specify the required dispatch conditions.
- (e) **Continuing airworthiness** – Operators must submit the following to Transport Canada:
  - (i) **continuing airworthiness** instructions, applicable to the aircraft’s configuration and the aircraft’s qualification for this navigation specification.
  - (ii) **maintenance programme**, including a reliability programme for monitoring the equipment.

**(2) Operating Procedures**

- (a) **Pre-flight planning**
  - (i) **Flight Plan** – Operators and pilots intending to conduct operations on RNP 2 (Continental) routes must file the appropriate flight plan suffixes.
  - (ii) **Data** – The on-board navigation data must be current and include appropriate procedures. Navigation databases must be current for the duration of the flight. If the Aeronautical Information Regulation and Control (AIRAC) cycle is due to change during flight, operators and pilots must establish procedures to ensure the accuracy of the navigation data, including the suitability of navigation facilities defining the routes and procedures for flight.

- (iii) **Infrastructure** – Operators must confirm the availability of the NAVAID infrastructure required for the intended routes, including those for use in a non-GNSS contingency, for the period of intended operations using all available information.
- (b) **Loss of ABAS availability** – Operators must revise a flight plan in the event of a predicted, continuous loss of appropriate level of fault detection of more than five (5) minutes for any part of the RNP 2 operation.
- (c) **General operating procedures**
  - (i) **Manufacturer’s instructions** – The pilot must comply with any instructions or procedures the manufacturer of the aircraft or avionics identifies as necessary to comply with the on RNP 2 (Continental) performance requirements. Pilots must adhere to any AFM limitations or operating procedures the manufacturer requires to maintain RNP 2 performance.
  - (ii) **ATC Clearances** – Operators and pilots must not request or file for RNP 2 routes unless they satisfy all the criteria in this document. If an aircraft does not meet the criteria and receives a clearance from ATC to operate on an on RNP 2 (Continental) route, the pilot must advise ATC that they are unable to accept the clearance and must request an alternate clearance.
  - (iii) **Navigation databases** – At system initialization, pilots must confirm the navigation database is current and verify proper aircraft position. Pilots must also verify proper entry of their ATC assigned route upon initial clearance and any subsequent change of route. Pilots must ensure that the waypoint sequence depicted by their navigation system matches the route depicted on the appropriate chart(s) and their assigned route.
- (d) Route retrieval – Pilots **must not**:
  - (i) **fly** a published RNP 2 (Continental) route unless they can retrieve the route by name from the on-board navigation database and confirm it matches the charted route. When the waypoints that make up an RNP 2 route are available by name in the aircraft’s on-board navigation database, pilots are permitted to select and insert the individual waypoints to define a published RNP 2 route in their navigation system.
  - (ii) **make** manual entries or create new waypoints by manual entry of latitude and longitude or rho/theta values for fixed, published routes.
  - (iii) **change** any route database waypoint type from a fly-by to a fly-over or vice versa.
- (e) **Lateral deviation indicator** – For RNP 2 (Continental) routes, pilots must use a lateral deviation indicator or moving map display with the appropriate scaling capability to bound Flight Technical Error (FTE), in addition to a flight director; or an autopilot in lateral navigation mode. Pilots must ensure that the lateral deviation scaling is suitable for the navigation accuracy associated with the route and know their allowable lateral deviation limits.
- (f) **Lateral deviation** – Pilots must maintain a centre line, as depicted by on-board lateral deviation indicators, moving map and/or flight guidance during all RNP 2 (Continental) operations, unless authorized to deviate by ATC or under emergency conditions.
- (g) **Contingency procedures** – Pilots must notify ATC of any loss of the RNP 2 (Continental) capability (integrity alerts or loss of navigation). If unable to comply with the RNP 2 (Continental) requirements for any reason, pilots must advise ATC as soon as possible.

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(3) **Pilot knowledge and training**

- (a) **General** – Training programmes must provide sufficient training on the aircraft's RNP system to the extent that the pilots are familiar with the following:
- (i) **Conditions** for an RNP 2 (Continental) SA;
  - (ii) **Equipment/Navigation suffixes** – the meaning and proper use of aircraft equipment/navigation suffixes;
  - (iii) **Chart depiction** – route and airspace characteristics as determined from chart depiction and textual description;
  - (iv) **Equipment** – required navigation equipment for RNP 2 (Continental) operations;
  - (v) **RNP system-specific information:**
    - (A) levels of automation, mode annunciations, changes, alerts, interactions, reversions, and degradation;
    - (B) functional integration with other aircraft systems;
    - (C) the meaning and appropriateness of route discontinuities as well as related flight crew procedures;
    - (D) pilot procedures consistent with the operation;
    - (E) types of navigation sensors utilized by the RNP system and associated system prioritization/weighting/logic/limitations;
    - (F) turn anticipation with consideration to speed and altitude effects;
    - (G) interpretation of electronic displays and symbols used to conduct an RNP 2 operation; and
    - (H) understanding of the aircraft configuration and operational conditions required to support RNP 2 operations.
  - (vi) **RNP system operating procedures**, as applicable, including how to perform the following actions:
    - (A) verify currency and integrity of the aircraft navigation data;
    - (B) verify the successful completion of RNP system self-tests;
    - (C) initialize navigation system position;
    - (D) retrieve/manually enter and fly an RNP 2 route;
    - (E) adhere to speed and/or altitude constraints associated with an RNP 2 route;
    - (F) verify waypoints and flight plan programming;
    - (G) fly direct to a waypoint;
    - (H) fly a course/track to a waypoint;
    - (I) intercept a course/track (flying assigned vectors and rejoining an RNP 2 route from “heading” mode);
    - (J) determine cross-track error/deviation. The maximum deviations allowed to support on RNP 2 (Continental) must be understood and respected;
    - (K) resolve route discontinuities;
    - (L) remove and reselect navigation sensor input; and

- (M) perform parallel offset function during RNP 2 operations if capability exists. Pilots should know how offsets are applied, the functionality of their particular RNP system and the need to advise ATC if this functionality is not available;

**Note:** *Parallel offset operations will not be used in Canadian RNP 2 (Continental) airspace.*

- (vii) **Level of Automation** – operator recommended levels of automation for phase of flight and workload, including methods to minimize cross-track error to maintain route centerline;
- (viii) **Radio telephony** phraseology for RNP applications; and
- (ix) **Contingency** procedures for RNP failures.

(4) **Navigation database**

- (a) **Data source** – Operators must obtain the navigation database from a supplier complying with RTCA DO 200() / EUROCAE document ED 76, Standards for Processing Aeronautical Data, and the database must be compatible with the intended function of the equipment.
- (b) **Discrepancies** – Operators must report any discrepancies invalidating an ATS route to the navigation database supplier, and the operator must take actions to prohibit their pilots from flying the affected ATS route.
- (c) **Checks** – Aircraft operators must conduct periodic checks of the operational navigation databases in order to meet existing quality system requirements.

## 2.0 Aircraft Requirements

- (1) **General** – The aircraft navigation system, or aircraft navigation system and pilot in combination, is required to monitor the TSE, and to provide an alert if the accuracy requirement is not met or if the probability that the lateral TSE exceeds two times the accuracy value is larger than  $1 \times 10^{-5}$ .
- (2) **On-board performance monitoring and alerting**
  - (a) **Accuracy-** During operations in airspace designated as RNP 2:
    - (i) **lateral** TSE must be within  $\pm 2$  NM for at least 95 per cent of the total flight time;
    - (ii) **along-track** error must also be within  $\pm 2$  NM for at least 95 per cent of the total flight time; and,
    - (iii) 95 per cent FTE must not exceed 1 NM.
  - (b) **Signal-in-Space (SIS)-** The aircraft navigation equipment shall provide an alert if the probability of SIS errors causing a Lateral Position Error (LPE) greater than 4 NM exceeds  $1 \times 10^{-7}$  per hour.
- (3) **Flight Technical Error (FTE)** – During the aircraft certification process, the manufacturer must demonstrate the ability of the pilot to operate the aircraft within the allowable FTE. The FTE value must be the cross-track distance to the defined path.
- (4) **Functional requirements** – The following navigation displays and functions are required:
  - (a) **Navigation data**, including a failure indicator, must be displayed on a lateral deviation display (CDI, EHSI) and/or a navigation map display. These must be used as primary flight instruments for the navigation of the aircraft, for manoeuvre anticipation and for failure/ status/ integrity indication.

- (b) Minimum system and equipment functions:
  - (i) A navigation database, containing current navigation data officially promulgated for civil aviation, which can be updated in accordance with the AIRAC cycle and from which RNP 2 routes can be retrieved and loaded into the RNP system. The stored resolution of the data must be sufficient to achieve negligible Path Definition Error (PDE). Database protections must prevent pilot modification of the onboard stored data;
  - (ii) A means to display the validity period of the navigation data to the pilot; and
  - (iii) A means to retrieve and display data stored in the navigation database relating to individual waypoints and NAVAIDs (when applicable).
- (c) **Minimum displayed items** – the means to display the following items, either in the pilot’s primary field of view, or on a readily accessible display:
  - (i) active navigation sensor type;
  - (ii) identification of the active (To) waypoint;
  - (iii) groundspeed or time to the active (To) waypoint; and
  - (iv) distance and bearing to the active (To) waypoint.
- (d) **Leg sequencing** – the capability for automatic leg sequencing with the display of sequencing to the pilot.
- (e) **Waypoint transitions** – the capability to automatically execute waypoint transitions and maintain track consistent with the RNP 2 (Continental) performance requirements.
- (f) **Indication of system failures** – the capability to display an indication of RNP 2 system failure in the pilot’s primary field of view.

### 3.0 Airport and Airspace Requirements

- (1) Nil

## APPENDIX B — CHECKLIST OF CONDITIONS FOR RNP 2 (CONTINENTAL) OPERATIONS

CHECKLIST FOR SPECIAL AUTHORIZATION OF RNP2 (CONTINENTAL) OPERATIONS			
Note: This checklist is intended to be a guide. Refer to Appendix A for specifics about conditions.			
Item	Specifics	Date	Remarks
<b>1.0 Operator Requirements</b>			
<b>(1) Operational Approval</b>	<ul style="list-style-type: none"> <li>• Configuration List.</li> <li>• Minimum Equipment List (MEL).</li> <li>• Training programme (commercial operators).</li> <li>• Familiarity with the practices and procedures (private operators).</li> <li>• SOP (commercial operators).</li> <li>• Operate within “Pilot knowledge and training” section of this document (private operators).</li> <li>• continuing airworthiness instructions.</li> <li>• maintenance &amp; reliability programme.</li> </ul>		
<b>(2) Operating Procedures</b>	<ul style="list-style-type: none"> <li>• Pre-flight planning:               <ul style="list-style-type: none"> <li>○ Flight Plan – use of appropriate flight plan suffixes.</li> <li>○ On-board navigation data current.</li> <li>○ Infrastructure – confirmation of the available NAVAIDs for intended routes (including non-GNSS contingency).</li> </ul> </li> <li>• Loss of ABAS availability –               <ul style="list-style-type: none"> <li>○ Operators able to revise flight plan if loss of appropriate level of fault detection of more than five (5) minutes for any part of the RNP 2 operation.</li> </ul> </li> <li>• General operating procedures:               <ul style="list-style-type: none"> <li>○ Compliance with manufacturer’s instructions (limitations and operating procedures).</li> <li>○ Compliance with ATC Clearances.</li> <li>○ Confirmation of navigation database, aircraft position, and proper entry of ATC assigned route.</li> </ul> </li> <li>• Route retrieval – Pilots do <b>not</b>:               <ul style="list-style-type: none"> <li>○ fly published RNP 2 route unless route retrieved by name or built by selecting individual waypoints by name from navigation system.</li> <li>○ make manual entries or create new waypoints by manual entry of latitude and longitude or rho/theta values for fixed, published routes.</li> <li>○ change any route database waypoint type from a fly-by to a fly-over or vice versa.</li> </ul> </li> <li>• Appropriate use of lateral deviation indicator or map display.</li> <li>• Contingency procedures for loss of RNP 2 capability.</li> </ul>		

<b>(3) Pilot knowledge and training</b>	<ul style="list-style-type: none"> <li>• Training programmes cover: <ul style="list-style-type: none"> <li>○ RNP 2 (Continental) SA conditions.</li> <li>○ Equip/Nav suffixes.</li> <li>○ Chart depiction.</li> <li>○ Required nav equipment.</li> <li>○ RNP system-specific information.</li> <li>○ RNP system operating procedures.</li> <li>○ Level of Automation.</li> <li>○ Radio telephony phraseology.</li> <li>○ RNP failures contingency procedures.</li> </ul> </li> </ul>		
<b>(4) Navigation Database</b>	<ul style="list-style-type: none"> <li>• Data source complies with RTCA DO 200() / EUROCAE document ED 76 Standards for Processing Aeronautical Data.</li> <li>• Database compatible with the intended function of equipment.</li> <li>• Discrepancy report procedures in place.</li> <li>• Periodic checks of nav databases conducted.</li> </ul>		
<b>2.0 Aircraft Requirements</b>			
<b>(1) General</b>	<ul style="list-style-type: none"> <li>• TSE monitoring and alerting in place.</li> </ul>		
<b>(3) Flight Technical Error (FTE)</b>	<ul style="list-style-type: none"> <li>• During aircraft certification process, manufacturer demonstrated ability of pilot to operate aircraft within allowable FTE.</li> </ul>		
<b>(4) Functional requirements</b>	<ul style="list-style-type: none"> <li>• Navigation data and failure indicator displayed on lateral deviation display (CDI, EHSI) and/or navigation map display.</li> <li>• Minimum system and equipment functions met.</li> <li>• Required minimum items for display to the pilot are met.</li> <li>• Automatic leg sequencing with the display.</li> <li>• Capable of automatically executing waypoint transitions and maintaining track consistent with RNP 2 (Continental) performance requirements.</li> <li>• Capable of displaying an RNP 2 system failure in the pilot's primary field of view.</li> </ul>		
<b>3.0 Airport and Airspace Requirements</b>			
<b>(1)</b>	Nil		

**APPENDIX Z — CONDITIONS FOR A FOREIGN AIR OPERATOR CERTIFICATE RNP 2  
(CONTINENTAL) SPECIAL AUTHORIZATION**

**1.0 Operator Requirements**

This Authorization is issued pursuant to paragraph 701.08(g)(iii) of the Canadian Aviation Regulations. This Authorization is valid if the air operator holds a valid Authorization from the State of the Operator, or the State of Registry, for performance based navigation operation, specifically Continental RNP 2. Flights in Canada in Continental RNP 2 airspace, are authorized using the types of aircraft listed in this authorization.

**2.0 Aircraft Requirements**

This Authorization is valid if the air operator holds a valid Authorization from the State of the Operator, or the State of Registry, for performance based navigation operations, specifically Continental RNP 2.

**3.0 Airspace Requirements**

All Canadian airspace designated as Continental RNP 2 airspace.