



# Advisory Circular

**Subject: Radius to Fix (RF) Path Terminator**

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## TABLE OF CONTENTS

<b>1.0</b>	<b>INTRODUCTION.....</b>	<b>2</b>
1.1	Purpose .....	2
1.2	Applicability .....	2
1.3	Description of Changes.....	2
<b>2.0</b>	<b>REFERENCES AND REQUIREMENTS .....</b>	<b>2</b>
2.1	Reference Documents .....	2
2.2	Cancelled Documents .....	3
2.3	Definitions and Abbreviations .....	3
<b>3.0</b>	<b>BACKGROUND.....</b>	<b>5</b>
<b>4.0</b>	<b>AIRCRAFT REQUIREMENTS.....</b>	<b>6</b>
4.1	Aircraft eligibility .....	6
4.2	On-Board Performance Monitoring and Alerting.....	7
4.3	Functional Requirements .....	7
4.4	Continued Airworthiness .....	8
<b>5.0</b>	<b>NAVIGATION DATABASE .....</b>	<b>9</b>
<b>6.0</b>	<b>OPERATIONAL REQUIREMENTS.....</b>	<b>9</b>
6.1	Operating Procedures .....	9
6.2	Contingency Procedures.....	10
<b>7.0</b>	<b>KNOWLEDGE AND TRAINING REQUIREMENTS.....</b>	<b>10</b>
<b>8.0</b>	<b>APPROVAL PROCESS .....</b>	<b>10</b>
<b>9.0</b>	<b>CONCLUSION .....</b>	<b>11</b>
<b>10.0</b>	<b>INFORMATION MANAGEMENT .....</b>	<b>11</b>
<b>11.0</b>	<b>DOCUMENT HISTORY .....</b>	<b>11</b>
<b>12.0</b>	<b>CONTACT OFFICE .....</b>	<b>12</b>

## 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 now obtain a Canadian authorization by Operations Specification (Ops Spec) 623 to conduct Radius to Fix Path Terminator procedures, otherwise known as radius-to-fix (RF) legs, as they are associated with Required Navigation Performance (RNP) operations. This authorization will enable Canadian air operators or private operators to conduct the RF segments of terminal and approach procedures, subject to the applicable requirements of Ops Spec 623 and the Ops Spec of the RNP terminal or approach procedures with which the RF legs conducted by the operator will be associated (e.g. Ops Spec 620 *Required Navigation Performance Approach (RNP APCH)*). The final step in the operational approval is the issuance of Ops Spec 623 to the air operator or private operator. This Ops Spec 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 conduct radius-to-fix procedures.

### 1.2 Applicability

- (1) This AC applies to Canadian air operators holding an Air Operator Certificate issued under Part VII of the *Canadian Aviation Regulations* (CARs) or to private operators holding a Private Operator Certificate issued under Subpart 604 of the CARs, commonly referred to as “operator”, who wish to conduct RF segments of RNP 1 procedures, Required Navigation Performance Approach (RNP APCH) procedures or future procedures which refer to Ops Spec 623 as the authorization requirement to conduct such procedures.
- (2) This AC does not apply to the RF legs associated with Required Navigation Performance Authorization Required Approach (RNP AR APCH) procedures. The requirements to conduct radius-to-fix segments associated with RNP AR APCH procedures are more restrictive than those associated with Ops Spec 623. The authorization to conduct the RF legs associated with RNP AR APCH procedures is obtained by way of Ops Spec 621 RNP AR APCH.
- (3) This document is also applicable to all Transport Canada Civil Aviation (TCCA) employees, to individuals and organizations when they are exercising privileges granted to them under an External Ministerial Delegation of Authority. This information is also available to 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) The following reference material may be consulted for information purposes:
  - (a) Part V of the *Canadian Aviation Regulations* (CARs) — *Airworthiness*;
  - (b) Part VI, subpart IV of the CARs—*Private Operator Passenger Transportation*;
  - (c) Part VII, subpart II of the CARs—*Aerial Work*;
  - (d) Part VII, subpart III of the CARs — *Air Taxi Operations*;

- (e) Part VII, subpart IV of the CARs—*Commuter Operations*;
- (f) Part VII, subpart V of the CARs—*Airline Operations*;
- (g) Standard 624 of the CARs — *Private Operator Passenger Transportation*;
- (h) Standard 722 of the *Commercial Air Services Standards (CASS)*—*Aerial Work*;
- (i) Standard 723 of the CASS — *Air Taxi Operations*;
- (j) Standard 724 of the CASS—*Commuter Operations*;
- (k) Standard 725 of the CASS—*Airline Operations*;
- (l) Operations Specification 623 — *Radius to Fix (RF) Path Terminator*;
- (m) Operations Specification 620 — *Required Navigation Performance Approach (RNP APCH)*;
- (n) Operations Specification 618 — *Required Navigation Performance 1 (RNP 1)*;
- (o) Advisory Circular (AC) 700-023 — *Required Navigation Performance Approach (RNP APCH)*;
- (p) AC 700-025 — *Required Navigation Performance 1 (RNP 1)*;
- (q) Transport Canada Publication (TP) 308 - *Criteria for the Development of Instrument Approaches*;
- (r) International Civil Aviation Organization (ICAO) Doc. 9613 *Performance Based Navigation (PBN) Manual*, Volume II Part C Appendix 1 RF Path Terminator;
- (s) 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*;
- (t) FAA AC 20-138B, *Airworthiness Approval of Positioning and Navigation Systems*;
- (u) Radio Technical Commission for Aeronautics (RTCA) DO-236B/EUROCAE ED-75B, *Minimum Aviation System Performance Standards: Required Navigation Performance for Area Navigation*; and
- (v) RTCA DO-283A, *Minimum Operational Performance Standards for Required Navigation Performance for Area Navigation*;

## 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 (AC):** A document providing an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards.
  - (b) **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 as well as other operations that are not contemplated in the definition of performance-based navigation.

- (i) **RNP System:** 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) **RNAV System:** 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).
- (c) **Global Navigation Satellite System (GNSS):** 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 aircraft-based augmentation systems (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).
- (d) **Global Positioning System (GPS):** The global positioning 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 by 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.
- (e) **Navigation specification:** A set of requirements needed to implement and support performance based navigation within a defined airspace.
- (f) **Performance Based Navigation (PBN):** 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: Performance requirements are expressed in navigation specification (RNAV specification or RNP specification) in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept.*
- (g) **Radius to Fix (RF) Leg:** See Radius to Fix (RF) Path Terminator.
- (h) **Radius to Fix (RF) Path Terminator:** A specific fixed-radius curved path in a terminal and approach procedure intended to be applied where an accurate repeatable and predictable ground path is required. Commonly referred to as RF leg.
- (i) **Standard instrument arrival (STAR):** A designated instrument flight rule (IFR) arrival route linking a significant point, normally on an air traffic service (ATS) route, with a point from which a published instrument approach procedure can be commenced.
- (j) **Standard instrument departure (SID):** A designated IFR departure route linking the aerodrome or a specified runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the en-route phase of a flight commences.
- (k) **Technical Standard Order (TSO):** A minimum performance standard for specified materials, parts, and appliances used on civil aircraft.
- (l) **Total System Error (TSE):** 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.
  - (m) **World Geodetic System 1984 (WGS 84):** The most recent geocentric reference system definition developed by the United States Department of Defence (World Geodetic System Committee).
- (2) The following **abbreviations** are used in this document:
- (a) **AC:** Advisory Circular;
  - (b) **AMC:** Acceptable Means of Compliance;
  - (c) **ARINC:** Aeronautical Radio Incorporated;
  - (d) **CDI:** Course Deviation Indicator;
  - (e) **FTE:** Flight Technical Error;
  - (f) **GNSS:** Global Navigation Satellite System;
  - (g) **GPS:** Global Positioning System;
  - (h) **NSE:** Navigation System Error;
  - (i) **PBN:** Performance Based Navigation;
  - (j) **PDE:** Path Definition Error;
  - (k) **RNAV:** Area Navigation;
  - (l) **RAIM:** Receiver Autonomous Integrity Monitoring;
  - (m) **RF:** Radius to Fix;
  - (n) **RNP:** Required Navigation Performance;
  - (o) **SBAS:** Satellite-Based Augmentation System;
  - (p) **SID:** Standard Instrument Departure;
  - (q) **STAR:** Standard Instrument Arrival;
  - (r) **TSE:** Total System Error;
  - (s) **TSO:** Technical Standard Order; and
  - (t) **TCCA:** Transport Canada, Civil Aviation.

### 3.0 BACKGROUND

- (1) If the aircraft is not capable of executing Radius to Fix (RF) leg segments, operators need to take the necessary steps to prevent flight crew members from attempting to fly a procedure requiring RF leg capability.

- (2) Since RF legs will not be performed in isolation, authorization to conduct RF legs will not be issued in isolation. An operator must obtain the authority to conduct the Performance Based Navigation (PBN) activities containing the RF legs (e.g. RNP APCH, RNP 1) either prior to or simultaneously with, the application for RF legs authorization.
- (3) An operator who has received authorization to conduct RF legs as part of *Required Navigation Performance Authorization Required Approach (RNP AR APCH)* procedures, may be issued Ops Spec 623 without further assessment, provided all RF legs will be performed consistent with the relevant SOPs applicable to RNP AR APCH procedures.
- (4) Although the ARINC 424 RF leg functionality in this advisory circular is identical to that found in the RNP AR APCH Ops Spec, the approval requirements when applied in association with a RNP terminal or approach procedure referencing this advisory circular for qualification criteria, are not as constraining as those applied to RNP AR APCH. This is taken into account in the related obstacle protection and route spacing criteria.
- (5) This attachment addresses ARINC 424 RF path terminator functionality when used in association with a RNP terminal or approach procedure which references this document for qualification criteria. RF legs are an optional capability, not a minimum requirement, for use with these authorizations. This functionality can be used in the initial and intermediate approach segments, the final phase of the missed approach, Standard Instrument Departures (SIDs) and Standard Arrival Routes (STARs). RF legs contained in the final approach, or the initial or intermediate phases of the missed approach, require Ops Spec 621 RNP AR APCH.
- (6) The RF leg is defined by the arc centre fix, the arc initial fix, the arc ending fix and the turn direction. The radius is calculated by the navigation computer as the distance from the arc centre fix to the arc ending fix. RNP systems supporting this leg type provide the same ability to conform to the track-keeping accuracy during the turn as in the straight line segments. RF legs are intended to be applied where accurate repeatable and predictable navigation performance is required in a constant radius turn.
- (7) RF legs provide a predictable and repeatable ground track during a turn and prevent the dispersion of tracks experienced in other types of turn construction due to varying aircraft speeds, turn anticipation, bank, roll rate, etc. Therefore, RF legs can be employed where a specified path must be flown during a turn. Additionally, because an RF leg traverses a specified distance, it can be used to maintain aircraft longitudinal spacing between aircraft having the same speed. This is not necessarily true with other turn constructions such as fly-by transitions, because of the varying turn paths aircraft execute.

## **4.0 AIRCRAFT REQUIREMENTS**

### **4.1 Aircraft eligibility**

- (1) Relevant documentation acceptable to Transport Canada Civil Aviation (TCCA) must be available in order to establish that the aircraft is equipped with an Area Navigation (RNAV) system meeting RF leg requirements. The determination of eligibility for existing systems will consider acceptance of manufacturer documentation of compliance.
- (2) Operators may demonstrate the qualification of their aircraft navigation system by satisfying one of the following criteria:
  - (a) The design approval holder will demonstrate compliance, and the approval will be documented in manufacturer documentation. Such documentation indicates that the aircraft and equipment meet the technical requirements of this AC, and no further assessment of the *On Board Performance Monitoring and Alerting or Functional Requirements* need be made.

- (i) The design approval holder has included a statement in the Aircraft Flight Manual indicating that the aircraft meets the requirements for RNP operations with RF legs and has demonstrated the established minimum capabilities for these operations. This documentation should include the phase of flight, mode of flight (e.g. flight director ON or OFF and/or autopilot ON or OFF, and applicable lateral and vertical modes), minimum demonstrated lateral navigation accuracy, and sensor limitations, if any; or
- (ii) The design approval holder has included a statement in the Aircraft Flight Manual that the aircraft meets the requirements of Federal Aviation Administration Advisory Circular (FAA AC) 20-138B, FAA AC 90-105, FAA AC 90-101A or EASA Acceptable Means of Compliance (AMC) 20-26 (or subsequent versions of these documents) as they pertain to radius-to-fix transition procedures; and
- (iii) The flight manual or referenced document should contain the following information:
  - (A) Any conditions or constraints on path steering performance (e.g. autopilot engaged, flight director with map display, including lateral and vertical modes, and/or CDI/map scaling requirements) should be identified.

**Note:** Use of manual control with CDI only is not permitted on RF legs.
  - (B) The criteria used for the demonstration of the system, acceptable normal and non-normal configurations and procedures, the demonstrated configurations and any constraints or limitations necessary for safe operation should be identified.
- (b) If aircraft approval to conduct RF legs has not been documented by the design approval holder, the operator may demonstrate aircraft eligibility by meeting the criteria described in this section.

#### 4.2 On-Board Performance Monitoring and Alerting

- (1) The navigation system must have the capability to execute leg transitions and maintain a track consistent with an RF leg between two fixes. The lateral total system error (TSE) must be within  $\pm 1 \times \text{RNP}$  of the path defined by the published procedure (e.g. for an RNP 1 procedure, the TSE must be  $\pm 1$  Nautical Mile (nm) for at least 95% of the total flight time for each phase of flight and each autopilot and/or flight director mode requested.

**Note:** Industry standards for RF defined paths can be found in Radio Technical Commission for Aeronautics (RTCA) DO-236B / EUROCAE ED-75B (section 3.2.5.4.1 and 3.2.5.4.2). Default values for Flight Technical Error (FTE) can be found in RTCA DO-283A. FAA AC 120-29A, paragraphs 5.19.2.2 and 5.19.3.1 also provides guidance on establishing FTE values.

#### 4.3 Functional Requirements

- (1) System Failure Modes/Annunciations:
  - (a) The RNP system must provide a visible alert within the flight crew's primary field of view when loss of navigation capability and/or loss of integrity are experienced.
  - (b) Any failure modes that have the potential to affect the RF leg capability should be identified. Failure modes may include loss of electrical power, loss of signal reception, RNP system failure, including degradation of navigation performance resulting in a loss of RNP containment integrity.

- (c) The ability of the aircraft to maintain the required FTE after a full or partial failure of the autopilot and/or flight director should be documented.

**Note:** *If autopilot malfunction testing was performed for worst case failures, no further validation is required. In this case, the design approval holder must provide a statement of confirmation.*

(2) Capabilities:

- (a) An autopilot or flight director with at least “roll-steering” capability that is driven by the RNP system is required. The autopilot/flight director must operate with suitable accuracy to track the lateral and, as appropriate, vertical paths required by a specific RNP procedure.
- (b) An electronic map display depicting the RNP computed path of the selected procedure is required.
- (c) The flight management computer, the flight director system, and the autopilot must be capable of commanding and achieving a bank angle up to 25 degrees above 400 feet Above Ground Level (AGL).
- (d) The flight guidance mode should remain in Lateral Navigation (LNAV) while on an RF leg, when a procedure is abandoned or a missed approach/go-around is initiated (through activation of Take Off Go Around (TOGA) or other means) to enable display of deviation and display of positive course guidance during the RF leg. As an alternative means, crew procedures may be used that ensure that the aircraft adheres to the specified flight path throughout the RF Leg segment.

#### 4.4 Continued Airworthiness

- (1) The operators of aircraft approved to perform RF operations must ensure that the navigation system is maintained according to the design approval holder’s instructions for continuing airworthiness (ICAs), including any software updates.
- (2) Each operator who applies for RF operational approval is required to incorporate the inspection requirements of the RF equipment specified by the design approval holder and amend the aircraft maintenance schedule as required. This requirement is designed to ensure that navigation systems continue to meet the RF approval criteria.

**Note:** *If the aircraft was delivered by the aircraft manufacturer with RF capability, the maintenance requirements may already exist in the maintenance schedule.*

- (3) Maintenance for the affected aircraft is required to include the maintenance practices listed in the maintenance manuals of the aircraft manufacturer and its components, and must consider:
- (a) that the equipment involved in the RF operation is required to be maintained according to the ICAs from the component design approval holder;
- (b) that any amendment or change of navigation system affecting in any way RF initial approval, must be submitted to the Principal Maintenance Inspector (PMI) and reviewed for acceptance or approval of such changes prior to its implementation; and
- (c) that any repair that is not included in the approved/accepted maintenance documentation, and that could affect the integrity of navigation performance, is required to be forwarded to the PMI or regional airworthiness office for acceptance or approval thereof.



## 5.0 NAVIGATION DATABASE

- (1) The navigation database must meet the requirements associated with the RNP terminal or approach procedure authorizations with which the RF legs procedures will be conducted. As a minimum:
  - (a) The operator must obtain the navigation database from a supplier that complies with RTCA (Radio Technical Commission for Aeronautics) document DO 200A/EUROCAE ED 76 – *Standards for Processing Aeronautical Data*. A letter of acceptance (LOA) issued by the appropriate regulatory authority to each participant in the data chain demonstrates compliance with this requirement (e.g., FAA LOA issued in accordance with FAA AC 20-153 or European Aviation Safety Agency (EASA) LOA issued in accordance with EASA OPINION Nr. 01/2005).
- (2) The navigation system should not permit the flight crew to select, either manually or automatically, a procedure that is not supported by the equipment (e.g. a procedure is not supported if it incorporates an RF leg and the equipment does not provide RF leg capability).
- (3) The navigation system should also prohibit flight crew access to procedures requiring RF leg capability if the system can select the procedure, but the aircraft is not otherwise equipped (e.g. the aircraft does not have the required roll steering autopilot or flight director installed).
- (4) Examples of an acceptable means to meet these requirements are:
  - (a) screening the aircraft's onboard navigation database to remove any routes or procedures that the aircraft is not eligible to execute;
  - (b) flight crew training to identify and prohibit the use of procedures containing RF legs.

## 6.0 OPERATIONAL REQUIREMENTS

### 6.1 Operating Procedures

- (1) The flight crew members must use either a flight director or autopilot when flying an RF leg.
- (2) The flight crew member must comply with any instructions or procedures identified by the manufacturer as necessary to comply with the performance requirements in this AC.
- (3) Procedures with RF legs will be identified on the appropriate chart.
- (4) When the dispatch of a flight is predicated on flying a RNP procedure with an RF leg, the operator must determine that the installed autopilot/flight director is operational.
- (5) Flight crew members are not authorised to fly a published RNP procedure unless it is retrievable by the procedure name from the aircraft navigation database and conforms to the charted procedure. The lateral path must not be modified, with the exception of complying with Air Traffic Control (ATC) clearances/instructions.
- (6) Aircraft must be established on the inbound track to the RF leg prior to it being sequenced by the navigation system. Flight crew members must not request or accept a Direct To clearance to a waypoint beginning an RF leg, nor a vector to intercept an RF leg.
- (7) Flight crew members are expected to maintain the centreline of the desired path on RF legs. For normal operations, cross-track error/deviation (the difference between the displayed path and the displayed aircraft position relative to the displayed path, (i.e., FTE)) will be limited to half the navigation accuracy associated with the procedure (e.g. 0.5 nm for RNP 1).
- (8) Where published, flight crew members must not exceed maximum airspeeds associated with the design of the RF leg.

## 6.2 Contingency Procedures

- (1) If an aircraft system failure results in the loss of capability to follow an RF turn, the flight crew members should maintain the current bank and roll out on the charted RF exit course. Flight crew members should advise ATC as soon as possible of the system failure.

## 7.0 KNOWLEDGE AND TRAINING REQUIREMENTS

- (1) The flight crew member training program must include:
  - (a) The information in this AC;
  - (b) The meaning and proper use of RF functionality in RNP systems;
  - (c) Associated procedure characteristics as determined from chart depiction and textual description;
  - (d) Associated levels of automation, mode annunciations, changes, alerts, interactions, reversions, and degradation;  
*Note: Manually selecting aircraft bank limiting functions may reduce the aircraft's ability to maintain its desired track, and are not permitted. Flight crew members should recognise that manually selectable aircraft bank-limiting functions may reduce their ability to satisfy ATC path expectations, especially when executing shorter radius turns.*
  - (e) Monitoring track-keeping performance;
  - (f) The effect of wind on aircraft performance during execution of RF legs and the need to remain within the RNP containment area. The training program must address any operational wind limitations and aircraft configurations essential to the safe completion of the RF turn;
  - (g) The effect of ground speed on compliance with RF paths and bank angle restrictions impacting the ability to remain on the course centreline;
  - (h) Interpretation of electronic displays and symbols; and
  - (i) Operator contingency procedures.

## 8.0 APPROVAL PROCESS

- (1) The requirements for authorization to conduct RF transition procedures are as follows:
  - (a) The operator must:
    - (i) have received authorization to conduct RNP terminal or approach procedures with which the RF legs conducted by the operator will be associated (e.g. RNP APCH; or
    - (ii) Simultaneously apply for the authorization applicable to the RNP terminal or approach procedures with which the RF legs conducted by the operator will be associated (e.g. RNP 1.
  - (b) If the operator has not received RNP AR APCH with RF legs authorization:
    - (i) The equipment must meet the certification and installation requirements of Part V of the CARs, and the criteria of this AC;
    - (ii) The operator must ensure the quality of the navigation database in accordance with this AC;

- (iii) The operator must establish procedures in its Company Operations Manual (COM), or private operator equivalent, for the guidance of its personnel related to the conduct of RF legs;
  - (iv) If a Minimum Equipment List (MEL) has been approved in respect of an operator by the Minister, the operator must establish guidance, restrictions and procedures (as required) in the MEL for use in the event of RNP equipment unavailability;
  - (v) The operator must amend its Maintenance Program in accordance with the maintenance requirements of this AC; and
  - (vi) The operator must amend its training program to provide training to operational control personnel, each flight crew member and, when applicable, maintenance personnel involved with RNP approach operations. Updates to the operator's Training Program must be done in accordance with the requirements of this AC, as well as Section 604.05 of the CARs or the guidance in Sections 722.76, 723.98, 724.115, 725.124 of the *Commercial Air Services Standards* (CASS), as applicable;
- (c) If an operator has received RNP AR APCH with RF legs authorization:
- (i) the operator must establish procedures in its COM, or private operator equivalent, for the guidance of its personnel indicating that all RF legs will be performed as those found in RNP AR APCH procedures.
- (d) The operator must receive RF *Path Terminator* authorization prior to performing the RF *Path terminator* procedures in RNP terminal and approach procedures.

## 9.0 CONCLUSION

- (1) Operators intending to apply for *RF Path Terminator* authorization should review the referenced documents and then contact their Principal Operations Inspector (POI), or private operator equivalent, for more information.
- (2) The POI, with the assistance of the PMI or Regional Airworthiness office, should confirm that all of the above requirements are satisfied. Once all of the applicable conditions of this AC have been met, authorization to conduct *RF Path Terminator* procedures may be issued to the operator.

## 10.0 INFORMATION MANAGEMENT

- (1) Not applicable.

## 11.0 DOCUMENT HISTORY

- (1) Not applicable.

## 12.0 CONTACT OFFICE

For more information, please contact:

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*Original signed by Arlo Speer on September 25, 2013 for*

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Contact Office.*