Australian Government
Civil Aviation Safety Authority

ADVISORY CIRCULAR

AC 91.U-01
Navigation authorisations

v1.0 – May 2015
Project Number: AS 08/19

Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Advisory Circulars should always be read in conjunction with the relevant regulations.

Audience

This Advisory Circular (AC) applies to:

- operators applying for navigation authorisations under the provisions of Civil Aviation Order (CAO) 20.91, Required Navigation Performance (RNP) 10 or RNP 4 under the provisions of Subpart 91.U of *the Civil Aviation Safety Regulations 1998 (CASR 1998)* or Reduced Vertical Separation Minima (RVSM) under the provisions of Parts 181A–181X of *the Civil Aviation Regulations 1988 (CAR 1988).*
- personnel preparing all or part of the documentation packages supporting applications for the navigation authorisations identified above.

Purpose

This AC provides information for operators of Australian registered aircraft who wish to gain approval to conduct Performance-based Navigation (PBN) operations in Australian airspace. These operations are consistent with the navigation specifications described in International Civil Aviation Organization (ICAO) Performance-based Navigation Manual (Doc 9613) Edition 4 (PBN Manual) and include area navigation (RNAV) and RNP navigation specifications.

This AC contains information pertinent to installation design engineering, maintenance engineering, flight operations and flight crew training staff. This AC also provides information for foreign operators on the conduct of PBN operations in Australian airspace.

Although RVSM, RNP 10 and RNP 4 navigation authorisations are not addressed in CAO 20.91, applications for these authorisations are made using the same application form and procedures as for the authorisations covered by CAO 20.91.

For further information

For further information on this AC, contact CASA's Air Traffic Management System Standards Section (telephone 131 757) or the CASA website CNS / Air Traffic Management (ATM) pages at: www.casa.gov.au/cns

Unless specified otherwise, all subregulations, regulations, subparts, parts and divisions referenced in this AC are references to the CASR 1998.

Status

This version of the AC is approved by the Executive Manager, Standards Division.

Version	Date	Details
1.0	December 2014	This is the first issue of this AC and consolidates PBN information into a single AC and replaces the following ACs: • AC 91U-II-B-2(0) Navigation Authorisations – RNAV 5 • AC 91U-II-B-3(0) Navigation Authorisations – RNAV 1 and RNAV 2 • AC 91U-II-C-2(0) Navigation Authorisations – RNP 2 • AC 91U-II-C-3(0) Navigation Authorisations – RNP 1 • AC 91U-II-C-5(0) Navigation Authorisations – RNP APCH • AC 91U-II-C-6(0) Navigation Authorisations – RNP AR APCH • AC 91U-II-Attachment(0) Navigation Authorisations – APV Baro-VNAV.

Contents

1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Acronym	Description
14 CFR	Title 14 Code of Federal Regulations (previously FAR)
AC	Advisory Circular
AFCS	Automatic Flight Control System
AFM	Aircraft Flight Manual
AFMS	Aircraft Flight Manual Supplement
AIRAC	Aeronautical Information Regulation and Control
AOC	Air Operators Certificate
APCH	Approach
APV	Approach with Vertical Guidance
AR	Authorisation Required
ARINC 424	Aeronautical Radio Incorporated Specification 424
ASE	Altimetry System Error
ATC	Air Traffic Control
ATS	Air Traffic Services
BARO	Barometric
Baro-VNAV	Barometric Vertical Navigation
B-RNAV	Basic RNAV
CAANZ	Civil Aviation Authority of New Zealand
CBT	Computer-based Training
CAR 1988	*Civil Aviation Regulation 1988*
CASA	Civil Aviation Safety Authority
CASR 1998	*Civil Aviation Safety Regulation 1998*
CDI	Course Deviation Indicator
CF	Path Terminator: Course to Fix
CMM	Component Maintenance Manual
CPDLC	Controller-Pilot Data Link Communications
CRC	Cyclic Redundancy Check
CS	EASA Certification Specification
DB	Database or Data Block

Acronym	Description
DF	Path Terminator: Direct to Fix
DME	Distance Measuring Equipment
(E)HSI	(Electronic) Horizontal Situation Indicator
(E)TSO	(European) Technical Standard Order
EASA	European Aviation Safety Agency
EFIS	Electronic Flight Instrument System
EHSI	Electronic Horizontal Situation Indicator
ELA	Electrical Load Analysis
ETSO	European Technical Standard Order
EUROCAE	European Organisation for Civil Aviation Equipment
FA	Path Terminator: Fix to Altitude
FAA	Federal Aviation Administration
FAAOC	Foreign Aircraft Air Operator's Certificate
FAR	Federal Aviation Requirement (obsolete)
FAS	Final Approach Segment
FD	Flight Director
FD	Fault Detection
FDE	Fault Detection and Exclusion
FL	Flight Level
FM	Path Terminator: Course from Fix to Manual Termination
FMS	Flight Management System
FRT	Fixed Radius Transition
FTE	Flight Technical Error
FTP	Fictitious Threshold Point
GA	General Aviation
GNSS	Global Navigation Satellite System
GPA	Glidepath Angle
GPS	Global Positioning System
HF	High Frequency
HF	Path Terminator: Hold terminating at Fix
HIL	Horizontal Integrity Limit
HM	Path Terminator: Hold with Manual Termination
HPL	Horizontal Protection Limit

Acronym	Description
HSI	Horizontal Situation Indicator
ICAO	International Civil Aviation Organization
ICAW	Instructions for Continued Airworthiness
IF	Path Terminator: Initial Fix
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
INS	Inertial Navigation System
IPC	Illustrated Parts Catalogue
IRS	Inertial Reference System
IRU	Inertial Reference Unit
LIP	Latest Intercept Point
LNAV	Lateral Navigation
LNAV / VNAV	Lateral Navigation with Vertical Navigation
LOA	Letter of Acceptance or Letter of Authorisation
LOI	Loss of Integrity
LP	Localiser Performance
LPV	Localiser Performance with Vertical Guidance
LRNS	Long Range Navigation System
LTP	Landing Threshold Point
MAP	Map Display
MASPS	Minimum Aviation System Performance Specification
MCDU	Multi-function Control Display Unit
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
MOPS	Minimum Operational Performance Specifications
NAVAID	Navigation Aid
ND	Navigation Display
NDB	Non-directional beacon
NM	Nautical Mile
NSE	Navigation System Error
OEI	One Engine Inoperative
OEM	Original Equipment Manufacturer
Ops Spec	Operations Specifications

Acronym	Description
PAC	Permission Application Centre
PBN	Performance-based Navigation
PDE	Path Definition Error
PF	Pilot flying
PFD	Primary Flight Display
PFOV	Primary Field of View
PM / PNF	Pilot monitoring /pilot not flying
P-RNAV	Precision Area Navigation
QFE	Barometric Pressure – Field Elevation
QNH	Barometric Pressure – Nautical Height
QRH	Quick Reference Handbook
RAIM	Receiver Autonomous Integrity Monitor
RF Leg	Path Terminator: Radius to Fix Path Terminator
RNAV	Area Navigation
RNP	Required Navigation Performance
RNP APCH	RNP Approach
RNP AR APCH	RNP AR Approach
RNP AR DEP	RNP AR Departure
RO	Registered Operator
RTCA	Radio Technical Commission for Aeronautics
RVSM	Reduced Vertical Separation Minimum
SBAS	Space Based Augmentation System
SAE	SAE International Incorporated (formerly Society of Automobile Engineers)
SATCOM	Satellite Communications
SID	Standard Instrument Departure
SRM	Structural Repair Manual
STAR	Standard Terminal Arrival Route
STC	Supplemental Type Certificate
TAWS	Terrain Awareness Warning System
TF	Path Terminator: Track to Fix
TSE	Total System Error
TSO	Technical Standard Order
US	United States

Acronym	Description
VA	Path Terminator: Heading Vector to Altitude
VDI	Vertical Deviation Indicator
VI	Path Terminator: Heading Vector to Intercept
VM	Path Terminator: Heading Vector to Manual Termination
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VOR	Very High Frequency (VHF) Omni Range
VTF	Vector to Final

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below.

Term	Definition
Airspace	Area(s), route(s) or procedure(s) where: navigation performance requirements have been specified (PBN specifications) and aircraft must hold an authorisation or approval for the specified requirements (PBN specifications) in order to operate in the designated environment; or aircraft navigation equipment carriage , navigation system functional or performance requirements, or aircraft installation requirements have been specified in order for an aircraft to operate in the designated environment.
Alternate means of navigation	The use of information from an area navigation system in lieu of that from operating conventional navigation aids and navigation equipment that is installed, operational and compatible with conventional navigation aids.
Aeronautical Radio Incorporated Specification (ARINC) 424 Path Terminator	Aeronautical Radio Incorporated Specification 424 format for coding airborne navigation databases.
Cross-track error/deviation	The perpendicular distance between the planned flight path of an aircraft and the computed aircraft position as displayed by the aircraft's navigation instruments. This term is often referred to as 'lateral deviation'.
Flight day	A 24 hour period (from midnight to midnight) either Universal Coordinated Time (UCT) or local time, as established by the operator, during which at least one flight is initiated for the affected aircraft.
Letter of Acceptance (LOA)	A letter of acceptance issued by a regulatory authority to a data supplier that has demonstrated compliance with the requirements of RTCA DO-200A / EUROCAE ED-76 Standards for Processing Aeronautical Data. A LOA may be a Type 1 LOA or a Type 2 LOA.
Latest Intercept Point	An RNAV (RNP) approach procedure waypoint, other than an initial approach fix (IAF) indicating a position that an aircraft receiving a surveillance service may be cleared direct to, to commence an RNAV (RNP) approach. Note: A LIP is identified by a hash (#) symbol on an IAL chart adjacent to the relevant waypoint.

Term	Definition
Long range navigation system	A navigation system comprising an Inertial Navigation System (INS), an Inertial Reference System (IRS) or a Global Navigation Satellite System (GNSS) capable for use in oceanic or remote airspace.
Navigation specification	A set of aircraft and aircrew requirements needed to support PBN operations within a defined airspace. There are two kinds of navigation specification: RNAV and RNP (see entries for definitions).
Operator	The individual or organisation responsible for operational use of the aircraft. This might or might not be the Registered Operator for maintenance purposes.
Performance-based Navigation	Area navigation based on performance requirements for aircraft operating along an Air Traffic Services (ATS) route, on an instrument approach procedure or in a designated airspace.
QFE	The barometric altimeter setting that will cause an altimeter to read zero when at the reference datum of a particular airfield (in general, a runway threshold). In ISA temperature conditions the altimeter will read height above the datum in the vicinity of the airfield.
QNH	The barometric altimeter setting that will cause the altimeter to read airfield elevation when on the airfield. In ISA temperature conditions the altimeter will read altitude above mean sea level in the vicinity of the airfield.
Receiver Autonomous Integrity Monitor	A form of Aircraft Based Augmentation System (ABAS) whereby a GNSS receiver processor determines the integrity of the GNSS navigation signals using only Global Positioning System (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 needs to be available with the correct geometry over and above that needed for the position estimation, for the receiver to perform the Receiver Autonomous Integrity Monitor (RAIM) function.
Requisite GNSS satellites	Not less than the number of serviceable GNSS satellites specified in writing by the manufacturer of an RNP system to provide a particular level of RNP capability.
Restricted aerodrome	An aerodrome for which an operator restricts operations to aircraft with certain equipment, or flight crew with a certain combination of training, qualifications and experience, as set out in the operations manual.
RNAV specification	A navigation specification based on area navigation that does not include the requirement for on-board performance monitoring and alerting, designated by the prefix RNAV (e.g. RNAV 5, RNAV 1).
RNP specification	A navigation specification based on area navigation that includes the requirement for on-board performance monitoring and alerting, designated by the prefix RNP (e.g. RNP 4, RNP APCH).
Self-contained navigation system	INS, IRS or GNSS
Standard Instrument Departure	A designated instrument flight rule (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.
Standard Terminal Arrival Route	A designated IFR arrival route linking a significant point, normally on an ATS route, with a point from which a published instrument approach procedure can be commenced.

Term	Definition
State	In the international context, and throughout this document, means a country.
State of Registration	In relation to an aircraft, means the country in whose register of aircraft the aircraft is entered.
State of the Operator	In relation to an aircraft, means the country in which the principal place of business of the aircraft operator is situated or, if the aircraft operator has no place of business, the country in which the principal place of residence of the aircraft operator is situated.
Substitute Means of Navigation	The use of information from an area navigation system in lieu of that from out-of-service conventional navigation aids and/or inoperative or not-installed navigation equipment compatible with conventional navigation aids.
Type 1 LOA	Provides recognition of a data supplier's compliance with RTCA DO-200A / EUROCAE ED-76 Standards for Processing Aeronautical Data with no identified compatibility with an aircraft system.
Type 2 LOA	Provides recognition of a data supplier's compliance with RTCA DO-200A / EUROCAE ED-76 Standards for Processing Aeronautical Data and identifies the compatibility of its delivered data with particular avionic systems that are identified in the LOA.

1.3 References

Regulations

Regulations are available on the ComLaw website http://www.comlaw.gov.au/Home

Document	Title
	Transport Safety Regulations 2003
Part 21	Certification and airworthiness requirements for aircraft and parts
Part 42	Continuing airworthiness requirements for aircraft and aeronautical products
CAO 20.18	Aircraft equipment – basic operational requirements
CAO 20.91	Instructions and directions for performance-based navigation

Airworthiness Standards

Document	Title
US 14 CFR Part 23	Airworthiness standards: normal, utility, acrobatic, and commuter category airplanes
US 14 CFR Part 25	Airworthiness standards: transport category airplanes
US 14 CFR Part 27	Airworthiness standards: normal category rotorcraft
European Aviation Safety Agency (EASA) CS – 23	Certification Specifications for Normal, Utility, Aerobatic, and Commuter Aeroplanes
EASA CS – 25	Certification Specifications for Large Aeroplanes

Document	Title
EASA CS – 27	Certification Specifications for Small Rotorcraft

Advisory material

CASA's Advisory Circulars are available at http://www.casa.gov.au/AC

CASA's Civil Aviation Advisory Publications (CAAPs) are available at http://www.casa.gov.au/CAAP

Document	Title
AC 21-36	Global Navigation Satellite System (GNSS) Equipment: Airworthiness Guidelines
AC 21-38	Aircraft Electrical Load Analysis and Power Source Capacity
AC 91.U-04	Airworthiness requirements for Performance Based Navigation
CAAP 35-1	Global Positioning System (GPS): general installation guidelines
CAANZ AC 91-18	Aircraft software configuration management
EASA AMC 20-26	Airworthiness Approval and Operational Criteria for RNP Authorisation Required (RNP AR) Operations
EASA AMC 20-27	Airworthiness Approval and Operational Criteria for RNP APPROACH (RNP APCH) Operations including APV BARO-VNAV Operations
EASA AMC 20-4	Airworthiness Approval and Operational Criteria For the Use of Navigation Systems in European Airspace Designated For Basic RNAV Operations
Federal Aviation Administration (FAA) AC 20-129	Criteria for Approval of Category I and Category II Weather Minima for Approach
FAA AC 20-130A	Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors
FAA AC 20-138C	Airworthiness Approval of Positioning and Navigation Systems.
FAA AC 25-15	Approval of Flight Management Systems in Transport Category Airplanes
FAA AC 90-100A	U.S. Terminal and En Route Area Navigation (RNAV) Operations
FAA AC 90-101A	Approval Guidance for RNP Procedures with AR
FAA AC 90-105	Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System
FAA AC 90-45A	Approval of Area Navigation Systems for use in the U.S. National Airspace System
FAA AC 90-96A	Approval of U.S. Operators and Aircraft to Operate under Instrument Flight Rules (IFR) in European Airspace Designated for Basic Area Navigation (B-RNAV) and Precision Area Navigation (P-RNAV)
FAA AC 120-29A	Criteria for Approval of Category I and Category II Weather Minima for Approach

Technical Standard Orders

Document	Title
European Technical Standard Order (ETSO) C106	Air Data Computer
ETSO C115b	Airborne Area Navigation Equipment using Multi-Sensor Inputs
ETSO C129a	Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS)
ETSO C145	Airborne Navigation Sensors Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS)
ETSO C146	Stand-Alone Airborne Navigation Equipment Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS)
US Technical Standard Order (TSO) C106	Air Data Computer
US TSO C115c	Flight management system (FMS) using multi-sensor inputs
US TSO C129a	Airborne Supplemental Navigation Equipment Using The Global Positioning System (GPS)
US TSO C145c	Airborne Navigation Sensors Using the Global Positioning System Augmented by the Satellite Based
US TSO C146c	Stand-Alone Airborne Navigation Equipment Using The Global Positioning System Augmented By The Satellite Based Augmentation System
US TSO C196a	Airborne Supplemental Navigation Sensors for Global Positioning System Equipment using Aircraft-Based Augmentation

ICAO documents

Document	Title
Annex 6 to the Chicago Convention	Operation of Aircraft
Document 9613 Edition 4	Performance-based Navigation (PBN) Manual
Document 9905	Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual

European Organisation for Civil Aviation Equipment (EUROCAE) documents

Document	Title
ED-26	Minimum Performance Specifications for airborne altitude measurements and coding systems - Including Erratum
ED-72A	Minimum Operational Performance Specifications for Airborne GPS Receiving Equipment used for Supplemental Means of Navigation
ED-75B	MASPS: Required Navigation Performance for Area Navigation (RNAV)

Document	Title
ED-76	Standards for Processing Aeronautical Data
ED-77	Standards for Aeronautical Information

RTCA, Inc. documents

Document	Title
DO-88	Altimetry
DO-200A	Standards for Processing Aeronautical Data
DO-201A	Standards for Aeronautical Information
DO-208	Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment using Global Positioning System (GPS)
DO-229D	Minimum Operational Performance Standards for Global Positioning System/Wide Area Augmentation System Airborne Equipment
DO-236B	Minimum Aviation System Performance Standards: Required Navigation Performance for Area Navigation
DO-283A	Minimum Operational Performance Standards for Required Navigation Performance for Area Navigation
DO-316	Minimum Operational Performance Standards for Global Positioning System/Aircraft Base Augmentation System Airborne Equipment

Aeronautical Radio, Inc. (ARINC) 424 documents

Document	Title
ARINC 424	Navigation Systems Data Base
ARINC 706	Mark 5 Air Data System

Society of Automotive Engineering Inc.: Aeronautical Recommended Practices

Document	Title
ARP-920A	Design and Installation of Pitot-Static Systems for Transport Aircraft
ARP-942	Pressure Altimeter Systems

Document number changes

The bundling of ACs (FAA) or AMCs (EASA) may result in document number changes, e.g. AC 20-138B supersedes AC 20-129, AC 20-130A, AC 20-138A and AC 25-4. Similarly, some TSOs have been superseded by newer publications, e.g. FAA TSO-C129() has been cancelled. In these cases the original document number available at the time of issue has been retained.

1.4 Forms

CASA's forms are available at http://www.casa.gov.au/forms

Document	Title
CASA Form 1307	Navigation Authorisations (PBN and RVSM) Application form.

2 Introduction

2.1 Overview

2.1.1 Performance-based Navigation (PBN) uses global navigation satellite systems (GNSS) and computerised on board systems. PBN encompasses two types of navigation specifications:

- RNAV (aRea NAVigation)
- RNP (Required Navigation Performance).

The difference between RNAV and RNP is that on-board performance monitoring and alerting is required for RNP but not for RNAV.

2.1.2 CAO 20.18 mandates the installation of GNSS into all instrument flight rules (IFR) aircraft from 4 February 2016. On 4 February 2016, the Back-up Navigation Network (BNN) comes into existence, which will result in approximately 200 terrestrial navigation aids being withdrawn from service soon after this date. Therefore, from 4 February 2016, Australia will effectively be GNSS-based PBN airspace.

2.1.3 The requirements for PBN are primarily in CAO 20.91;however, the requirements for RNP 10 and RNP 4 are in Subpart 91.U and the requirements for RVSM are in Parts 181A–181X of CAR 1988. To simplify the navigation authorisation process, all navigation authorisations (including RVSM, RNP 10 and RNP 4) are applied for using CASA Form 1307.

2.1.4 The navigation specifications addressed in Appendix A of this AC are:

- RNAV 5
- RNAV 1 and RNAV 2
- RNP 2
- RNP 1
- RNP 0.3
- RNP Approach (RNP APCH)
- RNP Authorisation Required Operations (RNP AR Operations)
- Advanced RNP.

2.1.5 The supplemental specifications are also addressed:

- Approach with Vertical Guidance (APV) Barometric Vertical Navigation (Baro-VNAV)
- Radius to Fix Path Terminators (RF Legs)
- Fixed Radius Transitions (FRT).

2.2 Applicability

2.2.1 This AC is applicable to operators of Australian registered aircraft and their flight crews conducting or intending to conduct PBN operations. A navigation authorisation must be obtained from the Civil Aviation Safety Authority (CASA) for each navigation specification to be used by the operator unless the deeming provisions of Sections 9,

10, 11 or 16 of CAO 20.91 are applicable and all requirements of those provisions are complied with.

2.2.2 Appendix B, Annex 5 of this AC provides information for foreign operators proposing to carry out PBN operations in Australian airspace. In accordance with the provisions of Parts I, II and III of Annex 6 to the Convention on International Civil Aviation (the Chicago Convention), subject to due diligence, Australia will accept the operational approvals (navigation authorisations) issued to foreign aircraft operators by their State of Registry or Operator.

2.3 Related publications

2.3.1 For further airworthiness and installation information, operators are advised to view AC 21-36.

2.4 AC structure

2.4.1 Appendix A provides advisory material related to CAO 20.91. This Appendix should be read in conjunction with CAO 20.91.

2.4.2 Appendix B provides general guidance associated with navigation authorisations, but more specifically oriented to the application process. The purpose of this Appendix is to assist applicants to compile navigation authorisation application data packages that demonstrate compliance with all relevant requirements.

2.5 Identifying the navigation authorisations required

2.5.1 Operators should identify the navigation authorisations required for their operation before submitting an application in accordance with this AC. To identify the applicable navigation specifications, operators should review the intended application section for each specification in Table 1.

2.5.2 Within CAO 20.91, there are supplemental authorisations for RF Legs and FRT that may be required in some airspace. If the aircraft is approved for these supplemental authorisations, they should be included in the application.

Table 1: Navigation authorisations for typical operations

Operation	Applicable navigation specifications
Australian continental operations not entering oceanic airspace that include en route, terminal and RNAV (GNSS) approach.	• RNP 2 • RNP 1 • RNP APCH – LNAV
Australian continental operations not entering oceanic airspace that include en route, terminal and RNAV (GNSS) approach with Baro-VNAV.	• RNP 2 • RNP 1 • RNP APCH – LNAV • Baro-VNAV
Operations entering oceanic airspace as well as continental operations that include en route, terminal and RNAV (GNSS) approach.	• RNAV 10 (RNP 10); • RNP 2; • RNP 1; and • RNP APCH – LNAV
Operations entering oceanic airspace as well as continental operations that include en route, terminal and RNAV (GNSS) approach that will also be operating in airspace with the service volume of a Space Based Augmentations System (SBAS) system.	• RNAV 10 (RNP 10); • RNP 2; • RNP 1; and • RNP APCH – LNAV • RNP APCH – LP and LPV
Operations entering oceanic airspace with reduced separation (30 NM lateral and longitudinal separation) as well as continental operations that include en route, terminal and RNAV (GNSS) approach. Note: There are likely to be additional requirements for aircraft to be *equipped* with CPDLC and ADS-C to support reduced separation operations in oceanic airspace.	• RNAV 10 (RNP 10) • RNP 4 • RNP 2 • RNP 1 • RNP APCH – LNAV
Aircraft that operate in B-RNAV airspace in Europe.	• RNAV 5
Aircraft that operate in European P-RNAV airspace or US RNAV Type A or Type B airspace.	• RNAV 1 • RNAV 2

2.6 Deeming provisions

2.6.1 CAO 20.91 sections 9, 10 and 11 provide for aircraft already fitted with appropriate GNSS navigation equipment to be deemed to meet the requirements of Appendices 1, 2, 3, 4 and 6. Those aircraft may have been operating with the equipment for many years and depending on the standard to which the equipment is certified, are likely to satisfy the requirements for RNAV 5; RNAV 1 and 2; RNP 2; RNP 1 and RNP APCH – LNAV.

2.6.2 To qualify for this deemed approval the Aircraft Flight Manual (AFM) must state the operations for which the GNSS navigation equipment is approved. Assuming the pilot meets the licensing requirements, the authorisations deemed applicable to an aircraft depend on the equipment installed in the aircraft and the installation meeting the requirements of CASA AC 21-36 or CAAP 35-1 for stand-alone GNSS installations. Table 2 identifies the authorisations deemed to be held by suitably equipped aircraft.

Table 2: PBN deeming provisions for GNSS-equipped aircraft

Aircraft GNSS equipment	PBN authorisation	Previously known as
TSO C129 ( ) Class A1 or A2 ETSO C129 ( ) Class A1 or A2 TSO C146( ) Class Gamma Operational Class 1, 2 or 3 ETSO C146( ) Class Gamma Operational Class 1, 2 or 3 Integrated avionics systems using GNSS sensors with TSO C129( ) or ETSO C129( ) Class B1, B2, B3, B4, C1,C2, C3 or C4 authorisation, or TSO C145( ) or ETSO C145( ) Class Beta and operational Class 1, 2 or 3 as the only primary sensor input to the area navigation function are deemed to be stand-alone systems for the purposes of these deeming provisions.	RNAV 5	GPS en-route
	RNAV 1 and RNAV 2	GPS terminal
	RNP 2	GPS en-route
	RNP 1	GPS terminal
TSO C129a Class A1 ETSO C129a Class A1 TSO C146( ) Class Gamma Operational Class 1, 2 or 3 ETSO C146( ) Class Gamma Operational Class 1, 2 or 3 Integrated avionics systems using GNSS sensors with TSO C129( ) or ETSO C129( ) Class B1, B3, C1, or C3 authorisation, or TSO C145( ) or ETSO C145( ) Class Beta and operational Class 1, 2 or 3 as the only primary sensor input to the area navigation function are deemed to be stand-alone systems for the purposes of these deeming provisions.	RNAV 5	GPS en-route
	RNAV 1 and RNAV 2	GPS terminal
	RNP 2	GPS en-route
	RNP 1	GPS terminal
	RNP APCH – LNAV	GPS non-precision approach
TSO C146( ) Class Gamma Operational Class 2 or 3 ETSO C146( ) Class Gamma Operational Class 2 or 3 Integrated avionics systems using GNSS sensors with TSO C145( ) or ETSO C145( ) Class Beta and operational Class 2 or 3 as the only primary sensor input to the area navigation function are deemed to be stand-alone systems for the purposes of these deeming provisions. **Note:** RNP APCH LP or LPV operational approvals are valid only when the aircraft is operating within the service volume of a SBAS.	RNAV 5	GPS en-route
	RNAV 1 and RNAV 2	GPS terminal
	RNP 2	GPS en-route
	RNP 1	GPS terminal
	RNP APCH – LNAV	GPS non-precision approach
	RNP APCH – LNAV/VNAV	
TSO C146( ) Class Gamma Operational Class 3 ETSO C146( ) Class Gamma Operational Class 3 Integrated avionics systems using GNSS sensors with TSO C145( ) or ETSO C145( ) Class Beta and operational Class 3 as the only primary sensor input to the area navigation function are deemed to be stand-	RNAV 5	GPS en-route
	RNAV 1 and RNAV 2	GPS terminal
	RNP 2	GPS en-route

Aircraft GNSS equipment	PBN authorisation	Previously known as
alone systems for the purposes of these deeming provisions. **Note:** RNP APCH LP or LPV operational approvals are valid only when the aircraft is operating within the service volume of a SBAS.	RNP 1	GPS terminal
	RNP APCH – LNAV	GPS non-precision approach
	RNP APCH – LNAV/VNAV	
	RNP APCH – LP	
	RNP APCH – LPV	

Notes:

1. If an alternate is required, for aircraft using TSO C129 GNSS equipment, the alternate must not be based on GNSS.
2. ( ) refers to any numbered version of the order. Always use the current version of the order.

2.6.3 For RNAV 5; RNAV 1 and 2; RNP 2; RNP 1, RNP APCH - LNAV, RNP APCH – LNAV/VNAV and RNP APCH-LP or RNP APCH-LPV specifications the pilot must hold a current instrument rating with appropriate approvals or endorsements.

2.6.4 For instrument ratings issued under CAO 40.2 the pilot must have completed the relevant ground and flight training and be endorsed for GNSS en-route and instrument approach navigation. Where the rating is a Private Instrument Flight Rating the pilot must hold the relevant approvals for GNSS en-route and approach.

2.6.5 Where the instrument rating has been issued or re-issued under CASR Part 61 the pilot must have the relevant 2 D or, in the case of RNP APCH – LNAV/VNAV, or RNP APCH-LPV, 3 D endorsements.

3 Human factors considerations

3.1 Autopilots

3.1.1 The use of autopilots is recommended as a means of minimising tracking errors, particularly where the accuracy requirement is more stringent, or the procedures are complex or have vertical and/or speed constraints.

3.2 Installation assessment

3.2.1 Navigation authorisation assessments will include consideration of the human factors and ergonomic elements of the operation and the equipment installed in the aircraft. Aircraft equipment installations will be assessed from a human factors perspective, particularly for aircraft that have been modified by installing new navigation or display systems. These assessments will consider the crew using the installed systems and the ability of the Pilot Flying (PF) and the Pilot Monitoring (PM) / Pilot Not Flying (PNF) to carry out their duties independently and as a crew. Where the application assessors identify human factors and ergonomic concerns with a navigation authorisation application, they will seek advice from CASA's subject matter experts.

3.2.2 If a further human factors assessment is found to be necessary, it will consider the impact on crew situational awareness, workload management and fatigue. Even though the aircraft navigation system installation has an airworthiness approval, if there are adverse human factors or ergonomic issues and the safety case presented in support of the request for authorisation is not sufficient then navigation authorisations could be subjected to operational limitations.

Appendix A

CAO 20.91 instructions and directions for performance-based navigation: advisory material

A.1 Instructions and directions for authorised use of PBN specifications

A.1.1 Subsection 8 of CAO 20.91 specifies the criteria that must be satisfied in order for an IFR flight to be undertaken using PBN specifications. For an IFR flight to be conducted using one or more PBN specifications, each of the following conditions must be met:

a. The aircraft meets the airworthiness requirements for the particular PBN specification.
b. The pilot in command holds the appropriate qualifications to operate the aircraft utilising the particular PBN authorisation.
c. Where required, the operator holds a navigation authorisation for the particular PBN navigation specification.
d. The flight is conducted in accordance with the navigation authorisation for the particular PBN specification and any conditions and limitations that may pertain to that authorisation.

A.2 Navigation authorisation deeming provisions

A.2.1 Subsections 9, 10 and 11 of CAO 20.91 deem the operator of an Australian aircraft to hold the navigation authorisations listed in the respective subsection when the criteria specified therein are met. The intent of these subsections is to enable the operators of aircraft equipped with GNSS stand-alone systems or integrated avionics systems that use only GNSS for the navigation function and not require a new CASA-issued navigation authorisation for the navigation specifications listed in the subsections.

A.2.2 The deeming of navigation authorisations for the navigation specifications listed in each of the subsections is based on previously demonstrated compliance. For the aircraft, the CAO requires that the installation must be approved in the AFM or Aircraft Flight Manual Supplement (AFMS), or must be compliant with AC 21-36, or CAAP 35-1 for installations completed before 13 April 2005. The CAO also requires that flight crew must have completed the specified training and have had their log book endorsed to certify completion of the training, and the training must have been valid for the navigation specification in which the aircraft is to be flown.

A.2.3 If an aircraft AFM or AFMS does not contain the required approval statements, but the aircraft is equipped with GNSS as specified in paragraphs 9.4, 10.4 or 11.4 of CAO 20.91, as applicable, the Post Installation Evaluation Sheet (AC 21-36 Appendix 2) should be completed. If the Post Installation Evaluation is completed satisfactorily for subsections 9, 10 or 11 of CAO 20.91, as applicable, the aircraft is eligible for deeming under the provisions of the applicable subsection.

A.2.4 The application of the deeming provisions to aircraft equipped with integrated avionics systems that use only GNSS for area navigation is oriented primarily at general aviation aircraft. In some installations, the systems have dual GNSS sensors; since the area navigation function is still based on GNSS only, these aircraft are not considered to be multi-sensor systems.

A.2.5 Aircraft that are equipped with FMS are considered to be multi-sensor systems when a combination of GNSS, inertial and/or radio updating may be used to determine the aircraft position for use in the area navigation function. Where an FMS has embedded

GNSS and the embedded GNSS is the only sensor used for area navigation, then these systems are considered to be stand-alone GNSS systems.

A.2.6 Where it is not possible to determine the GNSS navigation performance capability from the AFM or OEM documentation, Appendices 1, 2, 3, 4 and 5 should be used as a basis for seeking approval from CASA for the aircraft to be operated to these specifications

A.3 RNAV 5 guidance material

A.3.1 The information in this section provides additional guidance applicable specifically to the RNAV 5 navigation specification. Appendix 1 to CAO 20.91 defines the requirements for the issue of an RNAV 5 navigation authorisation.

A.3.2 System performance, monitoring and alerting

A.3.2.1 The RNAV 5 navigation specification allows aircraft navigation systems to use the following types or combinations of sensors:

a. Very High Frequency Omni Range (VOR) / Distance Measuring Equipment (DME)

or

b. DME/DME

or

c. Stand-alone inertial systems (INS or IRS)

or

d. GNSS.

A.3.2.2 While aircraft may be authorised to use any of the above sensors, it is the operator's responsibility to ensure that the navigation aid infrastructure supports the navigation performance requirements for the intended route and designated alternates. To meet the RNAV 5 navigation specification accuracy requirements, the following limitations apply to the above sensors[1]:

a. VOR may be used to a maximum or 60 NM (75 NM for Doppler VOR) from the navigation aid.
b. INS or IRS systems are limited to a maximum of two hours from the last alignment or position update.

A.3.2.3 The lack of VOR and DME navigation aids across large parts of Australia means that the accuracy requirements for RNAV 5 will not be met for operations based on VOR/DME or DME/DME position estimation. For practical purposes, the unlimited use of RNAV 5 in Australia relies on the use of GNSS as the primary sensor.

A.3.2.4 The use of GNSS to perform RNAV 5 operations is limited to equipment approved to European ETSO C129 ( ), ETSO C145( ), ETSO C146( ), FAA TSO C145( ), TSO C146( ), TSO C196 and TSO-C129( ) or equivalent.

[1] In accordance with the ICAO PBN Manual Vol II Part B Chapter 2 section 2.3.3.2.

A.3.2.5 Navigation integrity should be provided by RAIM or SBAS GNSS or an equivalent means within a multi-sensor navigation system. In addition, GPS stand-alone equipment should include the following functions:

a. pseudo-range step detection
b. health word checking.

Note: These two additional functions must be implemented in accordance with TSO C129a/ETSO-C129a or equivalent criteria.

A.3.3 Navigation Database

A.3.3.1 The RNAV 5 navigation specification does not require the aircraft to be equipped with a navigation database. If the navigation system(s) installed in the aircraft is equipped with a navigation database, the requirements specified in the CAO 20.91 subsection 13 are applicable.

A.4 RNAV 1 and RNAV 2 guidance material

A.4.1 The information in this section provides additional guidance applicable specifically to the RNAV 1 and RNAV 2 navigation specification. Appendix 2 to CAO 20.91 defines the requirements for the issue of an RNAV 1 and RNAV 2 navigation authorisation.

A.4.2 System performance, monitoring and alerting

A.4.2.1 The RNAV 1 and RNAV 2 navigation specification allows aircraft navigation systems to use the following types or combinations of sensors:

a. DME/DME
b. DME/DME/ Inertial Reference Unit (IRU)

or

c. GNSS.

A.4.2.2 While aircraft may be authorised to use any of the above sensors, it is the operator's responsibility to ensure that the navigation aid infrastructure supports the navigation performance requirements for the intended route and designated alternates. The lack of DME navigation aids across large parts of Australia means that the accuracy requirements for RNAV 1 and RNAV 2 will not be met for operations based on DME/DME or DME/DME/IRU position estimation. For practical purposes, the unlimited use of RNAV 1 and RNAV 2 in Australia relies on GNSS as a primary sensor.

A.4.2.3 If the aircraft will use DME/DME or DME/DME/IRU position estimation, the navigation system must meet the requirements of the PBN Manual Volume II Part B Chapter 3 paragraphs 3.3.3.2.2 and 3.3.3.2.3.

A.4.2.4 GNSS navigation equipment must comply with FAA TSO C145( ), TSO C146( ), TSO C196 or TSO C129( ). Positioning data from other types of navigation sensors may be integrated with the GNSS data, provided that other position data do not cause position errors exceeding the total system accuracy requirements. The use of GNSS equipment approved to TSO-C129 ( ) is limited to those systems that include the minimum functions specified in paragraph A.5.4. In addition, TSO-C129 equipment should include the following additional functions:

a. pseudo-range step detection
b. health word checking.

Note: These two additional functions are required to be implemented in accordance with TSOC 129a/ETSO-C129a or equivalent criteria.

A.4.3 Functional requirements

A.4.3.1 The navigation system in the aircraft must meet the functional requirements specified in the Appendix 2 to CAO 20.91. The PBN Manual RNAV 1 and RNAV 2 navigation specification functional requirements (reference PBN Manual Vol II Part B Chapter. 3 paragraph 3.3.3.3 are reproduced) in Table 3.

Table 3: RNAV 1 and RNAV 2 functional requirements

Paragraph	Functional requirement	Explanation
a)	Navigation data, including a to/from indication and a failure indicator, must be displayed on a lateral deviation display (CDI, (E)HSI) 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. They must meet the following requirements:	Non-numeric lateral deviation display (e.g. CDI, (E)HSI), with a to/from indication and a failure annunciation, for use as primary flight instruments for navigation of the aircraft, for manoeuvre anticipation, and for failure/status/integrity indication, with the following five attributes: 1. The displays must be visible to the pilot and located in the primary field of view (± 15 degrees from the pilot's normal line-of-sight) when looking forward along the flight path. 2. The lateral deviation display scaling should agree with any alerting and annunciation limits, if implemented. 3. The lateral deviation display must also have a full-scale deflection suitable for the current phase of flight and must be based on the required total system accuracy. 4. The display scaling may be set automatically by default logic or set to a value obtained from a navigation database. The full-scale deflection value must be known or must be available for display to the pilot commensurate with en-route, terminal, or approach values. 5. The lateral deviation display must be automatically slaved to the RNAV computed path. The course selector of the deviation display should be automatically slewed to the RNAV computed path. As an alternate means, a navigation map display

Paragraph	Functional requirement	Explanation
		should give equivalent functionality to a lateral deviation display as described in subparagraph a) (1-5), with appropriate map scales (scaling may be set manually by the pilot), and giving equivalent functionality to a lateral deviation display. **Note:** A number of modern aircraft eligible for this specification utilise a map display as an acceptable method to satisfy the stated requirements.
b)	The following system functions are required as a minimum within any RNAV 1 or RNAV 2 equipment:	1. The capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft (primary navigation display), the RNAV computed desired path and aircraft position relative to the path. For operations where the required minimum flight crew is two pilots, the means for the pilot not flying to verify the desired path and the aircraft position relative to the path must also be provided; 2. A navigation database, containing current navigation data officially promulgated for civil aviation, which can be updated in accordance with the Aeronautical Information Regulation and Control (AIRAC) cycle and from which ATS routes can be retrieved and loaded into the RNAV system. The stored resolution of the data must be sufficient to achieve negligible PDE. The database must be protected against pilot modification of the stored data; 3. The means to display the validity period of the navigation data to the pilot; 4. The means to retrieve and display data stored in the navigation database relating to individual waypoints and NAVAIDs, to enable the pilot to verify the route to be flown; and 5. The capacity to load from the database into the RNAV system the entire RNAV segment of the SID or STAR to be flown. **Note:** Due to variability in RNAV systems, this document defines the RNAV segment from the first occurrence of a named waypoint, track, or course to the last occurrence of a named waypoint, track, or course. Heading legs prior to the first named waypoint or after the last named waypoint do not have to be loaded from the database.
c)	The means to display the following items, either in the pilot's primary field of view, or on a readily accessible display page:	1. the active navigation sensor type 2. the identification of the active (To) waypoint 3. the ground speed or time to the active (To) waypoint; and 4. the distance and bearing to the active (To) waypoint.

Paragraph	Functional requirement	Explanation
d)	The capability to execute a 'direct to' function.	
e)	The capability for automatic leg sequencing with the display of sequencing to the pilot.	
f)	The capability to execute SIDs or STARs extracted from the on-board database, including the capability to execute flyover and fly-by turns.	
g)	The aircraft must have the capability to automatically execute leg transitions and maintain tracks consistent with the following ARINC 424 path terminators, or their equivalent: initial fix (IF) course to fix (CF) direct to fix (DF) track to fix (TF) .	**Notes:** 1. Path terminators are defined in ARINC Specification 424, and their application is described in more detail in documents RTCA DO-236B / EUROCAE ED-75B and RTCA DO-201A / EUROCAE ED-77. 2. Numeric values for courses and tracks must be automatically loaded from the RNAV system database.
h)	The aircraft must have the capability to automatically execute leg transitions consistent with VA, VM and VI ARINC 424 path terminators, or must be able to be manually flown on a heading to intercept a course or to go direct to another fix after reaching a procedure-specified altitude.	
i)	The aircraft must have the capability to automatically execute leg transitions consistent with CA and FM ARINC 424 path terminators, or the RNAV system must permit the pilot to readily designate a waypoint and select a desired course to or from a designated waypoint.	
j)	The capability to load an RNAV SID or STAR from the database, by route name, into the RNAV system is a recommended function. However, if all or part of the RNAV SID or STAR is entered through the manual entry of waypoints from the navigation database, the paths between a manually entered waypoint and the preceding and following waypoints must be flown in the same manner as a TF leg in terminal airspace.	
k)	The capability to display an indication of the RNAV system failure, including the associated sensors, in the pilot’s primary field of view.	

Paragraph	Functional requirement	Explanation
l)	For multi-sensor systems, the capability for automatic reversion to an alternate RNAV sensor if the primary RNAV sensor fails. This does not preclude providing a means for manual navigation source selection.	
m)	Database integrity	The navigation database suppliers should comply with document RTCA DO-200A / EUROCAE ED 76, Standards for Processing Aeronautical Data (see Part 1 Section 6). A Letter of Acceptance (LOA), issued by the appropriate regulatory authority to each of the participants in the data chain demonstrates compliance with this requirement. Discrepancies that invalidate a route must be reported to the navigation database supplier and affected routes must be prohibited by an operator's notice to its pilots. Aircraft operators should consider the need to conduct periodic checks of the operational navigation databases in order to meet existing quality system requirements.

A.5 RNP 2 guidance material

A.5.1 The information in this section provides additional guidance applicable specifically to the RNP 2 navigation specification. Appendix 3 to CAO 20.91 defines the requirements for the issue of an RNP 2 navigation authorisation.

A.5.2 Aircraft eligibility

A.5.2.1 The RNP 2 navigation specification may be used for continental operations or for oceanic / remote continental operations; both applications require GNSS.

A.5.2.2 For RNP 2 oceanic / remote continental airspace applications, loss of function is a major failure condition, which requires a dual independent navigation system configuration.

A.5.2.3 For RNP 2 continental applications, loss of function is a minor failure condition if the operator can utilise a different navigation system and proceed to a suitable airport; in this case, a single navigation system will meet the continuity requirement.

A.5.2.4 If a single aircraft configuration is to support all potential applications of RNP 2, the more stringent continuity requirement applies.

A.5.2.5 For large turboprop and jet aircraft, an autopilot system that is capable of being coupled to the flight guidance system (flight director and autopilot) should be installed. The installation of autopilots into other aircraft will be governed by regulatory requirements and human factors considerations. CAO 20.18 specifies requirements for fitment of automatic pilots.

A.5.3 System performance, monitoring and alerting

A.5.3.1 The following systems meet the accuracy and integrity requirements of these criteria:

a. aircraft with (E)TSO-C129a sensor (Class B or C), (E)TSO-C145( ) or TSO C196 and the requirements of (E)TSO C115b FMS, installed for IFR use in accordance with FAA AC 20-130A
b. aircraft with (E)TSO-C129a Class A1 or (E)TSO-C146( ) equipment installed for IFR use in accordance with AC 21-36( ) or FAA AC 20-138A.

A.5.4 Functional requirements

A.5.4.1 The navigation system in the aircraft must meet the functional requirements specified in Appendix 3 to CAO 20.91. The PBN Manual RNP 2 navigation specification functional requirements (PBN Manual Vol II Part C Ch. 2 paragraph 2.3.3.6) are reproduced in Table 4.Table 4: RNP 2 functional requirements

Table 4: RNP 2 functional requirements

Paragraph	Functional requirement	Explanation
a)	Navigation data, including a failure indicator, must be displayed on a lateral deviation display (CDI, (E) HSI)) 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.	Non-numeric lateral deviation display (e.g. CDI, (E)HSI), a failure annunciation, for use as primary flight instruments for navigation of the aircraft, for manoeuvre anticipation, and for failure/status/integrity indication, with the following six attributes: 1. The capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft (primary navigation display), the computed path and aircraft position relative to the path. For operations where the required minimum flight crew is two pilots, the means for the pilot not flying to verify the desired path and the aircraft position relative to the path must also be provided; 2. Each display must be visible to the pilot and located in the primary field of view (±15 degrees from the pilot's normal line of sight) when looking forward along the flight path; 3. The lateral deviation display scaling should agree with any implemented alerting and annunciation limits. 4. The lateral deviation display must also have a full-scale deflection suitable for the current phase of flight and must be based on the required track-keeping accuracy. 5. The display scaling may be set automatically by default logic; automatically to a value obtained from a navigation database; or, manually by flight crew procedures. The full-scale deflection value must be known or must be available for display to the pilot commensurate with the required track keeping accuracy; and 6. The lateral deviation display must be automatically slaved to the computed path. The course selector of the deviation display should be automatically slewed to the computed path or the pilot must adjust the CDI or HSI selected course to the computed desired track.

Paragraph	Functional requirement	Explanation
		As an alternate means of compliance, a navigation map display can provide equivalent functionality to a lateral deviation display as described in 1-6 above, with appropriate map scales and giving equivalent functionality to a lateral deviation display. The map scale should be set manually to a value appropriate for the RNP 2 operation.
b)	The RNP 2 operation requires the following minimum system and equipment functions:	1. 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 PDE. Database protections must prevent pilot modification of the on-board, stored data. 2. A means to display the validity period of the navigation data to the pilot. 3. A means to retrieve and display data stored in the navigation database relating to individual waypoints and NAVAIDs (when applicable), to enable the pilot to verify the RNP 2 route to be flown. 4. For RNP 2 tracks in oceanic/remote continental airspace using flexible (e.g. organized) tracks, a means to enter the unique waypoints required to build a track assigned by the ATS provider.
c)	The means to display the following items, either in the pilot's primary field of view, or on a readily accessible display:	1. the active navigation sensor type 2. the identification of the active (To) waypoint 3. the groundspeed or time to the active (To) waypoint; and 4. the distance and bearing to the active (To) waypoint.
d)	The capability to execute a 'direct to' function.	The aircraft and avionics manufacturers should identify any limitations associated with conducting the 'direct to' function during RNP 2 operations in the manufacturer's documentation.
e)	The capability for automatic leg sequencing with the display of sequencing to the pilot.	
f)	The capability to automatically execute waypoint transitions and maintain track consistent with the RNP 2 performance requirements.	
g)	The capability to display an indication of RNP 2 system failure in the pilot's primary field of view.	

Paragraph	Functional requirement	Explanation
h)	Parallel offset function (optional)	If implemented: 1. The system must have the capability to fly parallel tracks at a selected offset distance. 2. When executing a parallel offset, the navigation accuracy and all performance requirements of the original route in the active flight plan apply to the offset route. 3. The system must provide for entry of offset distances in increments of 1 NM, left or right of course. 4. The system must be capable of offsets of at least 20 NM. 5. When in use, the system must clearly annunciate the operation of offset mode. 6. When in offset mode, the system must provide reference parameters (e.g. cross-track deviation, distance-to-go, time-to-go) relative to the offset path and offset reference points. 7. The system must annunciate the upcoming end of the offset path and allow sufficient time for the aircraft to return to the original flight plan path. 8. Once the pilot activates a parallel offset, the offset must remain active for all flight plan route segments until the system deletes the offset automatically; the pilot enters a new direct-to routing; or, the pilot manually cancels the offset.

A.6 RNP 1 guidance material

A.6.1 The information in this section provides additional guidance applicable specifically to the RNP 1 navigation specification.

A.6.2 System performance, monitoring and alerting

A.6.2.1 The following systems meet the accuracy and integrity requirements of these criteria:

a. aircraft with (E)TSO-C129a sensor (Class B or C), (E)TSO-C145( ) or TSO C196 and the requirements of (E)TSO C115b FMS, installed for IFR use in accordance with FAA AC 20-130A

b. aircraft with (E)TSO-C129a Class A1 or (E)TSO-C146( ) equipment installed for IFR use in accordance with AC 21-36( ) or FAA AC 20-138A.

A.6.3 Functional requirements

The navigation system in the aircraft must meet the functional requirements specified in CAO CAO 20.91 Appendix 4. The PBN Manual RNP 1 navigation specification functional requirements (PBN Manual Vol II Part C Ch. 3 paragraph 3.3.3.4) are reproduced in

A.6.3.1 Table 5.

Table 5: RNP 1 functional requirements

Paragraph	Functional requirement	Explanation
a)	Navigation data, including a failure indicator, must be displayed on a lateral deviation display (CDI, (E)HSI)) 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.	Non-numeric lateral deviation display (e.g. CDI, (E)HSI)), with a to/from indication and a failure annunciation, for use as primary flight instruments for navigation of the aircraft, for manoeuvre anticipation, and for failure/status/integrity indication, with the following six attributes: 1. The capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft (primary navigation display), the computed path and aircraft position relative to the path. For operations where the required minimum flight crew is two pilots, the means for the pilot not flying to verify the desired path and the aircraft position relative to the path must also be provided; 2. Each display must be visible to the pilot and located in the primary field of view (±15 degrees from the pilot's normal line of sight) when looking forward along the flight path; 3. The lateral deviation display scaling should agree with any implemented alerting and annunciation limits; 4. The lateral deviation display must also have a full-scale deflection suitable for the current phase of flight and must be based on the required track-keeping accuracy. 5. The display scaling may be set: a. automatically by default logic; b. automatically to a value obtained from a navigation database; or c. manually by pilot procedures. **Note:** The full-scale deflection value must be known or must be available for display to the pilot commensurate with the required track keeping accuracy. 6. The lateral deviation display must be automatically slaved to the computed path. The course selector of the deviation display should be automatically slewed to the computed path or the pilot must adjust the CDI or HSI selected course to the computed desired track. As an alternate means of compliance, a navigation map display can provide equivalent functionality to a lateral deviation display as described in 1-6 above, with appropriate map scales and giving equivalent functionality to a lateral deviation display. The map scale should be set manually to a value appropriate for the RNP 1 operation.

Paragraph	Functional requirement	Explanation
b)	The following system functions are required as a minimum within any RNP 1 equipment:	1. 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 ATS routes can be retrieved and loaded into the RNP system. The stored resolution of the data must be sufficient to achieve negligible PDE. The database must be protected against pilot modification of the stored data. 2. The means to display the validity period of the navigation data to the pilot. 3. The means to retrieve and display data stored in the navigation database relating to individual waypoints and NAVAIDs, to enable the pilot to verify the route to be flown. 4. The capacity to load from the database into the RNP 1 system the entire segment of the SID or STAR to be flown. **Note:** Due to variability in systems, this document defines the RNAV segment from the first occurrence of a named waypoint, track, or course to the last occurrence of a named waypoint, track, or course. Heading legs prior to the first named waypoint or after the last named waypoint do not have to be loaded from the database. The entire SID will still be considered a RNP 1 procedure.
c)	The means to display the following items, either in the pilot's primary field of view, or on a readily accessible display page:	1. the active navigation sensor type 2. the identification of the active (To) waypoint 3. the ground speed or time to the active (To) waypoint 4. the distance and bearing to the active (To) waypoint.
d)	The capability to execute a 'direct to' function.	
e)	The capability for automatic leg sequencing with the display of sequencing to the pilot.	
f)	The capability to load and execute a RNP1 SID or STAR from the on board database, by procedure name, into the RNP system.	
g)	The aircraft must have the capability to automatically execute leg transitions and maintain tracks consistent with the following ARINC 424 path terminators, or their equivalent. • initial fix (IF) • course to fix (CF) • direct to fix (DF) • track to fix (TF)	**Notes:** 1. Path terminators are defined in ARINC Specification 424, and their application is described in more detail in documents RTCA DO-236B / EUROCAE ED-75B and RTCA DO-201A / EUROCAE ED-77. 2. Numeric values for courses and tracks must be automatically loaded from the RNP system database.

Paragraph	Functional requirement	Explanation
h)	The aircraft must have the capability to automatically execute leg transitions consistent with VA, VM and VI ARINC 424 path terminators, or must be able to be manually flown on a heading to intercept a course or to go direct to another fix after reaching a procedure-specified altitude.	
i)	The aircraft must have the capability to automatically execute leg transitions consistent with CA and FM ARINC 424 path terminators, or the RNP system must permit the pilot to readily designate a waypoint and select a desired course to or from a designated waypoint.	
j)	The capability to display an indication of the RNP 1 system failure, in the pilot's primary field of view.	

A.7 RNP 0.3 guidance material

A.7.1 The information in this section provides additional guidance applicable specifically to the RNP 0.3 navigation specification. The RNP 0.3 navigation specification is primarily for helicopters in metropolitan area or offshore support operations.

A.7.2 System performance, monitoring and alerting

A.7.2.1 The following systems meet the accuracy, integrity and continuity requirements of these criteria:

a. aircraft with (E)TSO-C145a and the requirements of (E)TSO-C115B FMS, installed for IFR use in accordance with FAA AC 20-130A
b. aircraft with (E)TSO-C146a equipment installed for IFR use in accordance with FAA AC 20-138 or AC 20-138A
c. aircraft with RNP 0.3 capability certified or approved to equivalent standards (e.g. TSO-C196).

A.7.3 Functional requirements

A.7.3.1 The navigation system in the aircraft must meet the functional requirements specified in Appendix 5 to CAO 20.91. The PBN Manual RNP 0.3 navigation specification functional requirements (PBN Manual 3 Vol II Part C Chapter 7 paragraph 7.3.3.5) are reproduced in Table 6.

Table 6: RNP 0.3 functional requirements

Paragraph	Functional Requirement	Explanation
a)	Navigation data, including a failure indicator, must be displayed on a lateral deviation display (CDI, (E)HSI) 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.	Non-numeric lateral deviation display (e.g. CDI, (E)HSI)), with a to/from indication and a failure annunciation, for use as primary flight instruments for navigation of the aircraft, for manoeuvre anticipation, and for failure/status/integrity indication, with the following six attributes: 1. The capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft (primary navigation display), the computed path and aircraft position relative to the path. For operations where the required minimum flight crew is two pilots, the means for the pilot not flying to verify the desired path and the aircraft position relative to the path must also be provided; 2. Each display must be visible to the pilot and located in the primary field of view (±15 degrees from the pilot's normal line of sight) when looking forward along the flight path; 3. The lateral deviation display scaling should agree with any implemented alerting and annunciation limits; 4. The lateral deviation display must also have a full-scale deflection suitable for the current phase of flight and must be based on the required track-keeping accuracy; 5. The display scaling may be set automatically by default logic, automatically to a value obtained from a navigation database; or manually by pilot procedures. The full-scale deflection value must be known or must be available for display to the pilot commensurate with the required track keeping accuracy; and 6. The lateral deviation display must be automatically slaved to the computed path. The course selector of the deviation display should be automatically slewed to the computed path. As an alternate means of compliance, a navigation map display can provide equivalent functionality to a lateral deviation display as described in 1-6 above, with appropriate map scales and giving equivalent functionality to a lateral deviation display. The map scale should be set manually to a value appropriate for the RNP 0.3 operation.

Paragraph	Functional Requirement	Explanation
b)	The following system functions are required as a minimum within any RNP 0.3 equipment:	1. The capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft (primary navigation display), the computed path and aircraft position relative to the path. For operations where the required minimum flight crew is two pilots, a means for the pilot not flying to verify the desired path and the aircraft position relative to the path must also be provided. 2. A navigation database, containing current navigation data officially promulgated for civil aviation, which can be updated in accordance with the Aeronautical Information Regulation and Control (AIRAC) cycle and from which IFR procedures and ATS routes or waypoint data corresponding to the coordinates of significant points on ATS 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. The database must be protected against pilot modification of the stored data. 3. The means to display the validity period of the navigation data to the pilot. 4. The means to retrieve and display data stored in the navigation database relating to individual waypoints and navigation aids, to enable the pilot to verify the ATS route to be flown. 5. The capacity to load into the RNP system, from the database, the entire Instrument Flight Procedure and the ATS route to be flown.
c)	The means to display the following items, either in the pilot's primary field of view, or on a readily accessible display page:	1. The active navigation sensor type. 2. The identification of the active (To) waypoint. 3. The ground speed or time to the active (To) waypoint. 4. The distance and bearing to the active (To) waypoint.
d)	The capability to execute a 'Direct to' function	
e)	The capability for automatic leg sequencing with the display of sequencing to the pilot.	
f)	The capability to execute RNP 0.3 terminal procedures extracted from the on-board navigation database, including the capability to execute fly-over and fly-by transitions.	

Paragraph	Functional Requirement	Explanation
g)	The capability to automatically execute leg transitions and maintain tracks consistent with the following ARINC 424 path terminators, or their equivalent. • Initial Fix (IF) • Course to Fix (CF) • Course to Altitude (CA) • Direct to Fix (DF) • Track to Fix (TF)	**Note:** Path terminators are defined in ARINC 424, and their application is described in more detail in documents RTCA DO-236B and RTCA DO-201A.
h)	The capability to automatically execute leg transitions consistent with VA, VM and VI ARINC 424 path terminators, or must be able to be manually flown on a heading to intercept a course or to go direct to another fix after reaching a procedure-specified altitude.	
i)	The capability to automatically execute leg transitions consistent with CA and FM ARINC 424 path terminators, or the RNAV system must permit the pilot to readily designate a waypoint and select a desired course to or from a designated waypoint.	
j)	The capability to load an ATS route from the database, by name.	
k)	The capability to display an indication of the RNP 0.3 system failure, in the pilot's primary field of view.	
l)	The system shall be capable of loading numeric values for courses and tracks from the onboard navigation database.	

A.8 RNP APCH guidance material

A.8.1 The information in this section provides additional guidance applicable specifically to the RNP APCH navigation specification. RNP APCH authorisations may be issued for:

a. RNP APCH – LNAV
b. RNP APCH – LNAV/VNAV (requires a Baro-VNAV authorisation in addition to the APCH – LNAV authorisation)
c. RNP APCH – LP
d. RNP APCH – LPV.

A.8.2 System performance, monitoring and alerting

A.8.2.1 The following systems meet the accuracy, integrity and continuity requirements of these criteria:

a. GNSS stand-alone systems, equipment should be approved in accordance with TSO-C129a/ ETSO-C129a Class A, (E)TSO-C146( ) Class Gamma and operational class 1, 2 or 3, or TSO C-196( )
b. GNSS sensors used in multi-sensor system (e.g. FMS) equipment should be approved in accordance with TSO C129 ( )/ ETSO-C129 ( ) Class B1, C1, B3, C3 or (E)TSO C145 ( ) class 1, 2 or 3, or TSO C-196( ). For GNSS receiver approved in accordance with (E)TSO-C129( ), capability for satellite FDE is recommended to improve continuity of function
c. multi-sensor systems using GNSS should be approved in accordance with AC20-130A, TSO-C115b or AC 20-138B, as well as having been demonstrated for RNP APCH capability.

A.8.2.2 For RNP APCH LP or LPV operations, the following systems meet the accuracy, integrity and continuity requirements of these criteria:

a. GNSS SBAS stand-alone equipment approved in accordance with (E)TSO C146a (or subsequent version). Application of this standard guarantees that the equipment is at least compliant with RTCA DO-229C. The equipment should be a class Gamma, operational class 3
b. For an integrated navigation system (e.g. FMS) incorporating a GNSS SBAS sensor, (E)TSO C115b and AC 20-130A provide an acceptable means of compliance for the approval of this navigation system when augmented by the following guidelines:
    i. the performance requirements of (E)TSO-C146a (or subsequent version) that apply to the functional class Gamma, operational class 3 or Delta 4 is demonstrated
    ii. the GNSS SBAS sensor is approved in accordance with (E)TSO C145a class Beta, operational class 3.
c. Approach system incorporating a class Delta GNSS SBAS equipment approved in accordance with (E)TSO C146a (or subsequent version). This standard guarantees that the equipment is at least compliant with RTCA DO-229C. The equipment should be a class Delta 4

A.8.3 Functional requirements: RNP APCH – LNAV

A.8.3.1 The navigation system in the aircraft must meet the functional requirements specified in CAO 20.91 Appendix 6. The PBN Manual RNP APCH Section A navigation specification functional requirements (PBN Manual Vol II Part C Chapter. 5 Section A paragraph 5.3.3.3) are reproduced in Table 7.

Table 7: RNP APCH LNAV functional requirements

Paragraph	Functional requirement
5.3.3.3.1	Navigation displays and required functions
5.3.3.3.1.2	Navigation data, including a to/from indication, and a failure indication, 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: a. The displays must be visible to the pilot and located in the primary field of view (±15 degrees from the pilot's normal line of sight) when looking forward along the flight path. b. The lateral deviation display scaling should agree with any alerting and annunciation limits. c. The lateral deviation display must also have a full-scale deflection suitable for the current phase of flight and must be based on the TSE requirement. Scaling is ±1 NM for the initial and intermediate segments and ±0.3 NM for the final segment. d. The display scaling may be set automatically by default logic or set to a value obtained from a navigation database. The full-scale deflection value must be known or must be available for display to the pilot commensurate with approach values. e. As an alternate means, a navigation map display must give equivalent functionality to a lateral deviation display with appropriate map scales (scaling may be set manually by the pilot). To be approved, the navigation map display must be shown to meet the TSE requirements f. It is highly recommended that the course selector of the deviation display is automatically slaved to the RNAV computed path. **Note:** This does not apply for installations where an electronic map display contains a graphical display of the flight path and path deviation. g. Flight director and/or autopilot is not required for this type of operation, however, if the lateral TSE cannot be demonstrated without these systems, it becomes mandatory. In this case, coupling to the flight director and/or automatic pilot from the RNP system must be clearly indicated at the cockpit level. h. Enhanced navigation display (e.g. electronic map display or enhanced EHSI) to improve lateral situational awareness, navigation monitoring and approach verification (flight plan verification) could become mandatory if the RNP installation does not support the display of information necessary for the accomplishment of these crew tasks.
5.3.3.3.1.3	The following system functions are required as a minimum: a. The capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft (primary navigation display), the RNAV computed desired path and aircraft position relative to the path. For aircraft where the minimum flight crew is two pilots, the means for the pilot not flying to verify the desired path and the aircraft position relative to the path must also be provided. b. 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 approach procedures can be retrieved and loaded into the RNP

Paragraph	Functional requirement
	system. The stored resolution of the data must be sufficient to achieve the required track-keeping accuracy. The database must be protected against pilot modification of the stored data. c. The means to display the validity period of the navigation data to the pilot. d. The means to retrieve and display data stored in the navigation database relating to individual waypoints and NAVAIDs, to enable the pilot to verify the procedure to be flown. e. Capacity to load from the database into the RNP system the whole approach to be flown. The approach must be loaded from the database, into the RNP system, by its name. f. The means to display the following items, either in the pilot's primary field of view, or on a readily accessible display page: i the identification of the active (To) waypoint ii the distance and bearing to the active (To) waypoint iii the ground speed or time to the active (To) waypoint. g. The means to display the following items on a readily accessible display page: i the display of distance between flight plan waypoints ii the display of distance to go iii the display of along-track distances iv the active navigation sensor type, if there is another sensor in addition to the GNSS sensor. h. The capability to execute a 'Direct to' function. i. The capability for automatic leg sequencing with the display of sequencing to the pilot j. The capability to execute procedures extracted from the on-board database, including the capability to execute fly-over and fly-by turns. k. The capability to automatically execute leg transitions and maintain tracks consistent with the following ARINC 424 path terminators, or their equivalent: i IF ii TF iii DF. **Note:** Path terminators are defined in ARINC 424, and their application is described in more detail in documents RTCA DO-236B / EUROCAE ED-75B and RTCA DO-201A / EUROCAE ED-77. l. the capability to display an indication of the RNP system failure, including the associated sensors, in the pilot's primary field of view m. the capability to indicate to the crew when NSE alert limit is exceeded (alert provided by the 'on-board performance monitoring and alerting function') n. the capability to automatically load numeric values for courses and tracks from the RNP system database.

A.8.4 Functional requirements: RNP APCH – LP and LPV

A.8.4.1 The navigation system in the aircraft must meet the functional requirements specified in Appendix 6 to CAO 20.91. The PBN Manual RNP APCH Section B navigation specification functional requirements (PBN Manual Vol II Part C Chapter 5 Section B paragraph 5.3.3.3) are reproduced in Table 8.

Table 8

Table 8: RNP APCH LPV functional requirements

Paragraph	Functional requirement
5.3.3.3.1	Navigation displays and required functions
5.3.3.3.1.2	Approach guidance must be displayed on a lateral and vertical deviation display (HSI, EHSI, CDI/VDI) including a failure indicator and must meet the following requirements: a. this display must be used as primary flight instruments for the approach b. the display must be visible to the pilot and located in the primary field of view (±15º from the pilot's normal line of sight) when looking forward along the flight path c. the deviation display must have a suitable full-scale deflection based on the required track-keeping accuracy. The lateral and vertical full-scale deflection are angular and associated to the lateral and vertical definitions of the Final Approach Segment (FAS) contained in the FAS Data Block (FAS DB). **Notes:** 1. Where the minimum flight crew is two pilots, it should be possible for the pilot not flying to verify the desired path and the aircraft position relative to the path. 2. For more details on lateral and vertical deviation display scales, see the non-numeric lateral cross-track and vertical deviation requirements of RTCA DO-229C ().
5.3.3.3.1.3	The following system functions are required as a minimum: a. The capability to display the GNSS approach mode (e.g. LP, LPV, LNAV/VNAV, lateral navigation) in the primary field of view. This annunciation indicates to the crew the active approach mode in order to correlate it to the corresponding line of minima on the approach chart. It can also detect a level of service degradation (e.g. downgrade from LPV to lateral navigation). The airborne system should automatically provide the highest 'level of service' available for the annunciation of the GNSS approach mode when the approach is selected. b. The capability to continuously display the distance to the Landing Threshold Point (LTP) / Fictitious Threshold Point (FTP). c. The navigation database must contain all the necessary data/information to fly the published approach procedure. Although data may be stored or transmitted in different ways, the data has to be organised in Final Approach Segment Data Blocks (FAS DBs) for the purpose of computing the Cyclic Redundancy Check (CRC). This format provides integrity protection for the data it contains. Consequently, each FAS is defined by a specific 'FAS DB' containing the necessary lateral and vertical parameters depicting the approach to be flown. Once the FAS DB has been decoded, the equipment shall apply the CRC to the DB to determine whether the data is valid. If the FAS DB does not pass the CRC test, the equipment shall not allow activation of the approach operation d. The capacity to select from the database into the installed system the whole approach procedure to be flown (SBAS channel number and/or approach name) e. The indication of the loss of navigation (e.g. system failure) in the pilot's primary field of view by means of a navigation warning flag or equivalent indicator on the vertical and/or lateral navigation display) f. The indication of the LOI function in the pilot's normal field of view (e.g. by means of an appropriately located annunciator) g. The capability to immediately provide track deviation indications relative to the extended FAS, in order to facilitate the interception of the extended FAS from a radar vector (e.g. VTF function). **Note:** These requirements are limited to the FAS, the straight continuation of the final approach in the missed approach, and to the interception of the extended FAS. If the installed system is also able to fly the initial, intermediate and missed approach segments of the approach, the corresponding requirement (e.g. RNP APCH, Section A of this chapter, or RNAV1 criteria) applies.

A.9 RNP AR Operations guidance material

A.9.1 The information in this section provides additional guidance applicable specifically to the RNP AR Operations navigation specification. Appendix 7 to CAO 20.91 defines the requirements for the issue of an RNP AR Operations navigation authorisation.

A.9.2 Since RNP AR navigation authorisations are complex, time consuming and expensive to obtain and maintain, operators considering applying for a RNP AR navigation authorisation should contact CASA to review the requirements and process for such an approval. The system performance and functional requirements, required in accordance with Appendix 7 to CAO 20.91, are specified in the PBN Manual RNP AR APCH navigation specification.

A.10 Baro-VNAV guidance material

A.10.1 The information in this section provides additional guidance applicable specifically to the Baro-VNAV navigation specification.

A.10.2 System performance, monitoring and alerting

A.10.2.1 Baro-VNAV approach operations are based upon the use of RNAV equipment that automatically determines aircraft position in the vertical plane using inputs from equipment that can include:

a. FAA TSO-C106, Air Data Computer
b. air data system, Aeronautical Radio Incorporated (ARINC) 706, Mark 5 Air Data System
c. barometric altimeter system, RTCA DO-88 Altimetry, EUROCAE ED-26 MPS for Airborne Altitude Measurements and Coding Systems, SAE ARP-942 Pressure Altimeter Systems, SAE ARP-920 Design and Installation of Pitot Static Systems for Transport Aircraft; and Attachment A. Barometric VNAV (Baro-VNAV) II-Attachment A-5
d. type certified integrated systems providing an air data system capability comparable to item b).

Notes:

1. Positioning data from other sources may be integrated with the barometric altitude information provided it does not cause position errors exceeding the track keeping accuracy requirements.
2. Altimetry system performance is demonstrated separately through the static pressure systems certification (e.g. FAR or CS 25.1325), where performance must be 30 ft per 100 KIAS. Altimetry systems meeting such a requirement will satisfy the Altimetry System Error (ASE) requirements for Baro-VNAV. No further demonstration or compliance is necessary.

A.10.2.2 The 99.7% aircraft ASE for each aircraft (assuming the temperature and lapse rates of the International Standard Atmosphere) must be less than or equal to the following:

$$ASE = -8.8 \times 10^{-8} \times H^2 + 6.5 \times 10^{-3} \times H + 50 \, (ft)$$

Where H is the true altitude of the aircraft.

A.10.3 Functional requirements

A.10.3.1 The navigation system in the aircraft must meet the functional requirements specified in Appendix 8 to CAO 20.91. The PBN Manual Attachment A Barometric VNAV navigation specification functional requirements (PBN Manual Attachment A paragraphs 4.7- 4.15) are reproduced in Table 9.

Table 9: APV Baro-VNAV functional requirements

Paragraph	Functional requirement
4.7.2.1	Path definition
4.7.2.1.1	The requirements for defining the vertical path are governed by the two general requirements for operation: allowance for aircraft performance, and repeatability and predictability in path definition. This operational relationship leads to the specifications in the following sections that are based upon specific phases of flight and flight operations.
4.7.2.1.2	The navigation system must be capable of defining a vertical path by a flight path angle to a fix. The system must also be capable of specifying a vertical path between altitude constraints at two fixes in the flight plan. Fix altitude constraints must be defined as one of the following: a. an 'AT OR ABOVE' altitude constraint (e.g. 2400A, may be appropriate for situations where bounding the vertical path is not required) b. an 'AT or BELOW' altitude constraint (e.g. 4800B, may be appropriate for situations where bounding the vertical path is not required) c. an 'AT' altitude constraint (e.g. 5200) d. a 'WINDOW' constraint (e.g. 2400A3400B). **Note:** For RNP AR approach procedures, any segment with a published vertical path will define that path based on an angle to the fix and altitude.
4.8	Vertical constraints Altitudes and/or speeds associated with published procedures must be automatically extracted from the navigation database upon selecting the approach procedure.
4.9	Path construction The system must be able to construct a path to provide guidance from the current position to a vertically constrained fix.
4.10	Capability to load procedures from the navigation database The navigation system must have the capability to load and modify the entire procedure(s) to be flown, based upon Air Traffic Control (ATC) instructions, into the RNP system from the on-board navigation database. This includes the approach (including vertical angle), the missed approach and the approach transitions for the selected airport and runway. The navigation system should preclude modification of the procedure data contained in the navigation database.
4.11	Temperature limits For aircraft using Baro-VNAV without temperature compensation to conduct the approach, low temperature limits are reflected in the procedure design and identified along with any high temperature limits on the charted procedure. Cold temperatures reduce the actual GPA, while high temperatures increase the actual GPA. Aircraft using Baro-VNAV with temperature compensation or aircraft using an alternate means for vertical guidance (e.g. SBAS) may disregard the temperature restrictions.

<table>
<tr><th>Paragraph</th><th>Functional requirement</th></tr>
<tr><td>4.12</td><td>Guidance and control
For the vertical performance requirements, the path steering error budget must reflect altitude reference as well as other factors, such as roll compensation and speed protection, as applicable.</td></tr>
<tr><td>4.13</td><td>User interface</td></tr>
<tr><td>4.13.1</td><td>Displays and control
The display resolution (readout) and entry resolution for VNAV information should be as specified below:
<table>
<tr><th>Parameter</th><th>Display resolution (readout)</th><th>Entry resolution</th></tr>
<tr><td>Altitude</td><td>Flight level or (1 ft)</td><td>Flight level or (1 ft)</td></tr>
<tr><td>Vertical path deviation</td><td>10 ft</td><td>Not applicable</td></tr>
<tr><td>Flight path angle</td><td>0.1°</td><td>0.1°</td></tr>
<tr><td>Temperature</td><td>1°</td><td>1°</td></tr>
</table></td></tr>
<tr><td>4.14</td><td>Path deviation and monitoring
The navigation system must provide the capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft, the aircraft position relative to the vertically defined path. The display must allow the pilot to readily distinguish if the vertical deviation exceeds +22 m/–22 m (+75 ft/–75 ft). The deviation should be monitored, and action taken to minimize errors.
a. It is recommended that an appropriately-scaled non-numeric deviation display (i.e. vertical deviation indicator) be located in the pilot’s primary field of view. A fixed-scale deviation indicator is acceptable as long as it demonstrates appropriate scaling and sensitivity for the intended operation. Any alerting and annunciation limits must also match the scaling values.
Note: Existing systems provide for vertical deviation scaling with a range of ±500 ft. Such deviation scaling should be assessed consistent with the above requirement on discernibility.
b. In lieu of appropriately scaled vertical deviation indicators in the pilot’s primary optimum field of view, a numeric display of deviation may be acceptable depending on the pilot workload and the numeric display characteristics. A numeric display may require additional initial and recurrent pilot training.
c. Since vertical deviation scaling and sensitivity varies widely, eligible aircraft must also be equipped with and operationally using either a flight director or autopilot capable of following the vertical path.</td></tr>
<tr><td>4.15</td><td>Barometric altitude
The aircraft must display barometric altitude from two independent altimetry sources, one in each pilot’s primary optimum field of view. Operator procedures should ensure current altimeter settings for the selected instrument procedure and runway.</td></tr>
</table>

A.11 Advanced RNP guidance material

A.11.1 The information in this section provides additional guidance applicable specifically to the Advanced RNP navigation specification.

A.11.2 System performance, monitoring and alerting

A.11.2.1 In Australia, Advanced RNP is predicated upon the use of GNSS for the primary means of navigation. The sensor must comply with the guidelines in FAA AC 20-138( ) or FAA AC 20-130A. For systems that comply with FAA AC 20-138( ), the following sensor accuracies can be used in the total system accuracy analysis without additional substantiation: GNSS sensor accuracy is better than 36 metres (95%), and augmented GNSS (GBAS or SBAS) sensor accuracy is better than 2 metres (95%). In the event of a latent GNSS satellite failure and marginal GNSS satellite geometry, the probability the TSE remains within the procedure design obstacle clearance volume must be greater than 95%.

Note: GNSS-based sensors output a HIL, also known as a HPL (see FAA AC 20-138( ) and RTCA DO-229D for an explanation of these terms). The HIL is a measure of the position estimation error assuming a latent failure is present. In lieu of a detailed analysis of the effects of latent failures on the TSE, an acceptable means of compliance for GNSS-based systems is to ensure the HIL remains less than twice the navigation accuracy, minus the 95 per cent of FTE, during the RNP operation.

A.11.3 System functionality

A.11.3.1 The navigation system in the aircraft must meet the functional requirements specified in Appendix 9 to CAO 20.91. The PBN Manual Advanced RNP navigation specification functional requirements (reference ICAO Doc 9613 Vol II Part C Chapter 4 paragraph 4.3.3.7) are reproduced in Table 10 through Table 13.

Table 10: Advanced RNP Functional requirements: Displays – guidance, situation and status

Item	Function/Feature	Description
a)	Continuous Display of Deviation	The navigation system must provide the capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft, the aircraft position relative to the RNP defined path. For operations where the required minimum flight crew is two pilots, the desired path and the aircraft position relative to the path must be provided for the non-flying pilot. The display must allow the pilot to readily distinguish if the cross-track deviation exceeds the navigation accuracy (or a smaller value). The numeric display of deviation on a map display with an appropriately scaled deviation indicator is generally considered acceptable for monitoring deviation. Moving map displays without an appropriately scaled deviation indicator may be acceptable depending on the task, flight crew workload, display characteristics, flight crew procedures and training.
b)	Identification of the Active (To) Waypoint.	The navigation system must provide a display identifying the active waypoint either in the pilot's primary optimum field of view, or on a readily accessible and visible display to the flight crew.

Item	Function/Feature	Description
c)	Display of Distance and Bearing	The navigation system must provide a display of distance and bearing to the active (To) waypoint in the pilot's primary optimum field of view. Where not viable, a readily accessible page on a control display unit, readily visible to the flight crew, may display the data.
d)	Display of Groundspeed and Time	The navigation system must provide the display of groundspeed and time to the active (To) waypoint in the pilot's primary optimum field of view. Where not viable, a readily accessible page on a control display unit, readily visible to the flight crew, may display the data.
e)	Desired Track Display	The navigation system must have the capability to continuously display to the pilot flying the aircraft desired track. This display must be on the primary flight instruments for navigation of the aircraft.
f)	Display of Aircraft Track.	The navigation system must provide a display of the actual aircraft track (or track angle error) either in the pilot's primary optimum field of view, or on a readily accessible and visible display to the flight crew.
g)	Failure Annunciation	The aircraft must provide a means to annunciate failures of any aircraft component of the RNP system, including navigation sensors. The annunciation must be visible to the pilot and located in the primary optimum field of view.
h)	Slaved Course Selector	The navigation system must provide a course selector automatically slaved to the RNP computed path.
i)	Display of Distance to Go	The navigation system must provide the ability to display distance to any waypoint selected by the flight crew.
j)	Display of Distance Between Flight Plan Waypoints	The navigation system must provide the ability to display the distance between flight plan waypoints.
k)	Display of Deviation	The navigation system must provide a numeric display of the lateral deviation with a resolution of 0.1 NM or less.
l)	Display of Active Sensors	The aircraft must display the current navigation sensor(s) in use. It is recommended that this display be provided in the primary optimum field of view. **Note:** This display is used to support operational contingency procedures. If such a display is not provided in the primary optimum field of view, crew procedures may mitigate the need for this display if the workload is determined to be acceptable.

Table 11: Advanced RNP functional requirements: Path definition and flight planning

Item	Function/Feature	Description
a)	Maintaining Tracks and Leg Transitions.	The aircraft must have the capability to execute leg transitions and maintain tracks consistent with the following ARINC 424 Path Terminators: • Initial Fix (IF) • Course to Fix (CF)

Item	Function/Feature	Description
		• Direct to Fix (DF) • Track to Fix (TF) • Radius to Fix (RF), see Appendix 1 to Part C, Volume II of this Manual • Course to Altitude (CA) • Course from a Fix to an Altitude (FA) • Heading to an Altitude (VA) • Course from a Fix to Manual Termination (FM) • Heading to Manual Termination (VM) • Heading to an Intercept (VI) • Holding to Manual Termination (HM) Where approval is sought for Fixed Radius Transitions (FRT) in association with this navigation specification, the RNP system must have the capability to create fixed radius transitions between route segments, based upon the data contained in the aircraft navigation system database – see Appendix 2 to Part C, Volume II of this Manual. **Notes:** 1. Path terminators and the fixed radius transition are defined in ARINC Specification 424, and their application is described in more detail in documents RTCA DO-236B / EUROCAE ED-75B and RTCA DO-201A / EUROCAE ED-77. 2. The list of path terminators includes a number that introduce variability in the flight path to be flown by the aircraft. For all RNP applications, the preferred path terminators are IF, DF, TF, and RF. Other path terminators may be used on the understanding that they will introduce less repeatability, predictability and reliability of aircraft lateral path performance. 3. For the VA, VM and VI path terminators, if the aircraft is not able to automatically execute these leg transitions, they should be able to be manually flown on a heading to intercept a course or to go direct to another fix after reaching a procedure-specified altitude.
b)	Leg Transition	1. Fly-By and Fly-Over Fixes. The aircraft must have the capability to execute fly-by and fly-over fixes. For fly-by turns, the navigation system must limit the path definition within the theoretical transition area defined in RTCA DO-236B / EUROCAE ED-75B. The fly-over turn is not compatible with RNP flight tracks and will only be used when there is no requirement for repeatable paths. 2. Fixed Radius Transitions: Where approval is sought for Fixed Radius Transitions (FRT), the aircraft must have the capability to execute the function in accordance with Appendix 2 to Part C, Volume II of this Manual.
c)	Intercepts	1. The RNP system should provide the ability to intercept the final approach at or before the final approach fix. 2. This functional capability must provide the pilot with the ability to re-join the published final approach track following a period when the aircraft has been flown manually, or in Automatic Flight Control System (AFCS) Heading mode, following ATC vectors to support Final Approach

Item	Function/Feature	Description
		Sequencing. 3. The implementation method and visual information (MCDU and primary displays (MAP/EHSI)) shall be sufficient to enable the correct re-acquisition of the track with a minimum of manual intervention on the MCDU. Due account must be taken of the workload associated with the re-acquisition and the impact of errors in leg sequencing.
d)	Holding	1. A holding procedure will only normally be required at defined holding points on entry to terminal airspace. However, holding may be required by ATC at any point. 2. A hold shall be defined by a point, the turn direction, an inbound track and an outbound distance. This data may be extracted from the database for published holds or may be manually entered for ad-hoc ATC holds. **Note:** It is highly desirable that the RNP system provide a holding capability that includes the computation of the hold flight path, guidance and/or cues to track the holding entry and path. 3. The system with the minimum of crew intervention must be capable of initiating, maintaining and discontinuing holding procedures at any point and at all altitudes.
e)	Parallel Offset	1. Parallel offsets provide a capability to fly offset from the parent track, as defined by the series of waypoints. 2. The turn defined for the parent track (fly-by or fixed radius transitions) shall be applied in the offset track. 3. Parallel offsets are applicable only for en-route segments and are not foreseen to be applied on SIDs, STARs or Approach procedures. 4. The activation of an offset shall be clearly displayed to the Flight Crew and the cross track deviation indication during the operation of the offset will be to the offset track.
f)	Offset Execution	1. The system should be capable of flying tracks offset by up to 20 NM from the parent track. 2. The presence of an offset should be continuously indicated. 3. Tracks offset from the parent track shall be continued for all ATS route segments and turns until either: a. removed by the crew or, b. automatically cancelled following: i amendment of the active flight plan by executing a 'Direct-To'; ii commencement of a terminal procedure; iii where a course change exceeds 90 degrees, the RNP system may terminate the offset at the fix where the course change occurs. The offset may also be terminated if the route segment ends at a hold fix. 4. The flight crew shall be given advance notice of this cancellation. 5. The cross track offset distance should be manually entered into the RNP system to a resolution of 1 NM or better.

Item	Function/Feature	Description
		6. Where parallel offsets are applied, the lateral track keeping requirement of RNP must be maintained referenced to the offset track. 7. Where Fixed Radius Transitions are applied, the offset track must be flown with the same turn radius as the parent track. 8. The cross track offset distance should be manually entered into the RNP system to a resolution of 1 NM or better. 9. Where parallel offsets are applied, the lateral track keeping requirement of RNP must be maintained referenced to the offset track.
g)	Entry and Recovery from Offsets	Transitions to and from the offset track must maintain an intercept angle of between 30 and 45°.
h)	Capability for a 'Direct-To' Function	1. The navigation system must have a 'Direct-To' function the flight crew can activate at any time. This function must be available to any fix. 2. The navigation system must also be capable of generating a geodesic path to the designated 'To' fix, without 'S-turning' and without undue delay.
i)	Altitudes and/or speeds associated with published terminal procedures	Altitudes and/or speeds associated with published terminal procedures must be extracted from the navigation database.
j)	Capability to Load Procedures from the Navigation Database	The navigation system must have the capability to load the entire procedure(s) to be flown into the RNP system from the on-board navigation database. This includes the approach (including vertical angle), the missed approach and the approach transitions for the selected airport and runway.
k)	Means to Retrieve and Display Navigation Data	The navigation system must provide the ability for the flight crew to verify the procedure to be flown through review of the data stored in the on-board navigation database. This includes the ability to review the data for individual waypoints and for navigation aids.
l)	Magnetic Variation	For paths defined by a course (e.g. CF and FA path terminators), the navigation system should use the appropriate magnetic variation value in the navigation database.
m)	Changes in Navigation accuracy	The RNP System should automatically retrieve and set the navigation accuracy for each leg segment of a route or procedure from the on-board navigation database. When a change occurs to a smaller navigation accuracy, e.g. from RNP 1.0 to RNP 0.3, the change must be complete by the first fix defining the leg with the smaller navigation accuracy requirement. The timing of this change must also consider any latency in alerting from the RNP System. When the RNP System cannot automatically set the navigation accuracy for each leg segment, any operational procedures necessary to accomplish this must be identified. **Note:** One acceptable means to meet this requirement may be to require the flight crew to manually set the smallest navigation accuracy the route or procedure uses before commencing the route or procedure (i.e., prior to the initial approach fix).

Item	Function/Feature	Description
		If the navigation accuracy for the RNP system has been set manually by the flight crew and following an RNP system change to the navigation accuracy required (e.g. the next flight path segment contains a different navigation accuracy), the RNP system should provide an alert to the flight crew.
n)	Automatic Leg Sequencing	The navigation system must provide the capability to automatically sequence to the next leg and display the sequencing to the flight crew in a readily visible manner.

Table 12: Advanced RNP functional requirements: System

Item	Function/Feature	Description
a)	Design Assurance	The system design assurance must be consistent with at least a major failure condition for the display of misleading lateral or vertical guidance in RNP applications.
b)	Navigation Database	1. The aircraft navigation system must use an on-board navigation database which can receive updates in accordance with the AIRAC cycle; and allow retrieval and loading of procedures into the RNP system. 2. The on-board navigation database must be protected against flight crew modification of the stored data. 3. When a procedure is loaded from the database, the RNP system must fly the procedure as published. This does not preclude the flight crew from having the means to modify a procedure or route already loaded into the RNP system. However, the procedures stored in the navigation database must not be modified and must remain intact within the navigation database for future use and reference. 4. The aircraft must provide a means to display the validity period for the on-board navigation database to the flight crew. 5. The equipment should not permit the flight crew to either manually or automatically select a route that is not supported. A route is not supported if it incorporates an FRT and the equipment does not provide FRT capability. The RNP system should also restrict pilot access to routes requiring fixed radius transitions if the equipment can support the route, but the aircraft is not otherwise equipped (e.g., the aircraft does not have the required roll steering autopilot or flight director installed). **Note:** An alternate means of satisfying this requirement is to remove such routes from the navigation database.

Table 13: Advanced RNP Functional Requirements: Optional capability

Item	Function/Feature	Description
a)	RNP Scalability	The RNP system must be capable of manual or automatic entry and display of navigation accuracy requirements in tenths of NM between 0.3 and 1.0 NM. The RNP system must provide lateral deviation displays and alerting appropriate to the selected navigation accuracy and application. **Notes:** 1. One means by which this can be achieved is as described in RTCA DO-283A MOPS. Another means is to develop lateral deviation displays and alerting as per RTCA/EUROCAE MASPS DO-236B / ED-75B. 2. It is recognized that aircraft and equipment that are based upon GNSS standards such as RTCA DO-208( ) and DO-229( ) have RNP capabilities for lateral deviation and alerting that are generally associated with navigation accuracies of 0.3, 1.0, and 2.0 NM only. Such capability exists in a large portion of the aircraft fleet but may not be extended to other navigation accuracies or the means of compliance specified herein. Additionally, some of this fleet does provide the capability to select other navigation accuracies. Therefore, before a manufacturer implements or an operator applies this functional capability, it is recommended that they determine the effects of the resolution of a number of issues including: a) How their aircraft and systems will be affected or accommodated operationally when different navigation accuracy requirements are needed. b) Whether there a basis for implementing improved functionality or operating procedures c) How such systems will need to be qualified, used by the flight crew and operationally approved.

A.12 Radius to fix path terminator guidance material

A.12.1 The information in this section provides additional guidance applicable specifically to the RF Leg supplemental navigation specification.

A.12.2 System performance, monitoring and alerting

A.12.2.1 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 TSE must be within 1 × RNP of the path defined by the published procedure for at least 95% of the total flight time for each phase of flight and each autopilot and/or flight director mode requested.

A.12.3 System functionality

A.12.3.1 The navigation system should not permit the pilot to select a procedure that is not supported by the equipment, either manually or automatically (e.g. a procedure is not supported if it incorporates an RF Leg and the equipment does not provide RF leg capability).

A.12.3.2 The navigation system should also prohibit pilot 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).

Notes:

1. One acceptable means to meet these requirements is to screen the aircraft's on-board navigation database and remove any routes or procedures the aircraft is not eligible to execute. For example, if the aircraft is not eligible to complete RF Leg segments, then the database screening could remove all procedures containing RF Leg segments from the navigation database.
2. Another acceptable means of compliance may be pilot training to identify and prohibit the use of procedures containing RF Legs.

A.13 Fixed radius transition guidance material

A.13.1 The information in this section provides additional guidance applicable specifically to the FRT navigation specification.

A.13.2 System performance, monitoring and alerting

A.13.2.1 The navigation system must have the capability to execute a flight path transition and maintain a track consistent with a fixed radius between two route segments. The lateral TSE must be within 1 × RNP of the path defined by the published procedure for at least 95% of the total flight time for each phase of flight and any manual, autopilot and/or flight director mode. For path transitions where the next route segment requires a different TSE and the path transition required is an FRT, the navigation system may retain the navigation accuracy value for the previous route segment throughout the entire FRT segment. For example, when a transition occurs from a route segment requiring an accuracy value of 2.0 to a route segment requiring an accuracy value of 1.0, the navigation system may use an accuracy value of 2.0 throughout the FRT.

A.13.3 Functional requirements

A.13.3.1 The system must be able to define transitions between flight path segments using a three-digit numeric value for the radius of turn (to 1 decimal place) in nautical miles, e.g. 15.0, 22.5.

A.13.4 Display requirements:

A.13.4.1 The aircraft system shall provide means for the flight crew to monitor the FTE during the FRT.

A.13.4.2 FTE monitoring shall be provided by means of displaying the curved path of the FRT on a moving map display (navigation display) with pilot selectable range and numerical indication of the cross-track value.

A.14 Flight crew knowledge and training: summary of requirements

A.14.1 Specific regulatory requirements for pilot training for RNAV 5; RNAV 1 and 2; RNP 2; RNP 1, RNP APCH and RNP APCH-LP or RNP APCH-LPV are defined in CAO 40.2 or Part 61. RNP AR training requirements are detailed in Appendix 7 to CAO 20.91.

A.14.2 The training program should provide sufficient training (e.g. simulator, training device or aircraft) on the aircraft's RNP system so that the pilots are familiar with the topics listed in Table 14.

Table 14: Summary of pilot training requirements

Knowledge Requirement	RNP 10	RNAV 5	RNAV 1 and RNAV 2	RNP 4	RNP 2	RNP 1	RNP 0.3	RNP APCH	Advanced RNP	Baro-VNAV	RF Legs	FRT
The capabilities and limitations of the navigation system(s) installed.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Knowledge of each of the navigation specifications to be used by the aircraft.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Theory of approach operations and the ILS look alike principle.								LPV	Y			
The meaning and proper use of aircraft equipment/navigation suffixes and functionality.			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Route, airspace and procedure characteristics as determined from chart depiction and textual description.	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	
Depiction of waypoint types (fly-over, fly-by and FRT) and AIRINC 424 path terminators (IF, TF, RF, CF, DF, FA, HA, HM, HF, CA, VA, FM, VM, VI) and any other types used by the operator, as well as associated aircraft/helicopter flight paths.						Y	Y	Y	Y	Y		
Knowledge on the required navigation equipment in order to conduct various RNAV and RNP operations including: GPS concepts and characteristics Augmented GNSS characteristics Minimum Equipment List provisions.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Navigation system-specific information.												

Knowledge Requirement	RNP 10	RNAV 5	RNAV 1 and RNAV 2	RNP 4	RNP 2	RNP 1	RNP 0.3	RNP APCH	Advanced RNP	Baro-VNAV	RF Legs	FRT
Levels of automation, mode annunciations, changes, alerts, interactions, reversions, and degradation.		Y	Y		Y	Y	Y	Y	Y	Y	Y	
Use of autopilot, auto throttle and flight director.			Y		Y	Y	Y	Y		Y		
Functional integration with other aircraft systems.		Y	Y		Y	Y	Y	Y	Y	Y	Y	
Flight Guidance(FG) mode behaviour.			Y		Y	Y	Y	Y	Y	Y		
The meaning and appropriateness of lateral and vertical route discontinuities as well as related pilot procedures.			Y		Y	Y	Y	Y	Y	Y		
Pilot procedures consistent with the operation.			Y		Y	Y	Y		Y	Y		
Monitoring procedures for each phase of the flight (e.g. monitor PROG or LEGS page).		Y	Y		Y	Y	Y	Y	Y	Y	Y	
Lateral and vertical path management.			Y		Y	Y	Y	Y		Y		
Types of navigation sensors (e.g. DME, IRU, GNSS) utilized by the navigation system and associated system prioritization/weighting/logic.		Y	Y		Y	Y	Y	Y	Y			
Turn anticipation with consideration to speed and altitude effects.		Y	Y		Y	Y	Y	Y	Y	Y		
Interpretation of (electronic) displays and symbols.		Y	Y		Y	Y	Y	Y	Y	Y	Y	
Understanding of the aircraft configuration and operational conditions required to support PBN operations, i.e. appropriate selection of CDI			Y		Y	Y	Y	Y	Y			

Knowledge Requirement	RNP 10	RNAV 5	RNAV 1 and RNAV 2	RNP 4	RNP 2	RNP 1	RNP 0.3	RNP APCH	Advanced RNP	Baro-VNAV	RF Legs	FRT
scaling (lateral deviation display scaling).												
Understand the performance requirement to couple the autopilot/flight director (AP/FD) to the navigation system's lateral guidance on RNP procedures, if required.			Y		Y	Y			Y			
The equipment should not permit the flight crew to select a procedure or route that is not supported by the equipment, either manually or automatically (e.g., a procedure is not supported if it incorporates an RF Leg and the equipment does not provide RF Leg capability). The system should also restrict pilot access to procedures requiring RF Leg capability or fixed radius transitions 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).									Y			
Automatic and/ or manual setting of the required navigation accuracy.			Y			Y	Y	Y	Y			
RNP system operating procedures, as applicable, including how to perform the following actions.												
Verify currency and integrity of the aircraft navigation data.		Y	Y		Y	Y	Y	Y	Y			
Verify the successful completion of RNP system self-tests.		Y	Y		Y	Y	Y	Y	Y			

Knowledge Requirement	RNP 10	RNAV 5	RNAV 1 and RNAV 2	RNP 4	RNP 2	RNP 1	RNP 0.3	RNP APCH	Advanced RNP	Baro-VNAV	RF Legs	FRT
Initialize navigation system position.		Y	Y		Y	Y	Y	Y	Y			
Retrieve and fly a route, SID or a STAR, or approach by name with appropriate transition.			Y		Y	Y	Y	Y	Y			
Retrieving a LP or LPV approach procedure from the database (e.g. using its name or the SBAS channel number) [LP and LPV only].								LPV				
Adhere to speed and/or altitude constraints associated with routes and procedures.			Y		Y	Y	Y	Y	Y	Y		
Where applicable, the importance of maintaining the published path and maximum airspeeds while performing RNP operations with RF Legs or FRT.									Y			
Impact of pilot selectable bank limitations on aircraft/rotorcraft ability to achieve the required accuracy on the planned route.			Y		Y	Y	Y				Y	
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 should address any operational wind limitations and aircraft configurations essential to safely complete the RF turn.											Y	
The effect of ground speed on compliance with RF paths and bank angle restrictions impacting the ability to remain on the course centreline.											Y	
Select the appropriate RNP 1 SID or STAR for the active runway in use and be familiar with			Y			Y	Y		Y			

Knowledge Requirement	RNP 10	RNAV 5	RNAV 1 and RNAV 2	RNP 4	RNP 2	RNP 1	RNP 0.3	RNP APCH	Advanced RNP	Baro-VNAV	RF Legs	FRT
procedures to deal with a runway change [RNP 1 and RNAV 1 & RNAV 2 only].												
Verify waypoints and flight plan programming.			Y		Y	Y	Y	Y	Y	Y		
Fly direct to a waypoint.		Y	Y		Y	Y	Y	Y	Y	Y		
Fly a course/track to a waypoint.			Y		Y	Y	Y		Y			
Intercept a course/track.		Y	Y		Y	Y	Y		Y			
Intercept a course/track. (Fly vectors, and rejoin an RNP route/procedure from the 'heading' mode.)		Y	Y		Y	Y	Y		Y			
Intercept initial or intermediate segment of an approach following ATC notification.								Y				
Fly interception of the extended final approach segment (e.g. using the VTF function).								LPV				
Determine cross-track (vertical) error/deviation. More specifically, the maximum deviations allowed to support route / procedure must be understood and respected.		Y	Y		Y	Y	Y	Y	Y	Y	Y	
Resolve route discontinuities.			Y		Y	Y		Y	Y			
Insert and delete route discontinuity.			Y		Y	Y	Y	Y	Y			
Remove and reselect navigation sensor input.		Y	Y		Y	Y	Y		Y			
When required, confirm exclusion of a specific NAVAID or NAVAID type.		Y	Y			Y	Y		Y			

Knowledge Requirement	RNP 10	RNAV 5	RNAV 1 and RNAV 2	RNP 4	RNP 2	RNP 1	RNP 0.3	RNP APCH	Advanced RNP	Baro-VNAV	RF Legs	FRT
Change arrival airport and alternate airport.			Y			Y	Y	Y	Y	Y		
Perform parallel offset function 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.	Y		Y	Y	Y	Y	Y		Y			
Perform RNAV holding function.			Y			Y			Y			
Performing a conventional holding pattern.			Y		Y	Y	Y	Y				
Perform gross navigation error checks using conventional NAVAIDs.		Y						Y	Y			
Perform a manual or automatic runway update (with take-off point shift), if applicable.			Y		Y	Y			Y			
Operator-recommended levels of automation for phase of flight and workload, including methods to minimize cross-track error to maintain route centreline.			Y		Y	Y	Y	Y	Y	Y		
The radio/telephony phraseology for the relevant airspace in accordance with the Aeronautical Information Publication (AIP) for the State in which the aircraft is operating.		Y	Y		Y	Y	Y	Y	Y			
Contingency procedures for RNAV/RNP failures.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
The flight planning requirements for the RNAV/RNP operations.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
There should be a clear understanding of crew										Y		

Knowledge Requirement	RNP 10	RNAV 5	RNAV 1 and RNAV 2	RNP 4	RNP 2	RNP 1	RNP 0.3	RNP APCH	Advanced RNP	Baro-VNAV	RF Legs	FRT
requirements for comparisons to primary altimeter information, altitude cross-checks (e.g. altimetry comparisons of 30 m (100 ft), temperature limitations for instrument procedures using Barometric VNAV, and procedures for altimeter settings for approach.												
Application and use of temperature compensation procedures, either manually or using FMS functions.										Y		
Discontinuation of a procedure based upon loss of systems or performance and flight conditions, e.g. inability to maintain required path tracking, loss of required guidance, etc. [Baro-VNAV only].										Y		

Appendix B

Navigation authorisation process

B.1 Performance-based navigation: general guidance

B.1.1 Appendix B of this AC provides general guidance associated with navigation authorisations, but more specifically oriented to application and assessment processes. The content of this Appendix is intended to assist applicants compile navigation authorisation application data packages that demonstrate compliance with all relevant requirements.

B.2 Navigation authorisation

B.2.1 A navigation authorisation is an authorisation issued by CASA that permits an operator to conduct the operations specified by the authorisation in accordance with any associated conditions and limitations.

B.2.2 A navigation authorisation is applicable specifically to the operator, aircraft and operation for which it has been issued. A navigation authorisation remains in force unless it is cancelled, revoked or otherwise revised and is not transferrable. When an aircraft changes operator or is deregistered, all navigation authorisations are automatically cancelled unless the deeming provisions of CAO 20.91 Sections 9, 10 or 11 are applicable.

B.3 Navigation authorisation application concept

B.3.1 The navigation authorisation process has been designed to take advantage of previously demonstrated compliance whenever practicable. This is the basis of the deeming provisions in CAO 20.91 for aircraft equipped with stand-alone GNSS systems.

B.3.2 The greatest amount of work by an operator is needed for the initial navigation authorisation application since all elements of the authorisations applied for must be demonstrated. Having successfully demonstrated compliance and had navigation authorisations issued, when adding authorisations or aircraft to existing authorisations, the focus of the work is on the differences from the existing navigation authorisations.

B.3.3 When adding an aircraft of a similar make/model to an existing authorisation, the aircraft's eligibility has to be demonstrated and any other significant differences identified. In most cases, any other changes needed for the addition of an aircraft are minor. When applying for a navigation authorisation for an additional aircraft, the operator must provide the material that demonstrates eligibility for the aircraft and documentation to support any other changes required. There is no requirement to submit an application with all the documentation needed for a new application. However, if the application is from a non Air Operator Certificate (AOC) holder and the intervening period between the initial authorisation and subsequent application is significant then the CASA assessor may request additional information from the applicant.

B.3.4 When a new aircraft make/model is added to an operator's fleet, the operator must demonstrate compliance for that aircraft. The evidence required will be similar to that needed for an initial application, however, the already accepted procedures should be acceptable having been updated to reflect the new aircraft type. The operator's existing procedures will require review along with the aircraft specific material.

B.3.5 If an authorisation for a navigation specification new to the operator is required, the operator will be required to demonstrate compliance for all aspects of the new authorisation.

B.4 Navigation authorisation process

B.4.1 The application and assessment processes for navigation authorisations for all PBN specifications and RVSM operations will follow the procedures set by CASA for these authorisations.

B.4.1.1 An aircraft operator applies for a navigation authorisation using CASA Form 1307: Navigation Authorisations (PBN & RVSM) Application and provides complete supporting documentation to the CASA Permissions Application Centre (PAC). Incomplete applications will not progress to the assessment stage.

B.4.1.2 The PAC will review the application to ensure it is administratively correct. A job will be raised and the applicant will be advised of the job number. CASA will calculate and send the applicant an estimate of cost to process the application and a list of any supporting documents still required. Should the applicant wish to proceed, the estimate will need to be paid and all supporting documentation provided.

B.4.1.3 CASA assessors conduct the navigation authorisation assessment to determine that compliance with all the relevant requirements has been demonstrated. The assessors will document their assessment and provide a recommendation to the PAC delegate to either notify the operator that their application has been declined or to issue the authorisation.

B.4.1.4 If the recommendation is to issue the navigation authorisation, the authorisation is entered into the operator's Operations Specifications (Ops Spec) and an updated Ops Spec is issued to the operator. If the inspectors' recommendation was for the authorisation(s) to not be issued, the PAC will notify the operator accordingly. The job costs will be reconciled and a refund or invoice will be issued to the applicant.

Notes:

1. For AOC holders, navigation authorisations will be issued by adding the authorisations to their Ops Spec and re-issuing the Ops Spec. For non-AOC holders, navigation authorisations will be issued using a CASA instrument.
2. CASA is introducing new regulatory management tools, thus interim processes will be used until the new systems are in place. During this period Charter operators will be issued CASA instruments rather than Ops Spec.

B.4.2 Applicants should submit applications for navigation authorisations with sufficient time to enable them to be assessed by CASA, prior to their intended use. For applications that involve the initial issue of a navigation authorisation to an operator or for the entry into service of a new aircraft type in the operator's fleet, a minimum of 90 days should be allowed for the CASA process. Late applications could result in navigation authorisations not being completed in time for the operator's planned activities. When submitting applications, operators should advise CASA of the planned schedule so that CASA has the opportunity to schedule work to meet project goals. CASA cannot guarantee that applicant schedules will be met but early and thorough preparation makes that more likely.

B.5 Application

B.5.1 The navigation authorisation process is the process whereby CASA assesses the airworthiness, continued airworthiness and flight operations elements of an application for compliance with the relevant requirements for the authorisation being sought. If compliance with the requirements is demonstrated, then the navigation authorisation(s) will be issued to the operator for the aircraft detailed in the application.

B.5.2 The application must provide evidence that demonstrates compliance with the requirements for the issue of each navigation authorisation requested. When multiple navigation authorisations are being sought, documentation that demonstrates compliance with the most stringent authorisation sought will usually be acceptable as a means of demonstrating compliance for other less stringent authorisations except for specific features. While compliance must be demonstrated for each authorisation sought, there is no requirement to compile a specific compliance package for each; a single package with extracts of procedures or detailed references to the procedures that meet the requirements for each authorisation are acceptable. Evidence demonstrating compliance will be required for each of the topics addressed in paragraphs B.5.3 through B.5.7.

B.5.3 Aircraft eligibility

B.5.3.1 Evidence of aircraft eligibility is typically provided through an AFM compliance statement, AFMS or aircraft OEM service letter or other document certifying the aircraft meets the relevant airworthiness requirements for the intended operation.

B.5.3.2 Where the aircraft eligibility is not covered by the methods described above, the operator will need to demonstrate eligibility by other means. Typical evidence may include: STC, modification data (Engineering Orders) that may include conformity inspections, compliance testing and/or inspection certifications, (which may include CASA AC 21-36 Appendix 2) and appropriate maintenance certifications.

B.5.3.3 Previous navigation authorisations may be used as evidence of aircraft eligibility and should be supplied where available. This means that the aircraft are the same make / model and that the equipment installation is the same make / model and the configuration has no significant differences.

B.5.3.4 Details must be provided of the equipment to be used for the intended operations. This would typically be an aircraft equipment list that includes the equipment make, model, hardware part number (and revision number or modification status) and software (part number and version) should be provided for the principle system components of the navigation, automation and radio systems. The supplied list should be certified as correct by or on behalf of the RO or by the Part 42 organisation.

B.5.3.5 Evidence must be provided that appropriate systems and calibration checks have been conducted and appropriately certified. This evidence would typically be a certification statement from the RO or Part 42 organisation or an extract from the maintenance log to the same effect.

B.5.3.6 Evidence must be provided that there are no structural repairs or damage that would affect the authorisations. This would typically be a certified statement from the RO or Part 42 organisation that states any structural repairs in areas that could affect

navigation sensor inputs or any damage in these areas have been repaired or are within tolerances prescribed in the Structural Repair Manual (SRM) or any other applicable continuing airworthiness document.

B.5.4 Continuing Airworthiness

B.5.4.1 Evidence that the operator maintains (and will continue to maintain) the aircraft compliant with Part 42, or Division 4 of CAR 1988 requirements and conforming to its type design must be provided.

B.5.5 Flight operations procedures

B.5.5.1 The operator must have operating procedures for the conduct of operations that are the subject of a navigational authorisation. These operational procedures should include:

a. a route guide or other similar document that defines the requirements and provides operational guidance for each route they operate
b. an implementation programme, including the proposed method to monitor RNAV / RNP operations, to identify, report and investigate any failure or potential failure in the aircraft systems or operating procedures.

B.5.5.2 Procedures to manage the navigation database that include:

a. Validation of navigation databases
b. Reporting of navigation database errors
c. Managing the updating of the navigation databases on each aircraft.

B.5.6 Training program including the syllabus and means of delivery

B.5.6.1 Where required, the flight crew training programme must be defined and should include:

a. the syllabus of training:
    i. relevant sections of the company operations manual
    ii. review of the relevant AFM limitations/supplement relating to PBN operations
    iii. checklists
    iv. contingency procedures Quick Reference Handbook (QRH) etc.
    v. means of delivery (class instruction, computer based training (CBT), synthetic training device, etc.)
b. details of training exercises and competency assessment to be undertaken
c. arrangements to manage recurrent training
d. a description of training programmes for dispatchers and any other relevant personnel training detailing the procedures to be used.

Note: Course material, lesson plans and other training products are subject to CASA approval.

B.5.6.2 The specific pilot knowledge and training requirements for each navigation specification are detailed in CAO 20.91.

B.5.6.3 When the training and assessment of flight crew requires the use of synthetic training devices, the devices should be configured so that they accurately reflect the configuration of the aircraft to which the navigation authorisation will be applicable.

Synthetic training devices must be maintained so that they continue to accurately represent the relevant aircraft configuration and system operation.

B.5.7 Operator's MEL

B.5.7.1 The operator's MEL needs to be revised to reflect the aircraft configuration and the operations being undertaken. In accordance with modern practices, instead of being equipment oriented, the MEL should be structured to reflect system functional requirements. The interdependencies between systems needs to be reflected in the MEL to ensure that all system required functionalities are considered when applying the provisions of the MEL. This is particularly significant for GNSS where the Terrain Awareness and Warning System (TAWS) and Automatic Dependent Surveillance – Broadcast (ADS-B) systems require GNSS inputs to operate.

B.5.7.2 Given aircraft complexity and operator route structures, the operator's MEL may refer to the route guide or other equivalent document to define the equipment required for a particular route or operation.

B.5.8 Evaluation and assessment

B.5.8.1 Following the initial evaluation for compliance with the requirements specified for each navigation authorisation, comments will be provided to the applicant to provide revised information where compliances cannot be found.

B.5.8.2 When the initial assessment has been completed, CASA will determine any further activities needed to complete the authorisation. These activities may include any or all of:

a. Site visits
b. Interviews with personnel
c. Observation of training classes
d. Analysis of test data
e. Observation of flights
f. Witnessing flight tests.

B.5.9 Issue of a navigation authorisation

B.5.9.1 A navigation authorisation includes:

a. the name of the operator (organisation or individual)
b. each aircraft covered by it by reference to the aircraft's registration mark
c. the operations authorised
d. any conditions and limitations imposed on the authorisation.

B.6 Flight operations procedures

B.6.1 Introduction

B.6.1.1 This Appendix provides guidance to operators for required content in their operating procedures documents in order to meet the requirements for the issuing of navigation authorisations. Since there are a wide range of operations, each operator needs to tailor the content of their procedures to their particular operating environment.

B.6.1.2 The operator must have operating procedures for the conduct of operations that are the subject of a navigational authorisation. These operational procedures should include:

a. A route guide or other similar document that defines the requirements and provides operational guidance for each route they operate.
b. An implementation programme, including the proposed method to monitor RNAV / RNP operations, to identify, report and investigate any failure or potential failure in the aircraft systems or operating procedures.
c. Procedures to manage the navigation database that include:
    i. Validation of navigation databases
    ii. Reporting of navigation database errors
    iii. Managing the updating of the navigation databases on each aircraft.

B.6.1.3 Different aircraft types may have different requirements detailed in the AFM, aircraft within a fleet may have different requirements due to the avionics equipment or software version installed. As such operating procedures (normal and non-normal) and training programmes must ensure any type and/or fleet differences are addressed.

B.6.2 Route guide

B.6.2.1 The operator's route guide, or other equivalent document, provides information for the flight crew on the operations being conducted related to the operator's routes and destinations. The route guide may also include details of aircraft equipment and procedures required in order to operate on specified routes or to designated destinations.

B.6.2.2 For destinations, the route guide should include the operational contingency procedures to be used at those locations.

B.6.3 Training program

B.6.3.1 The flight crew training programme (where required) must be documented and include:

a. the syllabus of training:
    i. relevant sections of the company operations manual;
    ii. review of the relevant AFM limitations/supplement relating to PBN operations;
    iii. checklists;
    iv. contingency procedures with QRH content.
b. means of delivery (class instruction, CBT, synthetic training device, etc.);
c. details of training exercises and competency assessment to be undertaken;
d. arrangements to manage recurrent training;
e. a description of training programmes for dispatchers and any other relevant personnel training detailing the procedures to be used.

Note: Course material, lesson plans and other training products are subject to CASA approval.

B.7 Information for foreign operations

B.7.1 Introduction

B.7.1.1 Foreign Operators should contact CASA-Australia, International Operations at international_ops@casa.gov.au

B.7.2 Foreign air carrier air operator certificate holders

RNP AR operations

B.7.2.1 The operator of a foreign registered aircraft holding an RNP AR navigation authorisation requires prior CASA acceptance of that navigation authorisation to conduct RNP AR operations in Australia. The increased complexity and safety risks associated require CASA to exercise due diligence prior to an authorisation being issued. The extent of this due diligence will be determined by the extent of the operator's RNP AR operations experience.

B.7.2.2 For operators wishing to conduct RNP AR operations only at major Australian airports and holding an authorisation from their State of Registry or Operator regulator, the review will be most likely be a desk based document review. Any operator electing to operate to aerodromes that require the use of proprietary procedures, or, where there is challenging terrain within the vicinity of the airport or procedures will require a more detailed review.

B.7.2.3 The Australian Multi-Variant Design (MVD) RNP AR approach procedures have One Engine Inoperative (OEI) Missed Approach procedures associated with them. CASA expects operators to have flight crews trained and capable of using these procedures.

B.7.3 Australian operators operating in foreign states

B.7.3.1 Australian operators operating in foreign States must comply with all relevant Australian regulatory requirements and those of the State in which they are operating.

B.7.3.2 Prior to departing from Australia, operators should obtain navigation authorisations for the navigation specifications that they may use.

B.7.3.3 Operators covered by the deeming provisions of CAO 20.91 clauses 8, 9 or 10 should obtain navigation authorisations from CASA for the navigations specifications they require so that they have evidence of compliance if requested by a foreign State. In many cases these operators will require an RNP 10 (RNAV 10) authorisation to operate in oceanic regions; the RNP 10 application can include the other navigation specifications addressed by the relevant deeming provisions.

B.8 Guidance for completing CASA Form 1307

B.8.1 Introduction

B.8.1.1 This Appendix provides guidance on the completion of the CASA Form 1307 Navigation Authorisations (PBN and RVSM) Application.

B.8.2 Part A – Details of the applicant

B.8.2.1 This section of the form provides all the necessary details of the operator and is largely self-explanatory.

Part A1 Applicant details/registered operator's details

B.8.2.2 This section contains the details of the aircraft registered operator; the phone, mobile, email and fax information should be for a person who will be able to readily direct queries to the responsible person within the applicants organisation.

Part A4 Point of Contact

B.8.2.3 Provide details of a point of contact for CASA to liaise with, if different from the contact details provided in A1 or A4 of the form.

B.8.3 Part B – Approvals requested

B.8.3.1 This section is where the applicant identifies the navigation authorisations being sought. The operator must identify the authorisations needed for their operation and for which they are capable of demonstrating compliance. Operators should not apply for authorisations that they either do not need or for which they are not able to demonstrate compliance.

B.8.3.2 Applicants need to review the navigation specifications in CAO 20.91 to determine the application of each specification. A common error is applications being received for RNP 0.3 (a helicopter specific application) when the application is really for RNP APCH.

B.8.4 Part C – List aircraft and their details

B.8.4.1 Form 1307 may be used to apply for navigation authorisations for multiple aircraft in a single application. Navigation authorisations are issued to specific operators and aircraft, therefore all aircraft must be listed on the form.

B.8.4.2 The aircraft make / model details required are self-explanatory but the details provided must be those specifically applicable to each aircraft and not generic descriptions e.g. Boeing 737-8F8 rather than B737-800 or B738.

B.8.4.3 The registration mark must be that of the aircraft.

B.8.4.4 The estimated entry into service date for each aircraft is needed to enable CASA to plan workflows. If this date changes, applicants should advise CASA. The Mode S code is the 24 bit unique identifier code assigned to the aircraft expressed in hexadecimal format.

B.8.4.5 The Aircraft Variable Number is applicable to Boeing aircraft only and is the number used to identify the aircraft in the operator's documentation.

B.8.4.6 The Aircraft Line Number is an aircraft manufacturer's number associated with the manufacturing process that is used in defining aircraft configurations in terms of its place on the production line.

B.8.4.7 The Aircraft History section of the form provides brief details of the history of the aircraft—is it new, if it is used, what was its previous registration mark, who was the last the operator and in what State was it registered.

B.8.5 Part D –Submission checklist

B.8.5.1 This section is an *aide memoire* for the applicant to ensure that all required documentation is submitted with the application. Not all documents listed in the checklist will be required for every application; applicants need to identify which documents have been submitted with the application.

B.8.6 Substantiating data package

B.8.6.1 The CASA Form 1307 Navigation Authorisations (PBN and RVSM) Application provides only the basic information on the applicant, the authorisations requested and the aircraft to which they will be applied. For the navigation authorisation to be completed, the applicant must also provide a data package that demonstrates compliance with all relevant and applicable on requirements.

B.8.6.2 When submitting the data package, applicants need to provide a list of the documents provided that also has brief description of the content. The preferred format for all documents is PDF; documents referencing manuals/books may be submitted without extracting the specific pages provided that the all references to the documents are specific. The names of documents / files submitted and the names used in the data list need to be the same so that they are easily identified and are not confused.

B.9 Applicant's data package

B.9.1 Introduction

B.9.1.1 This Appendix is provided to assist applicants ensure that they provide all information needed to complete navigation authorisations. The content does not include all aspects of all navigation authorisations; it is the operator’s responsibility to demonstrate to CASA that they meet all the relevant requirements.

B.9.2 Demonstrating compliance

B.9.2.1 To obtain a navigation authorisation, the applicant must demonstrate compliance.

B.9.2.2 To demonstrate compliance, applicants need to:

a. Identify the applicable requirements from the relevant navigation specifications in CAO 20.91 and CASR Subpart 91.U, taking into account the guidance in this and other relevant ACs.
b. Provide a Statement of Compliance that states how their application is compliant with each of the requirements.
c. The Statement of Compliance must provide a reference to the document that provides the basis upon which the statement of compliance is being made i.e. evidence of compliance.

B.9.2.3 This Statement of Compliance is the primary document upon which the assessment is based. It therefore needs to be clear, concise and provide precise references to the substantiating information.

B.9.2.4 A useful tool for applicants to ensure that they have addressed all relevant requirements is to prepare a compliance matrix that identifies all requirements and provides a brief

summary or reference to the material submitted in the data package. Including the compliance matrix in the data package is useful for the assessors to locate material that demonstrates compliance.

Aircraft configuration

B.9.2.5 The first step in demonstrating compliance is to define the aircraft and navigation system configuration. This will require a list of all the major system components to be compiled that provides the component name, make / model, hardware part number and software part number for each of the components. The list should include details of the all of the following components:

a. Air Data Computers
b. IRS
c. GNSS sensors or stand-alone navigation systems
d. Flight Guidance Computers (Flight Director and Autopilot)
e. Mode Control Panel
f. Flight Management Computer
g. Control Display Units
h. Autopilot system
i. Pitot – Static system sensors (including Air Data Sensor Modules).

B.9.2.6 To assist assessors understand the configuration of the aircraft, if the aircraft has been modified it would be helpful if the applicant included photographs of the aircraft installations. If the application includes a request for RVSM authorisation, photographs of the area surrounding the static vents or pitot-static heads should be provided.

Airworthiness compliance

B.9.2.7 In most cases, the airworthiness compliance will be demonstrated through the AFM or relevant AFMS in the Limitations section although some older AFMS have this information in the General section. The AFM entries typically state that the aircraft is approved for a particular navigation operation with a clause that states that the approval is not an operational authorisation.

B.9.2.8 If the airworthiness approval is not included in the AFM through either the aircraft manufacturer certification or a Supplemental Type Certificate (STC), a more detailed submission to demonstrate compliance will be required that demonstrates compliance with each individual requirement. For stand-alone GNSS installations in aircraft covered by AC 20-36 GNSS Equipment: Airworthiness Guidelines, the Appendix 2 Post Installation Evaluation that has been satisfactorily completed is an acceptable means of demonstrating airworthiness compliance.

Continued airworthiness compliance

B.9.2.9 The data package must include the information defined in Annex 2 Continued Airworthiness.

Flight operations compliance

B.9.2.10 The data package must include the information defined in Annex 3 Flight Operations Procedures.

Site visits

B.9.2.11 Applicants should expect the CASA assessors to visit and review some or all of the applicant's procedures, training, aircraft installation and operations relevant to the application. The need for site visits will be determined by the operations being conducted, the aircraft in use, whether or not the aircraft have been modified for PBN compliance and the quality of the PBN application data package.

Submission checklist

B.9.2.12 The following checklist identifies the items that applicants should address within their substantiating data package. Not all items in the list will be required for all applications however, applicants should be able to identify the elements that are required and those that are omitted. The list is an *aide memoire* for applicants and is not intended to be exhaustive for all applications.

Submission checklist

D1 Statement of Compliance	
SOC is complete and provides precise references to documents demonstrating compliance	
Aircraft equipment list (make, model, part number [hardware and software])	
D2 Aircraft Eligibility	
Applicable AFM or AFM Supplement Limitations section	
AC 21-36( ) Appendix 2 – Post-Installation Evaluation Sheet	
A brief description of the aircraft's system and installation of major components	
Previous navigation or RVSM approvals/authorisations	
D3 Continued Airworthiness	
Identification of maintenance organisation responsible for maintaining the aircraft and operator oversight procedures of the maintenance provider(s)	
Maintenance schedule reference for the relevant systems	
Aircraft configuration and management procedures (Specifying references for ELA and software configuration)	
Aircraft Maintenance Manual (AMM) reference for the relevant system	
Parts Management	
Test equipment required and management	
Maintenance personnel training and competency	
D4 Operational Procedures	
Standard operating procedures	
Route guide (or equivalent) documents	
Reporting navigation errors / system failure procedures	
Flight crew training syllabus	
Training means of delivery	
Synthetic flight training devices to be used (if applicable)	
Competency assessment	
Continued competency procedures	
Competency assessment	
Database validation procedures	
Aircraft navigation database updating management procedures	
Operator's Minimum Equipment List (if applicable)	