Australian Government

Civil Aviation Safety Authority

Civil Aviation Order 20.91 (Instructions and directions for performance-based navigation) Instrument 2014

as amended

made under regulation 179A of the *Civil Aviation Regulations 1988,* regulation 11.245 of the *Civil Aviation Safety Regulations 1998* and subsection 33 (3) of the *Acts Interpretation Act 1901*.

This compilation was prepared on 30 November 2018 taking into account amendments up to *Civil Aviation Order 20.91 Amendment Instrument 2018 (No. 1)*. It is a compilation of *Civil Aviation Order 20.91 (Instructions and directions for performance-based navigation) Instrument 2014* as amended and in force on 2 November 2018.

Prepared by the Advisory & Drafting Branch, Legal & Regulatory Affairs Division, Civil Aviation Safety Authority, Canberra.

Compilation No. 2.

1 Name of instrument

This instrument is the *Civil Aviation Order 20.91 (Instructions and directions for performance-based navigation) Instrument 2014*.

2 Repeal

Civil Aviation Order 20.91 (Instructions and directions for performance-based navigation) 2012 is repealed.

3 Commencement and duration

3.1 This Order commences on the day of registration.

3.2 For paragraph 11.250 (a) of CASR, anything in this Order that is a direction under regulation 11.245 of CASR, ceases to be in force on 30 November 2024.

Note To support this Order, CASA is using both the power to issue instructions under regulation 179A of CAR, and the power to issue directions under regulation 11.245 of CASR. For paragraph 11.250 (a) of CASR, an expiry date must be included for a direction which is to endure for longer than 1 year.

4 Definitions

Note In this Civil Aviation Order terms and expressions have the same meaning as they have in the *Civil Aviation Act 1988* and the regulations.

4.1 The acronyms and abbreviations used in this Order have the following meanings:

Acronym	Explanation
14 CFR	Title 14 Code of Federal Regulations *Note* 14 CFR is used instead of FAR and is consistent with the current practice in FAA documentation. Example: a reference to 14 CFR, Part 23 is a reference to Part 23 of the FAR.
ABAS	Aircraft Based Augmentation System

Acronym	Explanation
AFM	Aircraft Flight Manual
AFMS	Aircraft Flight Manual Supplement
AMM	Aircraft Maintenance Manual
AP	Autopilot
AP/FD	Autopilot/Flight Director
APCH	Approach
APV	Approach with Vertical Guidance
AR	Authorisation Required
ARINC 424	Aeronautical Radio Incorporated Specification 424
A-RNP	Advanced Required Navigation Performance
ASE	Altimetry System Error
BARO	Barometric
Baro-VNAV	Barometric Vertical Navigation
B-RNAV	Basic RNAV
CBT	Computer-based Training
CDI	Course Deviation Indicator
CPDLC	Controller-Pilot Data Link Communications
CS	EASA Certification Specification
DA	Decision Altitude
EADI	Electronic Attitude Director Indicator
(E)TSO	FAA Technical Standard Order and/or European Technical Standard Order
ETSO	European Technical Standard Order
FAF	Final Approach Fix
FAP	Final Approach Point
FAS	Final Approach Segment
FD	Fault Detection or Flight Director
FDE	Fault Detection and Exclusion
FM	Path Terminator: Course from Fix to Manual Termination
FMC	Flight Management Computer
FMS	Flight Management System

Acronym	Explanation
FOSA	Flight Operational Safety Assessment
FRT	Fixed Radius Transition
FTE	Flight Technical Error
GBAS	Ground-based Augmentation System
GNSS/FMS	An FMS area navigation system that has GNSS capability but does not have IRU or IRS inputs
HPL	Horizontal Protection Limit
HSI	Horizontal Situation Indicator
IAF	Initial Approach Fix
IF	Path Terminator: Initial Fix
INS	Inertial Navigation System
IRS	Inertial Reference System
IRU	Inertial Reference Unit
JAA	Joint Aviation Authorities
LNAV	Lateral Navigation
LNAV/VNAV	Lateral Navigation with Vertical Navigation
LOA	Letter of Acceptance or Letter of Authorisation
LOC	ILS Localizer
LP	Localiser Performance
LPV	Localiser Performance with Vertical Guidance
LRNS	Long-range Navigation System
MAP	Map Display
MMR	Multi-mode Receiver
MNPS	Minimum Navigation Performance Specifications
NM	nautical mile
NNDP	Non-normal Decision Point
NPA	Non-precision Approach
NPS	Navigation Performance Scales
NSE	Navigation System Error
OEI	One Engine Inoperative
OEM	Original Equipment Manufacturer

Acronym	Explanation
PBN	Performance-based Navigation
PF	Pilot flying
PNF/PM	Pilot not flying/pilot monitoring
P-RNAV	Precision Area Navigation
QRH	Quick Reference Handbook
RADALT	Radio Altimeter.
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
RTCA	Radio Technical Commission for Aeronautics
SBAS	Space-based Augmentation System
SIS	Signal-in-space
TSE	Total System Error
VDEV	Vertical Deviation
VI	Path Terminator: Heading Vector to Intercept
VIP	Vertical Intercept Point
VNAV	Vertical Navigation
VPA	Vertical Path Angle
VSD	Vertical Situation Display
XTK	Cross-track Error/Deviation

4.2 Terms defined for this Order:

Term	Definition (meaning)
AIRAC cycle	The Aeronautical Information Regulation and Control cycle. *Note* In accordance with Annex 15, Aeronautical Information Services (AIS), of the Chicago Convention, the AIRAC cycle documents and defines a series of common dates, and an associated standard aeronautical information publication procedure, for each Convention State.
Airspace	An area, route or procedure (the ***designated environment***) in respect of which all or any of the following requirements must be satisfied, before an aircraft to which this Order applies is able to use it: (a) navigation specifications (RNAV or RNP) applicable in the designated environment, for which the aircraft must hold an authorisation or approval; (b) aircraft navigation equipment requirements that the aircraft must satisfy; (c) aircraft navigation system functional and performance requirements that the aircraft must satisfy; (d) aircraft navigation equipment installation requirements that the aircraft must satisfy.
Alternate Means of Navigation	The use of information from an area navigation system in lieu of that from conventional navigation aids and navigation equipment that is installed, operational and compatible with conventional navigation aids.
ARINC 424 Path Terminator	Aeronautical Radio Incorporated Specification 424 format for coding airborne navigation databases.
Augmentation Systems	Augmentation systems are GNSS supplemental systems used to augment core satellite constellation signals to meet safety and reliability requirements. These systems may include ranging, integrity or differential elements in any combination. There are 3 categories of augmentation systems: Aircraft-based Augmentation Systems (***ABAS***); Ground-based Augmentation Systems (***GBAS***); Space-based Augmentation Systems (***SBAS***). Within each category there are multiple independent systems.
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. *Note* This term is also referred to as "lateral deviation".
(E)TSO	European Technical Standard Order and/or FAA Technical Standard Order. *Note* Both will have the same reference number.

Term	Definition (meaning)
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 1 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.
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 a particular avionic system or avionic systems.
Long range navigation system	A navigation system comprising an INS, an IRS or a GNSS capable of use in oceanic or remote airspace.
Navigation specification	A set of aircraft and aircrew requirements needed to support PBN operations within a defined airspace. *Note* There are 2 kinds of navigation specification: RNAV and RNP (see Definitions).
Operator	The individual or entity responsible for flight operation of the aircraft. This might or might not be the registered operator for maintenance purposes.
Path Terminator	A specific type of flight path along a segment of a route or procedure along with a specific type of termination of that flight path, as assigned to all area navigation routes, SID, STAR and approach procedure segments in an aircraft navigation database, and defined in ICAO Doc. 8168, Volume II, Part III, Section 2, Chapter 5.
Performance-based Navigation	Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.
Receiver Autonomous Integrity Monitor	A form of ABAS whereby a GNSS receiver processor determines the integrity of the GNSS navigation signals using only GPS signals or GPS signals augmented with altitude (baro-aiding). This determination is achieved by a consistency check among redundant pseudo-range measurements. For the receiver to perform the RAIM function, at least 1 additional satellite needs to be available with the correct geometry, over and above the requisite GNSS satellites needed for the position estimation.

Term	Definition (meaning)
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.
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.

4.3 In this Order, unless the contrary intention appears, a reference to a TSO standard, an ETSO standard, an (E)TSO standard, an ICAO document, an FAA document, an EASA document, an AC or other CASA document is taken to include a later version of the standard or document as in force or existing from time to time.

Note Subsection 98 (5D) of the *Civil Aviation Act 1988* permits the Order to apply, adopt or incorporate matter contained in any instruments or other writing as in force or existing from time to time.

4.4 Without affecting paragraph 4.3, in this Order, a reference to an (E)TSO, a TSO or an ETSO with an empty bracket at the end of the reference includes the (E)TSO, TSO or ETSO in a version that contains a number within the bracket.

4.5 In this Order, a reference to the PBN Manual means ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, 4th edition or later revised version.

5 Transitional — MNPS (Reserved)

Note MNPS will be retained until the North Atlantic Program Coordination Office publishes a navigation specification alternative procedure. It is anticipated that RNP 2, used in an Oceanic application, may provide this alternative. In the interim, CASA MNPS approvals will remain in force according to their terms.

6 Scope of Order

The instructions and directions in this Order apply to the operation of an Australian aircraft that uses PBN in I.F.R. flight, and to foreign registered aircraft, where expressed to do so, and contain:

(a) instructions to pilots in command for I.F.R. flights, specifying the method by which an aircraft engaged in PBN is to be navigated; and

(b) directions to pilots in command and operators in relation to the conduct of I.F.R. flight using a PBN navigation specification mentioned in subsection 7.

7 Application — navigation specifications

7.1 The instructions and directions in this Order apply to the operation of an Australian aircraft that uses 1 or more of the following navigation specifications in I.F.R. flight:

(a) RNAV 5;

Note See Appendix 1.

(b) RNAV 1 and RNAV 2;

Note See Appendix 2.

(c) RNP 2;

Note See Appendix 3.

(d) RNP 1;

Note See Appendix 4.

(e) RNP 0.3;

Note See Appendix 5.

(f) RNP APCH, including:

(i) LNAV; and

(ii) LNAV/VNAV (Baro-VNAV); and

(iii) LP; and

(iv) LPV;

Note See Appendix 6.

(g) RNP AR, including:

(i) RNP AR APCH; and

(ii) RNP AR DEP.

Note 1 See Appendix 7.

Note 2 RNP AR APCH and RNP AR DEP operations may include OEI procedures.

(h) Baro-VNAV;

Note 1 See Appendix 8.

Note 2 Navigation specification RNAV 10 and RNP 4 are each dealt with in Part 91 of CASR, as RNP 10 and RNP 4, respectively.

(i) Advanced RNP;

Note See Appendix 9.

(j) Radius to Fix Path Terminator;

Note See Appendix 10.

(k) Fixed Radius Transition;

Note See Appendix 11.

(l) Time of Arrival Control;

Note See Appendix 12 (reserved pending technical development by ICAO).

(m) Use of suitable area navigation systems on conventional routes and procedures.

Note See Appendix 13.

7.2 Foreign registered aircraft operating into or out of, and within, the Brisbane or Melbourne Flight Information Regions (***FIR***) are directed to have authorisations equivalent to those for Australian registered aircraft under this Order issued by the National Aviation Authority of their State of Registration or State of the Operator, as applicable.

8 Instructions and directions for authorised use of PBN navigation specifications

8.1 An Australian aircraft using a navigation specification mentioned in subsection 7 (the ***particular navigation specification***) may be navigated in I.F.R. flight in any airspace for which that PBN is required only in accordance with the requirements set out in this Order and in any Appendix to this Order that apply for the use of the specification.

8.2 The pilot in command of an I.F.R. flight must not use the particular navigation specification unless:

(a) he or she satisfies each requirement to be satisfied by the pilot under this Order for the use of the particular navigation specification; and

(b) for RNP 0.3 and RNP AR, the operator of the aircraft holds a navigation authorisation under this Order for the particular navigation specification; and

(c) the flight is conducted in accordance with the particular navigation specification; and

(d) the operating instructions for the area navigation system(s) installed in the aircraft are carried in the aircraft and are easily accessible to the pilot(s). The operating instructions may be:

(i) the operating instructions provided by the navigation system manufacturer; or

(ii) the AFM, provided the instructions are complete and not an abbreviated version; or

(iii) an applicable AFMS, provided the instructions are complete and not an abbreviated version; or

(iv) other operating instructions specified by the AFM or an applicable AFMS; or

(v) other operating instructions acceptable to CASA.

8.3 The operator of an aircraft engaged in an I.F.R. flight using a navigation specification mentioned in subparagraph 8.2 (b) is directed not to permit the flight to commence unless the operator:

(a) holds a navigation authorisation under the Appendix of this Order which applies for the use of the RNP 0.3 or RNP AR navigation specification (the ***relevant Appendix***); and

(b) complies with each requirement for the flight set out in the relevant Appendix; and

(c) ensures that each member of the flight crew of the aircraft:

(i) satisfies each flight crew requirement for the flight set out in the relevant Appendix; and

(ii) conducts the flight in accordance with the navigation authorisation.

8.4 Operators of foreign registered aircraft holding an RNP AR navigation authorisation must not navigate in accordance with RNP AR procedures in Australia without prior CASA acceptance of that navigation authorisation.

9 Certain aircraft are deemed to be approved for navigation specifications in Appendices 1, 2, 3 and 4

9.1 Subject to compliance with paragraphs 9.2 and 9.3, an Australian aircraft is deemed to be approved for navigation in accordance with any of the following navigation specifications:

(a) RNAV 5;

(b) RNAV 1 and RNAV 2;

(c) RNP 2;

(d) RNP 1.

9.2 The aircraft must be equipped with a GNSS stand-alone system with en route and terminal navigation capability having:

(a) (E)TSO-C129 ( ) authorisation for Class A1 or A2; or

(b) (E)TSO-C146 ( ) authorisation for Class Gamma and operational Class 1, 2 or 3; or

(c) an integrated avionics system using GNSS sensors with (E)TSO-C129 ( ) Class B1, B2, C1 or C2 authorisation, or (E)TSO-C145 ( ) Class Beta and operational Class 1, 2 or 3 authorisation as the only primary sensor input to the area navigation function, that is accepted as a stand-alone system for this subsection.

Note The integrated avionics systems referred to are those systems typically installed in US 14 CFR/EASA CS Part 23 or Part 27 aircraft that combine flight displays, communications, radio navigation (VOR and ILS) and area navigation into a single integrated system. (E)TSO C115 multi-sensor systems that utilise independent discrete sensor inputs are not addressed under this subsection.

9.3 The aircraft is approved for navigation during a flight in accordance with a navigation specification mentioned in paragraph 9.1 if the AFM or AFMS for the aircraft, as published at the time of the flight, states that the aircraft:

(a) is capable of the navigation specification; or

(b) has the GPS capability mentioned in an item of the Table that corresponds to the navigation specification.

Table

	GPS capability (Column 1)	**Navigation specification (Column 2)**
1	GPS RNAV EN ROUTE	RNAV 5; RNAV 2 or RNP 2
2	GPS RNAV TERMINAL	RNAV 1 or RNP 1

Note For example, for the purposes of subparagraph 9.3 (b), if the AFM or AFMS for an aircraft states that the aircraft is capable of GPS RNAV TERMINAL (a "GPS capability"), then the aircraft would be approved to navigate in accordance with RNAV 1 (the corresponding "navigation specification").

9.5 If the AFM or AFMS for an aircraft states that the aircraft is approved for RF Legs and the aircraft:

(a) meets the requirements of paragraph 9.3; and

(b) is equipped with a map display depicting the computed flight path of the aircraft;

the aircraft is taken to be approved for RF Legs in conjunction with RNP 1 operations.

9.6 If the AFM or AFMS for an aircraft states that the aircraft is approved for Radius to FRT, and the aircraft:

(a) meets the requirements in paragraph 9.3 above; and

(b) is equipped with a map display depicting the computed flight path of the aircraft;

the aircraft is taken to be approved for FRT in conjunction with RNP 2 operations.

10 Certain aircraft are deemed to be approved for navigation specifications in Appendices 1, 2, 3, 4 and 6

10.1 Subject to compliance with paragraphs 10.2 and 10.3, an Australian aircraft is deemed to be approved for navigation in accordance with any of the following navigation specifications:

(a) RNAV 5;

(b) RNAV 1 and RNAV 2;

(c) RNP 2;

(d) RNP 1;

(e) RNP APCH-LNAV;

(f) RNP APCH-LNAV/VNAV;

(g) RNP APCH-LP or RNP APCH-LPV.

10.2 The aircraft must be equipped with:

(a) a GNSS stand-alone system with en route, terminal and NPA capability having (E)TSO-C129a authorisation for Class A1; or

(b) a GNSS stand-alone system with en route, terminal and NPA capability having (E)TSO-C146 Class Gamma and operational Class 1, 2 or 3; or

(c) an integrated avionics system using a GNSS sensor with (E)TSO-C129a Class B1 or C1 or (E)TSO-C145 Class Beta and operational Class 1, 2 or 3 authorisation as the only primary sensor input to the area navigation function that is accepted as a stand-alone system for this subsection.

Note The integrated avionics systems referred to in subparagraph 10.2 (b) are those systems typically installed in US 14 CFR/EASA CS Part 23 or Part 27 aircraft that combine flight displays, communications, radio navigation (VOR and ILS) and area navigation into a single integrated system. (E)TSO C115 multi-sensor systems that utilise independent discrete sensor inputs are not addressed under this subsection.

10.3 The aircraft is approved for navigation during a flight in accordance with a navigation specification mentioned in paragraph 10.1 if the AFM or AFMS for the aircraft, as published at the time of the flight, states that the aircraft:

(a) is capable of the navigation specification; or

(b) has the GPS capability mentioned in an item of the Table that corresponds to the navigation specification.

Table

	GPS capability (Column 1)	**Navigation specification (Column 2)**
1	GPS RNAV EN ROUTE	RNAV 5; RNAV 2 or RNP 2
2	GPS RNAV TERMINAL	RNAV 1 or RNP 1
3	GPS RNAV NON-PRECISION APPROACH	RNP APCH-LNAV
4	GPS RNAV LP	RNP APCH-LP
5	GPS RNAV LPV	RNP APCH-LPV

Note For example, for the purposes of subparagraph 10.3 (b), if the AFM or AFMS for an aircraft states that the aircraft is capable of GPS RNAV NON-PRECISION APPROACH (a "GPS capability"), then the aircraft would be approved to navigate in accordance with RNP APCH-LNAV (the corresponding "navigation specification").

10.4 If the AFM or an AFMS for an aircraft states that the aircraft is approved for Baro-VNAV and the aircraft meets the requirements in paragraph 10.3, then the aircraft is deemed to be approved for Baro-VNAV in conjunction with RNP APCH-LNAV/VNAV.

10.5 In addition, if the aircraft is equipped with GNSS equipment authorised for:

(a) (E)TSO-C129a Class A1, B1or C1; or

(b) (E)TSO-C146 ( ) Class Gamma and operational Class 2 or 3; or

(c) (E)TSO-C145 Class Beta and operational Class 2 or 3;

the aircraft is deemed to be approved for RNP APCH – LNAV/VNAV operations.

10.6 If the AFM or an AFMS for an aircraft states that the aircraft is approved for RF Legs and the aircraft:

(a) meets the requirements of paragraph 10.3 above; and

(b) is equipped with a map display depicting the computed flight path of the aircraft;

the aircraft is deemed to be approved for RF Legs in conjunction with RNP 1 and RNP APCH – LNAV operations.

10.7 If the AFM or an AFMS for an aircraft states that the aircraft is approved for Radius to FRT and the aircraft:

(a) meets the requirements in paragraph 10.3 above; and

(b) is equipped with a map display depicting the computed flight path of the aircraft;

the aircraft is deemed to be approved for Radius to FRT in conjunction with RNP 2 operations.

11 Certain other aircraft deemed to be approved for navigation authorisations in Appendices 1, 2, 3, 4 and 6

11.1 Subject to compliance with paragraphs 11.2 and 11.3, an Australian aircraft is deemed to be approved for navigation in accordance with any of the following navigation specifications:

(a) RNAV 5;

(b) RNAV 1 and RNAV 2;

(c) RNP 2;

(d) RNP 1;

(e) RNP APCH-LNAV;

(f) RNP APCH-LNAV/VNAV;

(g) RNP APCH-LP or RNP APCH-LPV.

11.2 The aircraft must be equipped with:

(a) a GNSS stand-alone system with en route, terminal, NPA and LPV capability having (E)TSO-C146 ( ) authorisation for Class Gamma and operational Class 3; or

(b) an integrated avionics system using GNSS sensors with (E)TSO-C145 ( ) Class Beta and operational Class 3 authorisation as the only primary sensor input to the area navigation function is deemed to be a stand-alone system for this subsection.

Note The integrated avionics systems referred to are those systems typically installed in US 14 CFR/EASA CS Part 23 or Part 27 aircraft that combine flight displays, communications, radio navigation (VOR and ILS) and area navigation into a single integrated system. (E)TSO C115 multi-sensor systems that utilise independent discrete sensor inputs are not addressed under this subsection.

11.3 The aircraft is approved for navigation during a flight in accordance with a navigation specification mentioned in paragraph 11.1 if the AFM or AFMS for the aircraft, as published at the time of the flight, states that the aircraft:

(a) is capable of the navigation specification; or

(b) has the GPS capability mentioned in an item in the Table that corresponds to the navigation specification.

Table

	GPS capability (Column 1)	**Navigation specification (Column 2)**
1	GPS RNAV EN ROUTE	RNAV 5; RNAV 2 or RNP 2
2	GPS RNAV TERMINAL	RNAV 1 or RNP 1
3	GPS RNAV NON-PRECISION APPROACH	RNP APCH-LNAV
4	GPS RNAV LP	RNP APCH-LP
5	GPS RNAV LPV	RNP APCH-LPV

Note For example, for the purposes of subparagraph 11.3 (b), if the AFM or AFMS for an aircraft states that the aircraft is capable of GPS RNAV NON-PRECISION APPROACH (a "GPS capability"), then the aircraft would be approved to navigate in accordance with RNP APCH-LNAV (the corresponding "navigation specification").

11.4 If the AFM or an AFMS for an aircraft states that the aircraft meets the requirements in subsection 11.3, then it is deemed to be approved for Baro-VNAV in conjunction with RNP APCH-LNAV/VNAV operations.

11.5 If an aircraft:

(a) meets the requirements of paragraph 11.3 above; and

(b) is equipped with a map display depicting the computed flight path of the aircraft; and

(c) the AFM or AFMS states that the aircraft is approved for RF Legs;

it is deemed to be approved for RF Legs in conjunction with RNP 1, RNP APCH – LNAV, RNP APCH – LP, and RNP APCH – LPV operations.

11.6 If an aircraft:

(a) meets the requirements in paragraph 11.3 above; and

(b) is equipped with a map display depicting the computed flight path of the aircraft; and

(c) the AFM or AFMS states that the aircraft is approved for Radius to FRT;

it is deemed to be approved for FRT in conjunction with RNP 2 operations.

12 Pilot qualifications

12.1 To operate to a performance-based navigation specification, the pilot must hold:

(a) a current instrument endorsement valid for the navigation specification:

(i) in accordance with CASR Subpart 61.M.2; or

(ii) in accordance with Civil Aviation Order (***CAO***) 40.2.1; or

(b) the pilot must hold a current private instrument rating and flight procedure approvals or endorsements valid for the navigation specification:

(i) in accordance with CASR Subpart 61.N.2; or

(ii) in accordance with CAO 40.2.3.

12.2 The pilot must also comply with any requirements in the Order or an Appendix stating additional qualifications or conditions for use of the navigation specification.

13 Navigation database — standards and discrepancies

13.1 This subsection applies in relation to all area navigation systems in an aircraft used for PBN operations and sets out CASA's directions for the purposes of regulation 232A of CAR.

13.2 If particulars of way points and navigation aids that are published in maps and charts required to be carried in the aircraft under paragraph 233 (1) (h) of CAR are included in a navigation computer's database, then those particulars must be in a form that cannot be modified by the aircraft operator or flight crew members.

13.3 A navigation database for PBN operations must be valid. To be valid, a navigation database must be:

(a) obtained from a supplier who complies with:

(i) Radio Technical Commission for Aeronautics (RTCA) DO 200A; or

(ii) European Organisation for Civil Aviation Equipment (EUROCAE) document ED-76, Standards for Processing Aeronautical Data; and

(b) compatible with the intended function of the equipment in accordance with ICAO Annex 6, Part 1, Chapter 7.

Note 1 Annex 6, Part 1, Chapter 7 states that an operator shall not employ electronic navigation data products that have been processed for application in the air and on the ground unless the State regulatory authority has approved the operator's procedures for ensuring that the process applied and the products delivered have met acceptable standards of integrity and that the products are compatible with the intended function of the equipment that will use them. The State regulatory authority shall ensure that the operator continues to monitor both process and products.

Note 2 An LOA, issued by an appropriate regulatory authority to each of the participants in the data chain, demonstrates compliance with this requirement, for example, FAA LOA issued in accordance with FAA AC 20-153 or EASA LOA issued in accordance with EASA Agency Opinion 01/2005 and the associated "Conditions for the issuance of Letters of Acceptance for Navigation Database Suppliers by the Agency".

Note 3 A Type 1 LOA provides recognition of a data supplier's compliance with RTCA/DO-200A/EUROCAE ED-76 with no identified compatibility with an aircraft system. A Type 1 LOA ensures the processes for producing the aeronautical data comply with the documents identified in Note 1 and the documented data quality requirements (DQRs).

Note 4 A Type 2 LOA provides recognition of a data supplier's compliance with RTCA/DO-200A/EUROCAE ED-76 and the compatibility of its delivered data with particular avionic systems that are identified in the LOA letter.

Note 5 A CASR Part 175 approval equates to an EASA or FAA Type 1 LOA.

(c) current for the present AIRAC cycle.

13.4 Operators carrying out RNP APCH, Baro-VNAV, Advanced RNP, RNP 0.3 or RNP AR approach operations must obtain their navigation databases from suppliers holding a Type 2 LOA.

13.5 An operator who has a navigation authorisation from CASA must periodically check the navigation database for database integrity.

Note While an LOA provides assurance of minimum standards for the supply of a navigation database, errors may still occur. All operators must conduct periodic checks to ensure database integrity against a current navigation data source.

13.6 Any discrepancy in data in the operator's navigation database must be:

(a) reported as soon as practicable to the navigation database supplier; and

(b) resolved, before further operational use, by:

(i) reissue of the database; or

(ii) prohibition of the route; or

(iii) instructions to the flight crew.

13.7 Without affecting the operator's obligation under paragraph 13.6, any discrepancy in the operator's navigation database that is likely to lead to a hazardous condition arising through either loss of separation between the aircraft and terrain, or obstacles or loss of separation between aircraft, must be reported in accordance with the *Transport Safety Investigation Regulations 2003*.

13.8 If an event occurs in relation to a navigation database that is referred to in subregulation 2.3 (3) or regulation 2.4 of the *Transport Safety Investigation Regulations 2003*, it must be reported in accordance with that subregulation.

13.9 If the current AIRAC cycle of a navigation database changes to the next AIRAC cycle while an aircraft is in flight, the aircraft should continue to use the original AIRAC cycle navigation database for the remainder of the flight.

13.10 Subject to the limitations in paragraphs 13.7 and 13.8, a navigation database that is not current, or will not be current for the duration of a flight, may be used for navigation provided any data used for navigation is verified before use from a current navigation data source. A navigation database that is not current must not be used for radio updating of a navigation system.

Note 1 A current navigation data source can be either current maps, charts or other sources of navigation information provided by supplier meeting the requirements of subparagraph 13.3 (a). An Electronic Flight Bag that is current is an acceptable reference source for navigation database verification.

Note 2 Inertial systems (INS or IRS) may be used without radio updating provided that the conditions and limitations for inertial only operations are complied with.

13.11 An aircraft that is not operated with an MEL may operate for a period of not more than 72 hours from the time that the database expires.

13.12 An aircraft that is operated with an MEL may operate for up to 3 Flight Days from the time that the database expires.

13.13 Manually entered data in a navigation system must be checked for accuracy by 2 flight crew members.

13.14 In the case of a single-pilot operation, manually entered data in a navigation system must be checked against other aeronautical information, such as current maps and charts carried in the aircraft (see Note 1 to paragraph 13.10).

14 Operating standards – flight planning – GNSS integrity availability

14.1 When an RNP APCH is planned at the intended destination or designated alternate as part of flight planning, a prediction for GNSS integrity availability must be obtained from a ground-based source.

14.2 If a continuous loss of the GNSS integrity function for more than 5 minutes is predicted for any part of the RNP APCH operation, the flight plan must be revised, for example, by delaying the departure time or planning a different route.

14.3 When an aircraft is operating in oceanic airspace and navigation is based on GNSS, as part of flight planning a prediction for GNSS Fault Detection and Exclusion (FDE) availability for the intended route must be obtained.

14.4 For oceanic/remote operations, the maximum FDE outage duration cannot exceed 25 minutes for RNP-4 operation, 34 minutes for RNP-10 operation and 51 minutes for minimum navigation performance standards (MNPS) operation.

14.5 For continental en route operations a prediction for GNSS integrity availability is not required. If a continuous loss of the GNSS integrity function for more than 5 minutes occurs during PBN operations, Air Traffic Control must be advised.

14.6 For a PBN operation navigating with SBAS receivers, a check must be made for GNSS integrity availability in areas where SBAS is unavailable.

14.7 Paragraphs 14.1, 14.2, 14.3 and 14.4 do not apply to an aircraft whose RNP system can achieve LNAV accuracy less than 0.3 NM using requisite GNSS satellites.

Note ***Requisite GNSS satellites*** is defined in subsection 4 of this Order.

15 Navigation errors

15.1 The operator must take immediate action to remedy any condition that led to, or is likely to lead to, navigation error in the course of an RNAV or RNP operation.

15.2 Without affecting the obligation in paragraphs 13.7, 13.8 and 15.1, each of the following navigation errors or events must be reported in accordance with paragraph 2.4 (i) of the *Transport Safety Investigation Regulations 2003*:

(a) a lateral or longitudinal navigational error that exceeds the required accuracy value i.e. the RNAV or RNP value, for other than a transient duration during a turn; or

(b) an aircraft system failure that results in the aircraft losing the currently active navigation capability i.e. there is a loss of the navigation function.

Note Loss of the RNAV or RNP capability in use in the aircraft must be reported but the failure of 1 navigation system in a dual installation need not be reported since the capability to meet the navigation specification requirements has not been lost.

15.3 If an event occurs in relation to a navigation system that is referred to in subregulation 2.3 (3) of the *Transport Safety Investigation Regulations 2003*, it must be reported in accordance with that subregulation.

15.4 Each report mentioned in paragraph 15.2 or 15.3 must:

(a) contain a preliminary analysis of the cause of the error; and

(b) include a statement of the remedial action taken, and to be taken, to prevent a recurrence of the error.

15.5 Unless paragraph 15.6 applies, the operator must take the remedial action mentioned in paragraph 15.4 as soon as practicable.

15.6 Without affecting paragraphs 15.1 to 15.4, for this subsection CASA may:

(a) determine the cause of the error; and

(b) notify the operator of the cause of the error and of the remedial action to be taken to prevent a recurrence of the error.

15.7 If paragraph 15.6 applies, the operator must take the remedial action notified by CASA to prevent a recurrence of the error.

16 Oceanic/remote continental region operations

16.1 Aircraft operating in oceanic/remote continental airspace, where the routes or airspace being used are designated as RNP 10, RNP 4, RNP 2 or other navigation specification, must comply with all requirements for those respective navigation specifications and authorisations.

16.2 Aircraft operating in oceanic/remote continental airspace must be equipped in accordance with either paragraph 16.3 or 16.4 if:

(a) the routes or airspace being used are not designated as RNP 10, RNP 4, RNP 2 or other navigation specification; and

(b) GNSS is the primary means of navigation.

16.3 An aircraft is eligible for oceanic/remote continental airspace operations where the routes or airspace being used are not designated as RNP 10, RNP 4, RNP 2 or other navigation specification if the aircraft is equipped with dual independent stand-alone GNSS that are certified by the State of Manufacture for en route operations, installed in accordance with AC 21-36( ) or FAA AC 20-138D, and compliant with:

(a) (E)TSO-C129 Class A1 or A2 and the equipment is certified as complying with the requirements of FAA Notice 8110.60; or

(b) (E)TSO-C129 Class A1 or A2 and the equipment is certified as complying with the requirements of FAA Advisory Circular 20-138D, Appendix 1; or

(c) (E)TSO-C146 Class Gamma and operational Class 1, 2 or 3; or

(d) standards that CASA considers are equivalent to the standards mentioned in subparagraph (a), (b) or (c).

16.4 An aircraft is eligible for oceanic/remote continental airspace operations where the routes or airspace being used are not designated as RNP 10, RNP 4, RNP 2 or other navigation specification if the aircraft is equipped with dual independent multi-sensor systems (for example, FMS) with GNSS equipment that is certified by the State of Manufacture for en route operations, installed in accordance with FAA AC 20-138D, and meets:

(a) the requirements of (E)TSO-C115b FMS and 1 of the following:

(i) (E)TSO-C129 ( ) sensor Class B or C and the equipment is certified as complying with the requirements of FAA Notice 8110.60;

(ii) (E)TSO-C129 ( ) sensor Class B or C and the equipment is certified as complying with the requirements of FAA Advisory Circular 20-138D Appendix 1;

(iii) (E)TSO-C145 ( ) Class Beta and operational class 1, 2 or 3;

(iv) (E)TSO-C196 ( ); or

(b) standards that CASA considers are equivalent to the standards mentioned in subparagraph (a).

16.5 If the GNSS receiver has the capability for barometric aiding, this capability must be connected and operative.

17 Use of suitable area navigation systems on conventional routes and procedures

17.1 While operating on, or transitioning to, conventional routes and procedures (not RNAV or RNP), provided that the requirements in Appendix 13 are complied with, operators may use a suitable GNSS-based area navigation system as either:

(a) a substitute means of navigation when a conventional navigation aid is not available, or the aircraft is not equipped with an ADF, VOR or DME or the installed ADF, VOR or DME is inoperative; or

(b) as an alternate means of navigation when a conventional navigation aid is operative and the aircraft is equipped with operative equipment that is compatible with the conventional navigation aids.

17.2 A suitable GNSS-based area navigation system may be used as a substitute or alternate to the following conventional navigation aids:

(a) VOR; or

(b) DME; or

(c) VOR/DME; or

(d) NDB; or

(e) Outer Marker; or

(f) Middle Marker.

17.3 Appendix 13 details the requirements for a suitable GNSS-based area navigation system to be used as a substitute or alternate to the conventional navigation aids listed above when an aircraft is operating in the en route, terminal operations (***SID*** or ***STAR***) or approach operations phases of flight.

17.4 Before using a GNSS-based area navigation system as a substitute or alternate to the conventional navigation aids for terminal operations (***SID*** or ***STAR***) or approach operations phases of flight, the operator or pilot must verify that:

(a) the intended waypoints or procedure(s) can be loaded from the navigation database by name in accordance with Appendix 13; and

(b) the navigation system will fly the procedure as published in the relevant State AIP.

18 MEL

The operator's MEL must identify any unserviceability that affects the conduct of any PBN operation for which the aircraft is authorised.

Appendix 1 — Requirements for use of RNAV 5

1 RNAV 5 navigation eligibility for I.F.R. flights

1.1 RNAV 5 may only be used for PBN by an aircraft if the aircraft meets the eligibility requirements for RNAV 5 as set out in this Appendix.

Note Air routes may be designed to support RNAV 5 depending on the supporting navaid infrastructure. In Australia, as the navaid infrastructure is limited, RNAV 5 operations are typically dependent on self-contained navigation systems.

1.2 RNAV 5 may be used by an aircraft if the operator has been issued with, or is deemed to hold, an RNAV 5 navigation authorisation under Civil Aviation Order 20.91 as in force immediately before the commencement of this Order.

1.3 An aircraft to which subclause 2.1 of this Appendix applies may be considered eligible for RNAV 5 operations subject to conditions that CASA considers necessary in the interests of safety.

1.4 An aircraft using RNAV 5 must comply with the operational requirements of this Appendix.

1.5 Where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

2 Application — documents

2.1 If the aircraft is not covered by subclause 1.1 or 1.2 of this Appendix, approval of an aircraft for RNAV 5 operations is required.

2.2 If subclause 2.1 applies, an operator must be able to supply to CASA at its request, in order to establish eligibility, aircraft airworthiness documents that satisfy CASA the aircraft is equipped for RNAV 5 operations, for example, the AFM, the AFMS or OEM service letters.

3 RNAV 5 system performance

3.1 For RNAV 5 eligibility, an aircraft's navigation system (the ***system***) must meet the performance, monitoring and alerting requirements for RNAV 5 operations as stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part B, Chapter 2, *Implementing RNAV 5*.

3.2 If GNSS is used for an RNAV 5 operation, positioning data from non-GNSS navigation sensors may be integrated with GNSS data if:

(a) the non-GNSS data does not cause position errors exceeding the TSE limit; or

(b) if paragraph (a) cannot be complied with — there is a means to deselect the non-GNSS inputs.

4 RNAV 5 system functionality

4.1 For RNAV 5 eligibility, the system must meet the following minimum standards of functionality:

(a) the aircraft position relative to track must be continuously displayed on a navigation display situated in the primary field of view of the pilot flying the aircraft;

(b) where the minimum flight crew is 2 pilots, the aircraft position relative to track must also be continuously displayed on a navigation display situated in the primary field of view of the pilot not flying the aircraft;

(c) the system must display distance and bearing to the active (to) waypoint;

(d) the system must display ground-speed or time to the active (to) waypoint;

(e) the system must store at least 4 waypoints;

(f) the system must indicate failure of the system, including the sensors.

4.2 The following standards apply to navigation displays:

(a) navigation data must be available on:

(i) a display forming part of the RNAV equipment; or

(ii) a lateral deviation display, for example, CDI, (E)HSI, or a navigation map display;

(b) the display must be suitable for use:

(i) as the primary flight instrument for navigation of the aircraft; and

(ii) for manoeuvre anticipation; and

(iii) for failure, status or integrity indication;

(c) the display must be visible to the pilot when looking forward along the flight path;

(d) where a lateral deviation display is implemented, the lateral deviation display must have:

(i) scaling compatible with any alerting and annunciation limits; and

(ii) scaling and full-scale deflection suitable for RNAV 5 operations.

5 RNAV 5 equipment

5.1 For RNAV 5 eligibility, an aircraft's navigation equipment must:

(a) enable the aircraft to establish and follow a desired flight path; and

(b) automatically determine the aircraft's position in the horizontal plane using inputs from 1 or more of the following types or combinations of position sensors:

(i) VOR/DME;

(ii) DME/DME;

(iii) INS or IRS;

(iv) GNSS.

5.2 If an aircraft is not equipped with GNSS, it must, nevertheless, have the capability to satisfy the RNAV 5 inertial only time limits for any relevant route on which it is flown.

6 Operating standards – flight planning – general

6.1 Before an RNAV 5 operation commences, proper consideration must be given to matters that may affect the safety of the operation, including the following:

(a) whether the aircraft and the flight crew have relevant authorisations for RNAV 5;

(b) whether the aircraft can be operated in accordance with the RNAV 5 requirements for:

(i) the planned route, including the route to any alternate aerodromes; and

(ii) minimum equipment requirements for the flight;

(c) whether the navaids required for the planned route are available and adequate for the period of the operation, including any non-RNAV contingencies;

(d) whether, if a navigation database is used, it is current and appropriate for the region of operation and includes the navaids and waypoints required for the route;

(e) whether operating restrictions, including time limits, apply to the operation.

6.2 If the aircraft's essential RNAV 5 equipment is functioning properly, the PBN capability of the aircraft must be indicated in the flight plan.

7 Operating standards – flight procedures – general

7.1 An RNAV 5 operation must comply with the following:

(a) the instructions and procedures of the OEM in relation to the performance requirements of RNAV 5;

(b) any AFM limitations or operating procedures required to maintain the navigation accuracy specified for RNAV 5.

7.2 The following checks and cross-checks must be made:

(a) a check that the navigation database is valid;

(b) a cross-check of the flight plan by comparing charts or other applicable resources with the navigation system flight plan and the aircraft map display (if applicable) and, if necessary, excluding specific navaids.

7.3 Flight progress must be monitored for navigational reasonableness by periodic cross-checks with conventional navaids, where available.

7.4 Subject to subclause 7.5, the aircraft must be flown to maintain the route centreline as close as practicable.

Note Piloting standards usually require the aircraft to be flown to maintain lateral deviation not exceeding half the current accuracy requirement (RNP value) or half the lateral deviation scale. Whilst this standard should be observed, pilots must also be aware that Navigation System Error + Flight Technical Error (lateral deviation) may not exceed the specified navigation accuracy.

7.5 Brief deviations from the standard mentioned in subclause 8.4 are acceptable during and immediately after turns, but only to the minimal extent that accurate cross-track information may not be provided during the turn. Unless emergency conditions exist, any other intentional deviation from the route centreline requires prior clearance from ATC.

Note Flight crew procedures and training should emphasise observance of turn anticipation commands and management of rate of turn.

7.6 If ATC issues a heading assignment taking the aircraft off a route, the navigation system flight plan may only be modified when:

(a) ATC clearance is received to rejoin the route; or

(b) ATC confirms a new clearance.

8 Contingency procedures for performance failure

8.1 If the system performance ceases to meet RNAV 5 requirements during an RNAV 5 operation in controlled airspace, ATC must be notified immediately.

8.2 Where stand-alone GNSS or GNSS/FMS equipment is used for an RNAV 5 operation and a loss of the integrity monitoring function occurs, the following checks and procedures must be followed:

(a) while continuing to navigate using GNSS — cross-check the aircraft position with other sources of position information, for example, VOR, DME and NDB information, to confirm an acceptable level of navigation performance;

(b) if unable to confirm navigation accuracy — revert to an alternative means of navigation and advise ATC accordingly.

8.3 If:

(a) stand-alone GNSS or GNSS/FMS equipment is used for an RNAV 5 operation; and

(b) a navigation display is flagged invalid due to an integrity alert;

the aircraft must:

(c) revert to an alternative means of navigation; and

(d) ATC must be advised accordingly.

Appendix 2 – Requirements for use of RNAV 1 and RNAV 2

1 RNAV 1 and RNAV 2 eligibility for I.F.R. flights

1.1 RNAV 1 and RNAV 2 may only be used for PBN by an aircraft if the aircraft meets the requirements for RNAV 1 and RNAV 2 as set out in this Appendix.

Note Air routes may be designed to support RNAV 1 or RNAV 2 depending on the supporting navaid infrastructure. In Australia, as the navaid infrastructure is limited, RNAV 1 and RNAV 2 operations are dependent on self-contained navigation systems.

1.2 RNAV 1 and RNAV 2 requirements are identical, however, some operating procedures may be different.

Note In Australian airspace, RNAV 1 will be used only in terminal area operations and RNAV 2 routes or procedures will not be used.

1.3 RNAV 1 and RNAV 2 may be used by an aircraft:

(a) if it meets the aircraft eligibility requirements for use of RNP 1 or RNP 2; or

(b) the operator has been issued with, or is deemed to hold, an RNAV 1 and RNAV 2 navigation authorisation under Civil Aviation Order 20.91 as in force immediately before the commencement of this Order.

1.4 An aircraft to which subclause 3.3 of this Appendix applies may be considered eligible for RNAV 1 and RNAV 2 operations subject to conditions that CASA considers necessary in the interests of safety.

1.5 An aircraft using RNAV 1 and RNAV 2 must comply with the operational requirements of this Appendix.

1.6 Where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

2 Application — documents

If the aircraft is not covered by subclause 1.3 of this Appendix, approval of the aircraft for RNAV 1 and RNAV 2 operations is required. In that case, an operator must be able to supply to CASA at its request:

(a) aircraft airworthiness documents which satisfy CASA that the aircraft is equipped for RNAV 1 and RNAV 2 operations, for example, the AFM, the AFMS or OEM service letters; and

(b) a detailed description of relevant aircraft equipment for RNAV 1 and RNAV 2 operations, including a configuration list of the components and equipment; and

(c) a detailed description of the operating procedures to be used for RNAV 1 and RNAV 2 operations (including flight planning and flight procedures) supported by relevant copies of, or extracts from, the following:

(i) the checklists;

(ii) the contingency procedures;

(iii) the QRH; and

(d) copies of the sections of the MEL applicable to RNAV 1 and RNAV 2 operations; and

(e) a detailed description of the maintenance program used to ensure the continuing airworthiness of the aircraft for RNAV 1 and RNAV 2 operations; and

(f) a detailed description of the method used to ensure the validity and continuing integrity of the airborne navigation database; and

(g) if requested in writing by CASA — a copy of any relevant document referred to in any of the documents mentioned in clauses (a) to (f).

3 Aircraft eligibility

3.1 An aircraft is eligible for RNAV 1 and RNAV 2 operations if the requirements of either subclause 3.2 or 3.3 of this Appendix are satisfied.

3.2 Subject to subclause 3.3, an aircraft is eligible for RNAV 1 and RNAV 2 operations if the operator has demonstrated to CASA that the aircraft meets the requirements of ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part B, Chapter 3, *Implementing RNAV 1 and RNAV 2*.

3.3 At least 1 of the following must apply:

(a) the aircraft's AFM, an AFMS or an OEM service letter states that the aircraft navigation system is approved for RNAV 1 and RNAV 2 operations;

(b) the aircraft's AFM, an AFMS or an OEM service letter states that the aircraft navigation system is approved for P-RNAV in accordance with JAA TGL-10, and the additional requirements for RNAV 1 and RNAV 2 are met as set out in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part B, Chapter 3, *Implementing RNAV 1 and RNAV 2* (see Table 1 below);

(c) the aircraft's AFM, an AFMS or an OEM service letter states that the aircraft navigation system is approved for US-RNAV in accordance with FAA AC 90-100A, and the additional requirements for RNAV 1 and RNAV 2 are met as set out in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part B, Chapter 3, *Implementing RNAV 1 and RNAV 2* (see Table 2 below).

3.4 The additional requirements to obtain an RNAV 1 and RNAV 2 aircraft eligibility under clause 3.3 of this Appendix beginning with either a TGL-10 or AC 90-100 approval are listed in Tables 1 and 2 below.

Table 1 Additional requirements for obtaining an RNAV 1 and RNAV 2 approval from a TGL-10 approval

Operator has TGL-10	**Needs to confirm these performance capabilities for ICAO RNAV 1 and RNAV 2**	**Note**
If approval includes use of DME/VOR (DME/VOR may be used as the only positioning input where this is explicitly allowed.)	RNAV 1 does not accommodate any routes based on DME/VOR RNAV	RNAV system performance must be based on GNSS, DME/DME, or DME/DME/IRU. However, DME/VOR input does not have to be inhibited or deselected
If approval includes use of DME/DME	No action required if RNAV system performance meets specific navigation service criteria in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Vol II, Part B, Chapter 3, clause 3.3.3.2.2 (DME/DME only) or 3.3.3.2.3 (DME/DME/IRU)	Operator can ask manufacturer or check FAA website for list of compliant systems (see the Note below this Table)
RNAV SID specific requirement with DME/DME aircraft	RNAV guidance available no later than 500 ft above field elevation (AFE)	Operator should add these operational procedures
If approval includes use of GNSS	No action required	

Table 2 Additional requirements for obtaining RNAV 1 and RNAV 2 approval from an AC 90-100 approval

Operator has AC 90-100	Needs to confirm these performance capabilities to ICAO RNAV 1/RNAV 2	Note
If approval is based on GNSS (TSO-C129 OR ETSO-C129)	GPS pseudo-range step detector and GPS health word checking is required in accordance with TSO C129a/ETSO C129a	The operator should check if pseudo-range step detector and health word checking is supported by the installed GPS receiver or check if GPS receiver is approved in accordance with TSO C129a/ETSO C129a
No navigation database updating process required under AC 90-100	Data suppliers and avionics data suppliers must have Letter of Acceptance (LOA) in accordance with ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Vol II, Part B, Chapter 3, clause 3.3.3.3 m)	The operator should ask the data supplier for the status of the RNAV equipment

4 RNAV 1 and RNAV 2 system performance

4.1 To establish RNAV 1 and RNAV 2 aircraft eligibility, the navigation system must meet the system performance, monitoring and alerting requirements for RNAV 1 and RNAV 2 operations as stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part B, Chapter 3, *Implementing RNAV 1 and RNAV 2*.

4.2 If GNSS is used for an RNAV 1 and RNAV 2 operation, positioning data from non-GNSS navigation sensors may be integrated with GNSS data if:

(a) the non-GNSS data does not cause position errors exceeding the TSE budget; or

(b) if paragraph (a) cannot be complied with — there is a means to deselect the non-GNSS inputs.

5 RNAV 1 and RNAV 2 system functionality

5.1 To establish RNAV 1 and RNAV 2 aircraft eligibility, the navigation system must as a minimum meet the functional requirements for navigation displays and standards stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part B, Chapter 3, *Implementing RNAV 1 and RNAV 2*.

5.2 Baro-VNAV authorised in accordance with Appendix 8 may be used in conjunction with RNAV 1 under this Appendix.

6 Operating standards – flight planning – general

6.1 Before an RNAV 1 and RNAV 2 operation commences, consideration must be given to matters that may affect the safety of the RNAV 1 and RNAV 2 operation, including the following:

(a) whether the aircraft and the flight crew have relevant authorisations for RNAV 1 and RNAV 2;

(b) whether the aircraft can be operated in accordance with the RNAV 1 and RNAV 2 requirements for:

(i) the planned route, including the route to any alternate aerodromes; and

(ii) minimum equipment requirements for the flight;

(c) whether the navaids (if any) required for the planned route are available and adequate for the period of the operation, including any non-RNAV contingencies;

(d) whether the navigation database is current and appropriate for the region of operation and includes the navaids and waypoints required for the route;

(e) for navigation relying on DME — whether operating procedures properly require the pilot in command:

(i) to check NOTAMs to verify the condition of critical DMEs; and

(ii) to consider his or her capability to navigate (including to an alternate destination) in the case of a failure of a critical DME while airborne;

(f) whether operating restrictions, including time limits, apply to the operation.

6.2 If the aircraft's essential RNAV 1 and RNAV 2 equipment is functioning properly, the PBN capability of the aircraft must be indicated in the flight plan.

7 Operating standards – flight procedures – general

7.1 An RNAV 1 and RNAV 2 operation must comply with the instructions and procedures of the OEM in relation to the performance requirements of RNAV 1 and RNAV 2.

7.2 At system initialisation, the following must occur:

(a) confirmation that the navigation database is current;

(b) verification that the aircraft position has been entered correctly;

(c) verification of proper entry of the ATC-assigned route immediately after initial clearance from ATC to conduct the relevant RNAV route;

(d) action to ensure the waypoints sequence, depicted by the navigation system, matches the route depicted on the appropriate charts and the assigned route.

7.3 The following steps must occur:

(a) selection of an RNAV 1 or RNAV 2 SID or STAR by route name from the on-board navigation database;

(b) confirmation that the selected route conforms to the charted route, or the route as modified through the insertion or deletion of specific waypoints in response to ATC clearances.

7.4 Except in response to ATC clearances, the following must not occur:

(a) creation of new waypoints by manual entry; or

(b) making manual entry of latitude, longitude or rho/theta values; or

(c) changing an RNAV SID or STAR database waypoint type from a fly-by to a flyover or vice versa.

Note Wherever possible, the pilot in command should extract RNAV 1 and RNAV 2 routes in the en route domain from the database in their entirety rather than load individual waypoints from the database into the navigation system flight plan. The pilot in command may, however, select and insert individual, named fixes and waypoints from the navigation database, provided all fixes along the published route to be flown are inserted.

7.5 The following checks and cross-checks must be made:

(a) a cross-check of the flight plan by comparing charts or other applicable resources with the navigation system flight plan and the aircraft map display (if applicable);

(b) if required, confirm the exclusion of specific navaids.

Note Small differences between charted navigation information and displayed navigation data may be noted. Differences of 3 degrees or less due to the equipment manufacturer's application of magnetic variation or leg track averaging are operationally acceptable.

7.6 Flight progress must be monitored for navigational reasonableness by periodic cross-checks with available data from ground-based aids, if available.

7.7 For RNAV 1 routes, a lateral deviation indicator, flight director or autopilot in LNAV mode must be used.

Note For RNAV 2 routes, a lateral deviation indicator, flight director or autopilot in the LNAV mode is recommended. In lieu of a lateral deviation indicator, a navigation map display with equivalent functionality to a lateral deviation indicator is recommended.

7.8 Where a lateral deviation indicator is used, scaling must be selected suitable for the navigation accuracy associated with the route or procedure, for example, full scale deflection ±1 NM for RNAV 1, ±2 NM for RNAV 2, or ±5 NM for (E)TSO-C129 ( ) equipment on RNAV 2 routes.

7.9 Route centrelines must be maintained as close as practicable, as depicted by lateral deviation indicators or flight guidance, unless authorised to deviate by ATC or under emergency conditions. Navigation System Error + Flight Technical Error (lateral deviation) must not exceed the specified navigation accuracy.

7.10 Brief deviations from the standard mentioned in subclause 7.9 of this Appendix are acceptable during and immediately after turns, but only to the minimal extent that accurate cross-track information may not be provided during the turn.

7.11 If ATC issues a heading assignment taking the aircraft off a route, the navigation system flight plan may only be modified when:

(a) ATC clearance is received to rejoin the route; or

(b) ATC confirms a new clearance.

8 Operating standards – flight procedures – RNAV SID requirements

8.1 Before an eligible aircraft takes-off, the following RNAV SID requirements must be verified:

(a) that the aircraft's RNAV system is available, is operating correctly and the correct aerodrome and runway data is loaded;

(b) that the correct runway and departure procedure (including any applicable en route transition) is entered in the navigation system flight plan and properly depicted;

8.2 RNAV guidance must be selected and available to provide flight guidance for lateral RNAV at no later than 153 m (or 500 ft) above the aerodrome field elevation.

8.3 For an RNAV 1 operation, an authorised method must be used to achieve an appropriate level of performance, for example, lateral deviation indicator, flight director or autopilot.

8.4 For operations without GNSS using DME/DME/IRU, the aircraft navigation system position must be confirmed within 304 m (or 1 000 ft) of a known position, at the starting point of the take-off roll.

8.5 When the aircraft is using GNSS, the signal must be acquired before the take-off roll commences.

9 Operating standards – flight procedures – RNAV STAR requirements

9.1 The following must be checked and confirmed for RNAV STAR:

(a) that the aircraft navigation system is operating correctly;

(b) that the correct arrival procedure and runway (including any applicable transition) are entered in the navigation system flight plan and properly depicted.

9.2 A route is not to be used if doubt exists as to its validity in the navigation database.

9.3 No member of the flight crew may create a new waypoint by manual entry into the RNAV system.

9.4 If the operator's contingency procedures require reversion to a conventional arrival route, provision for that arrival route must be made before commencement of the RNAV STAR.

9.5 Route modifications in the terminal area may take the form of radar headings or "direct to" clearances and may require the insertion of tactical waypoints from the navigation database. However, no member of the flight crew may make a manual entry or modification of the loaded route using temporary waypoints or fixes not contained in the database.

9.6 All relevant published altitude and speed constraints must be observed.

10 Contingency procedures for performance failure

ATC must be notified immediately if the system performance ceases to meet RNAV 1 and RNAV 2 requirements (as applicable) during an RNAV 1 and RNAV 2 operation in controlled airspace.

Appendix 3 — Requirements for use of RNP 2

1 Eligibility for RNP 2 I.F.R. flights

1.1 RNP 2 navigation may only be used for PBN by an aircraft that meets the requirements of this Appendix.

1.2 RNP 2 may only be used for PBN by an aircraft that has GNSS as the primary navigation sensor.

1.3 RNP 2 may be used by an aircraft:

(a) if it meets the aircraft eligibility requirements for use of RNP 1 or an RNP APCH or RNP AR navigation authorisation; or

(b) the operator has been issued with, or is deemed to hold, an RNP 2 navigation authorisation under Civil Aviation Order 20.91 as in force immediately before the commencement of this Order.

1.4 An aircraft to which subclause 3.3 of this Appendix applies may be considered eligible for RNP 2 operations subject to conditions that CASA considers necessary in the interests of safety.

1.5 The applicable operational requirements of this Appendix must be complied with by an aircraft using RNP 2.

1.6 It is a condition of the issue of a navigation authorisation that where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

2 Application — documents

If the aircraft does not comply with subclauses 1.1 and 1.2 or subclause 1.3 of this Appendix, approval of the aircraft for RNP 2 operations is required. In that case, an operator must be able to supply to CASA at its request:

(a) aircraft airworthiness documents which satisfy CASA that the aircraft is equipped for RNP 2 operations, for example, the AFM, the AFMS or OEM service letters; and

(b) a detailed description of relevant aircraft equipment for RNP 2 operations, including a configuration list of the components and equipment; and

(c) a detailed description of the operating procedures to be used for RNP 2 operations (including flight planning and flight procedures) supported by relevant copies of, or extracts from, the following:

(i) the checklists;

(ii) the contingency procedures;

(iii) the QRH; and

(d) copies of the sections of the MEL applicable to RNP 2 operations; and

(e) a detailed description of the maintenance program used to ensure the continuing airworthiness of the aircraft for RNP 2 operations; and

(f) a detailed description of the method used to ensure the validity and continuing integrity of the airborne navigation database; and

(g) if requested in writing by CASA — a copy of any relevant document referred to in any of the documents mentioned in paragraphs (a) to (f).

3 Aircraft eligibility

3.1 An aircraft is eligible for RNP 2 operations if subclause 3.2, 3.3, 3.4 or 3.5 of this Appendix is satisfied.

3.2 The aircraft's AFM, AFMS or OEM service letter must state that the aircraft navigation system is approved for RNP 2 operations.

3.3 An aircraft is eligible for RNP 2 operations if the aircraft is equipped with a stand-alone GNSS that is certified by the manufacturer for en route operations, installed in accordance with AC 21-36 ( ), and compliant with:

(a) (E)TSO-C129 ( ) Class A1 or A2; or

(b) (E)TSO-C146 Class Gamma and operational Class 1, 2 or 3; or

(c) standards that CASA considers are equivalent to the standards mentioned in paragraph (a) or (b).

3.4 An aircraft is eligible for RNP 2 operations if the aircraft is equipped with a multi-sensor system (for example, FMS) with GNSS equipment that is certified by the manufacturer for en route operations, installed in accordance with AC 21-37 (0), and meets:

(a) the requirements of TSO-C115b FMS or ETSO-C115b FMS, and 1 of the following:

(i) (E)TSO-C129 sensor Class B or C;

(ii) (E)TSO-C145 Class Beta and operational Class 1, 2 or 3;

(iii) (E)TSO-C196; or

(b) standards that CASA considers are equivalent to the standards mentioned in paragraph (a).

3.5 An aircraft is eligible for RNP 2 operations if the operator has demonstrated to CASA that the aircraft meets the requirements of ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 2, *Implementing RNP 2*.

4 RNP 2 system performance

4.1 To meet the requirements of clause 3 of this Appendix, the system must meet the performance, monitoring and alerting requirements for RNP 2 operations as stated in ICAO Doc. 9613, *Performance-based Navigation* (*PBN*) *Manual*, Volume II, Part C, Chapter 2, *Implementing RNP 2*.

4.2 Positioning data from non-GNSS navigation sensors may be integrated with GNSS data if:

(a) the non-GNSS data does not cause position errors exceeding the TSE limit; or

(b) if paragraph (a) does not apply — there is a means to deselect the non-GNSS inputs.

5 RNP 2 system functionality

5.1 To meet the requirements of clause 3 of this Appendix, the system must as a minimum meet the standards of functionality stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual,* Volume II, Part C, Chapter 2, *Implementing RNP 2*.

5.2 An aircraft conducting RNP 2 operations in oceanic or remote airspace must be equipped with appropriate dual, independent, serviceable LRNS.

5.3 An aircraft conducting RNP 2 operations in continental en route airspace must be equipped with at least an appropriate single GNSS RNAV system, provided that an alternative means of navigation is available if required for the class of operation.

5.4 FRT authorised in accordance with Appendix 11 may be used in conjunction with this Appendix.

5.5 If FRT are authorised for use in conjunction with this Appendix, the aircraft must be equipped with a map display depicting the computed flight path of the aircraft.

6 Operating standards – flight planning – general

6.1 Before an RNP 2 operation commences, consideration must be given to matters that may affect the safety of the operation, including the following:

(a) whether the aircraft and the flight crew have relevant authorisations for RNP 2;

(b) whether the aircraft can be operated in accordance with the RNP 2 requirements for:

(i) the planned route, including the route to any alternate aerodromes; and

(ii) minimum equipment requirements for the flight;

(c) whether, the navigation database is current and appropriate for the region of operation and includes the navaids and waypoints required for the route;

(d) whether operating restrictions, including time limits, apply to the operation.

6.2 If the aircraft's essential RNP 2 equipment is functioning properly, the PBN capability of the aircraft must be indicated in the flight plan.

7 Operating standards – flight procedures – general

7.1 An RNP 2 operation must comply with the instructions and procedures of the OEM in relation to the performance requirements of RNP 2.

7.2 At system initialisation, the following must occur:

(a) confirmation that the navigation database is current;

(b) verification of proper entry of the ATC-assigned route immediately after initial clearance from ATC to conduct the relevant RNAV route;

(c) action to ensure the waypoints sequence, depicted by the navigation system, matches the route depicted on the appropriate charts and the assigned route.

7.3 The following checks and cross-checks must be made:

(a) a cross-check of the flight plan by comparing charts or other applicable resources with the navigation system flight plan and the aircraft map display (if applicable);

(b) if required, confirm the exclusion of specific navaids.

Note Small differences between charted navigation information and displayed navigation data may be noted. Differences of 3 degrees or less due to the equipment manufacturer's application of magnetic variation or leg track averaging are operationally acceptable.

7.4 During flight, as far as practicable, navigation reasonableness must be periodically confirmed by cross-reference to available data from ground-based aids, if available.

7.5 For RNP 2 routes, 1 or more of the following must be used:

(a) subject to subclause 7.6 of this Appendix, a lateral deviation indicator;

(b) a flight director; or

(c) an autopilot in the lateral deviation mode.

7.6 A navigation map display may be used instead of a lateral deviation indicator, if the navigation map display has functionality equivalent to a lateral deviation indicator as described in ICAO Doc. 9613, *Performance-based Manual* (*PBN*), Volume II, Part C, Chapter 2, *Implementing RNP 2*.

7.7 Where a lateral deviation indicator is used, scaling must be selected suitable for the navigation accuracy associated with the route or procedure, for example:

(a) full scale deflection ±2 NM; or

(b) on an RNP 2 route using a lateral deviation indicator that complies with (E)TSO-C129 ( ) — full scale deflection ±5 NM.

7.8 Route centrelines must be maintained as close as practicable, as depicted by lateral deviation indicators or flight guidance, unless authorised to deviate by ATC or under emergency conditions. Navigation System Error + Flight Technical Error (lateral deviation) must not exceed the specified navigation accuracy

7.9 Brief deviations from the standard mentioned in subclause 7.8 of this Appendix are acceptable during and immediately after turns, but only to the minimal extent that accurate cross-track information may not be provided during the turn.

7.10 If ATC issues a heading assignment taking the aircraft off a route, the navigation system flight plan may only be modified when:

(a) ATC clearance is received to rejoin the route; or

(b) ATC confirms a new clearance.

8 Contingency procedures for performance failure

ATC must be notified immediately if the system performance ceases to meet RNP 2 requirements during an RNP 2 operation in controlled airspace.

Appendix 4 — Requirements for use of RNP 1

1 Eligibility for RNP 1 I.F.R. flights

1.1 RNP 1 may only be used for PBN by an aircraft that meets the requirements of this Appendix.

1.2 RNP 1 may only be used for PBN by an aircraft that has GNSS as the primary navigation sensor.

1.3 RNP 1 may be used by an aircraft which meets the aircraft eligibility requirements for an RNP APCH or RNP AR navigation authorisation.

1.4 RNP 1 may be used by an aircraft if the operator has been issued with, or is deemed to hold, an RNP 1 navigation authorisation under Civil Aviation Order 20.91 as in force immediately before the commencement of this Order.

1.5 An aircraft to which clause 3.3 applies may be considered eligible for RNP 1 operations subject to conditions that CASA considers necessary in the interests of safety.

1.6 The applicable operational requirements of this Appendix must be complied with by an aircraft using RNP 1.

1.7 It is a condition of the issue of a navigation authorisation that where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be, by a person holding a relevant authorisation, if required.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

2 Application — documents

If the aircraft does not comply with subclauses 1.1 and 1.2 or subclause 1.3 or 1.4 of this Appendix, approval of the aircraft for RNP 1 operations is required. In that case, an operator must be able to supply to CASA at its request:

(a) aircraft airworthiness documents which satisfy CASA that the aircraft is equipped for RNP 1 operations, for example, the AFM, the AFMS or OEM service letters; and

(b) a detailed description of relevant aircraft equipment for RNP 1 operations, including a configuration list of the components and equipment; and

(c) a detailed description of the operating procedures to be used for RNP 1 operations (including flight planning and flight procedures) supported by relevant copies of, or extracts from, the following:

(i) the checklists;

(ii) the contingency procedures;

(iii) the QRH; and

(d) copies of the sections of the MEL applicable to RNP 1 operations; and

(e) a detailed description of the maintenance program used to ensure the continuing airworthiness of the aircraft for RNP 1 operations; and

(f) a detailed description of the method used to ensure the validity and continuing integrity of the airborne navigation database; and

(g) if requested in writing by CASA — a copy of any relevant document referred to in any of the documents mentioned in paragraphs (a) to (f).

3 Aircraft eligibility

3.1 An aircraft is eligible for RNP 1 operations if the requirements of either subclause 3.2 or 3.3 of this Appendix are satisfied.

3.2 The aircraft's AFM, an AFMS or an OEM service letter states that the aircraft navigation system is approved for RNP 1 operations.

Note For subclause 3.2, an AFM or AFMS may state that the aircraft is approved for GPS RNAV TERMINAL operations.

3.3 An aircraft is eligible for RNP 1 operations if the operator has demonstrated to CASA that the aircraft meets the requirements of ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual,* Volume II, Part C, Chapter 3, *Implementing RNP 1*.

4 RNP 1 system performance

4.1 To meet the requirements of clause 3 of this Appendix, the system must meet the performance, monitoring and alerting requirements for RNP 1 operations as stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual,* Volume II, Part C, Chapter 3, *Implementing RNP 1*.

4.2 Positioning data from non-GNSS navigation sensors may be integrated with GNSS data if:

(a) the non-GNSS data does not cause position errors exceeding the TSE budget; or

(b) if paragraph (a) does not apply — there is a means to deselect the non-GNSS inputs.

5 RNP 1 system functionality

5.1 To meet the requirements of clause 3 of this Appendix, the system must as a minimum meet the standards of functionality stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual,* Volume II, Part C, Chapter 3, *Implementing RNP 1*.

5.2 Baro-VNAV authorised in accordance with Appendix 8 may be used in conjunction with [RNP 1 under] this Appendix.

5.3 Radius to Fix Path Terminators (***RF Legs***) authorised in accordance with Appendix 10 of this order may be used in conjunction with this Appendix.

5.4 If RF Legs are authorised for use in conjunction with this Appendix, the aircraft must be equipped with a map display that depicts the computed aircraft flight path.

6 Operating standards – flight planning – general

6.1 Before an RNP 1 operation commences, consideration must be given to matters that may affect the safety of the operation, including the following:

(a) whether the aircraft and the flight crew have relevant authorisations for RNP 1;

(b) whether the aircraft can be operated in accordance with the RNP 1 requirements for:

(i) the planned route, including the route to any alternate aerodromes; and

(ii) minimum equipment requirements for the flight;

(c) whether the navigation database is current and appropriate for the region of operation and includes the navaids and waypoints required for the route;

(d) whether operating restrictions, including time limits, apply to the operation.

6.2 If the aircraft's essential RNP 1 equipment is functioning properly, the PBN capability of the aircraft must be indicated in the flight plan.

7 Operating standards – flight procedures – general

7.1 An RNP 1 operation must comply with the instructions and procedures of the OEM in relation to the performance requirements of RNP 1.

7.2 At system initialisation, the following must occur:

(a) confirmation that the navigation database is current;

(b) verification of proper entry of the ATC-assigned route immediately after initial clearance from ATC to conduct the relevant RNAV route;

(c) action to ensure the waypoints sequence, depicted by the navigation system, matches the route depicted on the appropriate charts and the assigned route.

7.3 The following steps must occur:

(a) selection of an RNP 1 SID or STAR by route name from the on-board navigation database;

(b) confirmation that the selected route conforms to the charted route or the route as modified through the insertion or deletion of specific waypoints in response to ATC clearances.

7.4 The following must not occur:

(a) creation of new waypoints by manual entry; or

(b) making manual entry of latitude, longitude or rho/theta values; or

(c) changing an RNAV SID or STAR database waypoint type from a fly-by to a flyover or vice versa.

7.5 The following checks and cross-checks must be made:

(a) a cross-check of the flight plan by comparing charts or other applicable resources with the navigation system flight plan and the aircraft map display (if applicable);

(b) if required, confirm the exclusion of specific navaids.

Note Small differences between charted navigation information and displayed navigation data may be noted. Differences of 3 degrees or less due to the equipment manufacturer's application of magnetic variation or leg track averaging are operationally acceptable.

7.6 For RNP 1 routes, a lateral deviation indicator, flight director or autopilot in LNAV mode must be used.

Note Examples of a lateral deviation indicator include CDI and HSI.

7.7 Where a lateral deviation indicator is used, scaling must be selected suitable for the navigation accuracy associated with the route or procedure, for example, full scale deflection ±1 NM.

7.8 Route centrelines must be maintained as close as practicable, as depicted by lateral deviation indicators or flight guidance, unless authorised to deviate by ATC or under emergency conditions. Navigation System Error + Flight

Technical Error (lateral deviation) must not exceed the specified navigation accuracy.

7.9 Brief deviations from the standard mentioned in subclause 7.8 of this Appendix are acceptable during and immediately after turns, but only to the minimal extent that accurate cross-track information may not be provided during the turn.

Note Flight crew procedures and training should emphasise observance of turn anticipation commands and management of rate of turn.

7.10 If ATC issues a heading assignment taking the aircraft off a route, the navigation system flight plan may only be modified when:

(a) ATC clearance is received to rejoin the route; or

(b) ATC confirms a new clearance.

8 Operating standards – flight procedures – RNAV SID requirements

8.1 Before an eligible aircraft takes-off, the following RNAV SID requirements must be verified:

(a) that the aircraft's RNP system is available, is operating correctly and the correct aerodrome and runway data is loaded;

(b) that the correct runway and departure procedure (including any applicable en route transition) is entered in the navigation system flight plan and properly depicted;

8.2 The operator must ensure that each member of the flight crew is aware of the functional limitations of relevant RNP systems and the correct application of manual tracking procedures for path following.

8.3 RNAV guidance must be selected and available to provide flight guidance for lateral RNAV at no later than 153 m (or 500 ft) above the aerodrome field elevation.

Note The altitude at which RNAV guidance begins on a given route may be higher, for example, "climb to 304 m (or 1 000 ft), then direct to X….".

8.4 For an RNP 1 operation, an authorised method must be used to achieve an appropriate level of performance for RNP 1, for example, lateral deviation indicator, navigation map display, flight director or autopilot.

8.5 The GNSS signal must be acquired before the take-off roll commences.

8.6 For aircraft using (E)TSO-C129a equipment, the departure aerodrome must be loaded into the flight plan in order to achieve the appropriate navigation system monitoring and sensitivity.

8.7 For aircraft using (E)TSO-C146a equipment, if the departure begins at a runway waypoint, then the departure aerodrome does not need to be in the flight plan to obtain appropriate monitoring and sensitivity.

9 Operating standards – flight procedures – RNAV STAR requirements

9.1 The following must be checked and confirmed for RNAV STAR:

(a) that the aircraft navigation system is operating correctly;

(b) that the correct arrival procedure and runway (including any applicable transition) are entered in the system and properly depicted.

9.2 The operator must ensure that updating will exclude a particular navaid, if so required by a route.

9.3 A route is not to be used if doubt exists as to its validity in the navigation database.

9.4 If the operator's contingency procedures require reversion to a conventional arrival route, provision for that arrival route must be made before commencement of the RNAV STAR.

9.5 Route modifications in the terminal area may take the form of radar headings or "direct to" clearances and may require the insertion of tactical waypoints from the navigation database. However, no member of the flight crew may make a manual entry or modification of the loaded route using temporary waypoints or fixes not contained in the database.

10 Contingency procedures for performance failure

ATC must be notified immediately if the system performance ceases to meet RNP 1 requirements during an RNP 1 operation in controlled airspace.

Appendix 5 – Requirements for use of RNP 0.3

1 RNP 0.3 navigation authorisation for I.F.R. flights

1.1 The RNP 0.3 navigation specification was developed specifically for helicopter operations in metropolitan areas and for offshore support, including Point-in-Space (PINS) arrival and departure operations. This navigation specification addresses en route, terminal and approach operations using RNP 0.3 for all phases of flight. Fixed-wing aircraft that operate at speeds similar to helicopters are eligible for an RNP 0.3 navigation authorisation provided they meet all the requirements specified in this Appendix.

1.2 RNP 0.3 may only be used for PBN by an aircraft if the operator has an RNP 0.3 navigation authorisation in writing from CASA.

1.3 An operator may fly on a route, or in airspace designated as RNP 0.3, only if the operator holds an RNP 0.3 navigation authorisation.

1.4 RNP 0.3 requires GNSS approved to (E)TSO-C145, (E)TSO-C146 or (E)TSO-C196 as the primary navigation sensor.

1.5 An RNP 0.3 navigation authorisation may only be issued to an operator who:

(a) applies in writing to CASA for it; and

(b) supplies the documents mentioned in clause 2 of this Appendix; and

(c) satisfies CASA that RNP 0.3 operations can, and are likely to continue to, meet the requirements of this Appendix, including in relation to:

(i) aircraft eligibility; and

(ii) RNP 0.3 equipment, system performance and system functionality; and

(iii) operating standards, including flight planning and flight procedures; and

(iv) approved flight crew training referred to in clause 11; and

(v) MEL procedures; and

(vi) aircraft and RNP system maintenance; and

(vii) validity and continuing integrity of the airborne navigation database (if carried); and

(viii) navigation error reporting procedures.

1.6 An RNP 0.3 navigation authorisation may not be issued unless the aircraft meets the requirements of this Appendix.

1.7 An RNP 0.3 navigation authorisation may be issued subject to conditions if CASA considers this is necessary in the interests of safety.

1.8 It is a condition of the issue of a navigation authorisation that the applicable operational requirements of this Appendix are complied with after the issue of the authorisation.

1.9 It is a condition of the issue of a navigation authorisation that where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

2 Application — documents

The application must be made on the approved form and be accompanied by the following documents:

(a) aircraft airworthiness documents which satisfy CASA that the aircraft is equipped for RNP 0.3 operations, for example, the AFM, the AFMS or OEM service letters;

(b) a detailed description of relevant aircraft equipment for RNP 0.3 operations, including a configuration list of the components and equipment;

(c) a detailed description of the proposed flight crew training for RNP 0.3 operations, including a copy of the training syllabus for approval by CASA;

(d) a detailed description of the operating procedures to be used for RNP 0.3 operations (including flight planning and flight procedures) supported by relevant copies of, or extracts from, the following:

(i) the operations manual;

(ii) the checklists;

(iii) the contingency procedures;

(iv) the QRH;

(e) copies of the sections of the MEL applicable to RNP 0.3 operations;

(f) a detailed description of the maintenance program used to ensure the continuing airworthiness of the aircraft for RNP 0.3 operations;

(g) a detailed description of the method used to ensure the validity and continuing integrity of the airborne navigation database;

(h) if requested in writing by CASA — a copy of any relevant document referred to in any of the documents mentioned in paragraphs (a) to (g).

3 Aircraft eligibility

3.1 The aircraft is eligible for RNP 0.3 operations if the aircraft meets the requirements of subclause 3.2 or 3.3 of this Appendix.

3.2 An aircraft is eligible for RNP 0.3 operations if the operator has demonstrated to CASA that the aircraft meets the requirements of ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual,* Volume II, Part C, Chapter 7, *Implementing RNP 0.3*.

Note The system performance and functional requirements for RNP 0.3 operations are replicated in clauses 4 and 5 below.

3.3 An aircraft is eligible for RNP 0.3 operations if the aircraft's AFM, an AFMS or an OEM service letter states that the aircraft navigation system is approved for RNP 0.3 operations.

4 RNP 0.3 system performance

4.1 To meet the requirements of clause 3 of this Appendix, the system must meet the performance, monitoring and alerting requirements for RNP 0.3 operations as stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 7, *Implementing RNP 0.3*.

4.2 Positioning data from non-GNSS navigation sensors may be integrated with GNSS data if:

(a) the non-GNSS data does not cause position errors exceeding the TSE budget; or

(b) if paragraph (a) does not apply — there is a means to deselect the non-GNSS inputs.

5 RNP 0.3 system functionality

5.1 To meet the requirements of clause 3 of this Appendix, the system must as a minimum meet the standards of functionality stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual,* Volume II, Part C, Chapter 7, *Implementing RNP 0.3*.

5.2 Baro-VNAV authorised in accordance with Appendix 8 may be used in conjunction with RNP 0.3 under this Appendix provided that the GNSS is:

(a) (E)TSO-C145 ( ) and authorised for Class Beta and operational Class 2 or 3; or

(b) (E)TSO-C146 ( ) and authorised for Class Gamma and operational Class 2 or 3; or

(c) (E)TSO-C196 ( ).

5.3 Radius to Fix Path Terminators (***RF Legs***) authorised in accordance with Appendix 10 may be used in conjunction with RNP 0.3 under this Appendix.

5.4 If RF Legs are authorised for use in conjunction with RNP 0.3 under this Appendix, the aircraft must be equipped with a map display that depicts the computed aircraft flight path.

6 Operating standards – flight planning – general

6.1 Before an RNP 0.3 operation commences, consideration must be given to matters that may affect the safety of the operation, including the following:

(a) whether the aircraft and the flight crew have relevant authorisations for RNP 0.3;

(b) whether the aircraft can be operated in accordance with the RNP 0.3 requirements for:

(i) the planned route, including the route to any alternate aerodromes; and

(ii) minimum equipment requirements for the flight;

(c) whether the navaids required for the planned route are available and adequate for the period of the operation, including any non-RNAV contingencies;

(d) whether the navigation database is current and appropriate for the region of operation and includes the navaids and waypoints required for the route;

(e) whether operating restrictions, including time limits, apply to the operation.

6.2 If the aircraft's essential RNP 0.3 equipment is functioning properly, the PBN capability of the aircraft must be indicated in the flight plan.

7 Operating standards – flight procedures – general

7.1 An RNP 0.3 operation must comply with the instructions and procedures of the OEM in relation to the performance requirements of RNP 0.3.

7.2 At system initialisation, the following must occur:

(a) confirmation that the navigation database is current;

(b) verification of proper entry of the ATC-assigned route immediately after initial clearance from ATC to conduct the relevant RNP route;

(c) action to ensure the waypoints sequence, depicted by the navigation system, matches the route depicted on the appropriate charts and the assigned route.

7.3 The following steps must occur:

(a) selection of an RNP 0.3 SID or STAR by route name from the on-board navigation database;

(b) confirmation that the selected route conforms to the charted route, or the route as modified through the insertion or deletion of specific waypoints in response to ATC clearances.

7.4 Except in response to ATC clearances, the following must not occur:

(a) creation of new waypoints by manual entry; or

(b) making manual entry of latitude, longitude or rho/theta values; or

(c) changing an RNAV SID or STAR database waypoint type from a fly-by to a flyover or vice versa.

7.5 The following checks and cross-checks must be made:

(a) a cross-check of the flight plan by comparing charts or other applicable resources with the navigation system flight plan and the aircraft map display (if applicable);

(b) if required, confirm the exclusion of specific navaids.

Note Small differences between charted navigation information and displayed navigation data may be noted. Differences of 3 degrees or less due to the equipment manufacturer's application of magnetic variation or leg track averaging are operationally acceptable.

7.6 For RNP 0.3 routes, a lateral deviation indicator, flight director or autopilot in LNAV mode must be used. If the aircraft is approved for RF Legs, the map display under subclause 5.4 must be in accordance with Appendix 10.

Note Examples of a lateral deviation indicator include CDI and HSI.

7.7 Where a lateral deviation indicator is used, scaling must be selected suitable for the navigation accuracy associated with the route or procedure, but not greater than a full scale deflection ±0.3 NM.

7.8 Route centrelines must be maintained as close as practicable, as depicted by lateral deviation indicators or flight guidance, unless authorised to deviate by ATC or under emergency conditions NSE + FTE (lateral deviation) must not exceed the specified navigation accuracy.

7.9 Brief deviations from the standard mentioned in subclause 7.8 of this Appendix are acceptable during and immediately after turns, but only to the minimal extent that accurate cross-track information may not be provided during the turn.

Note Flight crew procedures and training must emphasise observance of turn anticipation commands and management of rate of turn.

7.10 If ATC issues a heading assignment taking the aircraft off a route, the navigation system flight plan may only be modified when:

(a) ATC clearance is received to rejoin the route; or

(b) ATC confirms a new clearance.

7.11 Manually selecting aircraft bank limiting functions may reduce the aircraft's ability to maintain its desired track and is not recommended. The pilot should recognise manually selectable aircraft bank-limiting functions might reduce ability to satisfy path requirements of the procedure, especially when executing large angle turns. This should not be construed as a requirement to deviate from FM procedures; rather, pilots should be encouraged to avoid the selection of such functions except where needed for flight safety reasons.

7.12 If the navigation system does not automatically retrieve and set the navigation accuracy from the on-board navigation database for each leg segment of a route

or procedure, the flight crew's operating procedures must ensure the RNP 0.3 navigation accuracy for the route or procedure is manually entered into the RNP system.

8 Operating standards – flight procedures – RNP SID requirements

8.1 Before an eligible aircraft takes-off, the following RNP SID requirements must be verified:

(a) that the aircraft's RNP system is available, is operating correctly and the correct aerodrome and runway data is loaded;

(b) that the aircraft navigation system is operating correctly;

(c) that the correct aerodrome/heliport and departure procedure (including any applicable en route transition) is entered in the navigation system flight plan and properly depicted;

(d) that, if an RNP departure procedure is assigned and the runway, procedure or transition is subsequently changed, the appropriate changes are entered in the navigation system flight plan, properly depicted and available for navigation.

Note It is recommended that, within the constraints of normal operations, there be a final check of proper runway entry and correct route depiction, shortly before take-off.

8.2 The operator must ensure that each member of the flight crew is aware of the functional limitations of relevant RNP systems and the correct application of manual tracking procedures.

8.3 The flight guidance system must be selected and available to provide flight guidance for lateral navigation no later than the first waypoint defining a procedure requiring RNP 0.3 in accordance with this Appendix.

8.4 For an RNP 0.3 operation, an authorised method must be used to achieve an appropriate level of performance for RNP 0.3, for example, lateral deviation indicator, navigation map display, flight director or autopilot.

8.5 The GNSS signal must be acquired before take-off.

9 Operating standards – flight procedures – RNP STAR requirements

9.1 The following must be checked and confirmed for RNP STAR:

(a) that the aircraft navigation system is operating correctly;

(b) that the correct arrival procedure and aerodrome/heliport (including any applicable transition) are entered in the system and properly depicted.

9.2 The following must be checked and confirmed:

(a) the active navigation system flight plan, by comparing the charts with the navigation displays;

(b) the sequence of waypoints;

(c) the reasonableness of track angles;

(d) distances, altitude or speed constraints;

(e) as far as practicable, which waypoints are fly-by and which are flyover;

(f) which waypoints represent the beginning or end of a radius-to-fix leg segment.

9.3 The operator must ensure that updating will exclude a particular navaid, if so required by a route.

9.4 A route is not to be used if doubt exists as to its validity in the navigation database.

9.5 No member of the flight crew may create a new waypoint by manual entry into the RNP system.

9.6 If the operator's contingency procedures require reversion to a conventional arrival route, provision for that arrival route must be made before commencement of the RNP STAR.

9.7 Route modifications in the terminal area may take the form of radar headings or "direct to" clearances and may require the insertion of tactical waypoints from the navigation database. However, no member of the flight crew may make a manual entry or modification of the loaded route using temporary waypoints or fixes not contained in the database.

9.8 All relevant published altitude and speed constraints must be observed.

10 Contingency procedures for performance failure

ATC must be notified immediately if the system performance ceases to meet RNP 0.3 requirements during an RNP 0.3 operation in controlled airspace.

11 Flight crew knowledge and training

11.1 An RNP 0.3 operation may only be commenced if each member of the flight crew has sufficient knowledge of the following subjects:

(a) the meaning and proper use of aircraft/helicopter equipment and navigation suffixes;

(b) the capabilities and limitations of the RNP system installed in the aircraft;

(c) the operations and airspace for which the RNP 0.3 system is approved;

(d) the limitations of the navaids to be used for the RNP 0.3 operation;

(e) the required navigation equipment for operation on RNAV routes with SIDs or STARs;

(f) depiction of waypoint types (flyover and fly-by), ARINC 424 Path Terminators, and associated aircraft flight paths;

(g) contingency procedures for RNP 0.3 failures;

(h) the radio telephony phraseology for the relevant airspace in accordance with the AIP for the State in which the aircraft is operating;

(i) the flight planning requirements for RNP 0.3 operation;

(j) RNP 0.3 procedure requirements as determined from chart depiction and textual description;

(k) RNP 0.3 system-specific information, including:

(i) levels of automation, mode annunciations, changes, alerts, interactions, reversions and degradation; and

(ii) functional integration with other aircraft systems; and

(iii) monitoring procedures for each phase of the flight; and

(iv) types of navigation sensors, for example, DME, IRU, GNSS, utilised by the RNP 0.3 system, and associated system prioritisation, weighting and logic; and

(v) aircraft configuration and operational conditions required to support RNP operations, including appropriate selection of CDI scaling (lateral deviation display scaling); and

(vi) pilot procedures consistent with the operation; and

(vii) the meaning and appropriateness of route discontinuities and related flight crew procedures; and

(viii) turn anticipation with consideration of speed and altitude effects; and

(ix) interpretation of electronic displays and symbols;

(x) impact of pilot selectable bank limitations on aircraft/rotorcraft ability to achieve the required accuracy on the planned route.

11.2 An RNP 0.3 operation may only be conducted if each member of the flight crew has received training in, or has equivalent experience of, RNP 0.3 equipment and operating procedures, including training or experience in how to do the following, and is considered competent to use that equipment and those procedures:

(a) verify that the aircraft navigation data is current;

(b) verify the successful completion of RNP 0.3 system self-tests;

(c) initialise RNP 0.3 system position;

(d) perform a manual or automatic update (with take-off point shift, if applicable);

(e) retrieve and fly a SID and STAR with appropriate transition;

(f) verify waypoints and navigation system flight plan programming;

(g) resolve route discontinuities;

(h) adhere to speed and altitude constraints associated with a SID or STAR;

(i) fly direct to waypoint;

(j) fly a course or track to waypoint;

(k) intercept a course or track;

(l) vector off and rejoin a procedure;

(m) fly radar vectors and rejoin an RNAV route from a heading mode;

(n) determine cross-track error/deviation;

(o) determine allowable deviation limits and maintain flight within those limits;

(p) remove and reselect navigation sensor input;

(q) confirm exclusion of a specific navaid or navaid type;

(r) perform gross navigation error checks using conventional aids;

(s) change arrival aerodrome and alternate aerodrome;

(t) perform parallel offset function if capability exists, and advise ATC if this functionality is not available;

(u) perform conventional holding;

(v) carry out contingency procedures for RNAV failures.

Appendix 6 — Requirements for use of RNP APCH

1 Eligibility for RNP APCH navigation for I.F.R. flights

1.1 RNP APCH may only be used for PBN by an aircraft that meets the requirements of this Appendix.

1.2 RNP APCH may only be used for PBN by an aircraft if the aircraft is equipped with:

(a) a stand-alone GNSS system approved for RNP APCH operations; or

(b) an FMS with GNSS input system approved for RNP APCH operations.

1.3 RNP APCH means 1 of the following:

(a) the NPA known as RNP APCH-LNAV:

(i) where lateral and longitudinal guidance is provided by GNSS SIS; and

(ii) which is flown to an MDA charted as LNAV minima on the approach plate;

Note RNP APCH-LNAV was formerly known as RNAV (GNSS).

(b) the APV known as RNP APCH-LNAV/VNAV, where:

(i) lateral and longitudinal guidance is provided by GNSS SIS; and

(ii) vertical guidance is provided by Baro-VNAV; and

Note There is, therefore, some overlap of scope and meaning between RNP APCH-LNAV/VNAV on the one hand, and Baro-VNAV on the other. See Appendix 8 for Baro-VNAV.

(iii) the approach is flown to a DA charted as LNAV/VNAV minima on the approach plate;

(c) the NPA known as RNP APCH-LP:

(i) where lateral guidance equivalent to a localiser approach is provided by SBAS augmented GNSS SIS; and

(ii) which is flown to an MDA charted as LP minima on the approach plate;

Note The NPA known as RNP APCH-LP has not yet been deployed in Australia.

(d) the APV known as RNP APCH-LPV, where:

(i) lateral, longitudinal and vertical guidance is provided by SBAS augmented GNSS SIS; and

(ii) the approach is flown to a DA charted as LPV minima on the approach plate.

Note The APV known as RNP APCH-LPV has not yet been deployed in Australia at the commencement of this Order.

1.4 RNP APCH may be used by an aircraft if the operator has been issued with, or is deemed to hold, an RNP APCH navigation authorisation under Civil Aviation Order 20.91 as in force immediately before the commencement of this Order.

1.5 An aircraft is eligible for RNP APCH-LNAV/VNAV if it meets the aircraft eligibility requirements for both of the following:

(a) Baro-VNAV;

(b) RNP APCH-LNAV.

1.6 An aircraft is eligible for RNP APCH-LNAV and RNP APCH – LNAV/VNAV if it meets the aircraft eligibility requirements for RNP AR APCH.

1.7 An aircraft referred to in subclause 1.1, 1.4, 1.5 or 1.6 of this Appendix may be subject to conditions that CASA considers necessary in the interests of safety.

1.8 It is a condition of the eligibility of an aircraft to engage in PBN under this Appendix that the applicable operational requirements of this Appendix are complied with.

1.9 Where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be, by a flight crew member holding a relevant authorisation to do so, if required.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

1.10 An aircraft that is approved for RNP APCH – LPV, when operating within an SBAS service volume, may utilise SBAS derived vertical guidance to carry out an RNP APCH – LNAV/VNAV procedure.

2 Application — documents

If the aircraft does not comply with subclause 1.4, 1.5 or 1.6 of this Appendix, approval of the aircraft for RNP APCH operations is required. In that case, an operator must be able to supply to CASA at its request:

(a) aircraft airworthiness documents which satisfy CASA that the aircraft is equipped for RNP APCH operations, for example, the AFM, the AFMS or OEM service letters; and

(b) a detailed description of relevant aircraft equipment for RNP APCH operations, including a configuration list of the components and equipment; and

(c) a detailed description of the operating procedures to be used for RNP APCH operations (including flight planning and flight procedures) supported by relevant copies of, or extracts from, the following:

(i) the checklists;

(ii) the contingency procedures;

(iii) the QRH; and

(d) copies of the sections of the MEL applicable to RNP APCH operations; and

(e) a detailed description of the maintenance program used to ensure the continuing airworthiness of the aircraft for RNP APCH operations; and

(f) a detailed description of the method used to ensure the validity and continuing integrity of the airborne navigation database; and

(g) if requested in writing by CASA — a copy of any relevant document referred to in any of the documents mentioned in paragraphs (a) to (f).

3 Aircraft eligibility

3.1 An aircraft is eligible for RNP APCH operations if:

(a) the AFM, an AFMS or OEM service letter states that the aircraft navigation system is approved for RNP 0.3 approach operations with GNSS updating; or

(b) the aircraft is equipped with a navigation system which meets the requirements for RNP AR navigation authorisation; or

(c) the aircraft is equipped with a GNSS stand-alone system approved for NPA operations in accordance with AC 21-36 ( ) ((E)(TSO-C129a Class A1 or (E)TSO-C146 Class Gamma and operational Class 1, 2 or 3); or

(d) the aircraft is equipped with a multi-sensor system (for example, FMS) with GNSS equipment that is:

(i) in accordance with (E)TSO-C129a Class B1, C1, B3 or C3 or (E)TSO-C145 ( ) Class 1, 2 or 3 or (E)TSO-C196 ( ); and

(ii) installation is in accordance with AC 21-36 and AC 21- 37.

3.2 An aircraft is eligible for RNP APCH – LNAV/VNAV operations if:

(a) the AFM, an AFMS or OEM service letter states that the aircraft navigation system is approved for RNP 0.3 approach operations with GNSS updating; or

(b) the aircraft is equipped with a navigation system which meets the requirements for PBN type RNP AR navigation authorisation; or

(c) the aircraft is equipped with a GNSS stand-alone system approved for NPA operations in accordance with AC 21-36 ( ) ((E)TSO-C129a Class A1 or (E)TSO-C146 Class Gamma and operational Class 2 or 3) and is approved for Baro-VNAV operations under Appendix 8; or

(d) the aircraft is equipped with a multi-sensor system (for example, FMS) with GNSS equipment that is:

(i) in accordance with (E)TSO-C129a Class B1, C1, B3, C3 or (E)TSO-C145 Class Beta and operational Class 2 or 3 or (E)TSO-C196; and

(ii) installed in accordance with AC 21-36 and AC 21-37; and

(iii) the aircraft is authorised for Baro-VNAV operations in accordance with Appendix 8.

3.3 An aircraft is eligible for RNP APCH – LP operations if:

(a) the AFM, an AFMS, or OEM service letter states that the aircraft navigation system is approved for RNP APCH – LP approach operations; or

(b) the aircraft is equipped with a GNSS stand-alone system approved for LP operations that is:

(i) in accordance with (E)TSO-C146 ( ) Class Gamma and operational Class 3; and

(ii) installed in accordance with AC 21-36; or

(c) the aircraft is equipped with a multi-sensor system (for example, FMS) with GNSS equipment that is:

(i) in accordance with (E)TSO-C145 Class Beta and operational Class 3; and

(ii) installed in accordance with AC 21-36 and AC 21-37.

3.4 An aircraft is eligible for RNP APCH – LP and RNP APCH – LPV operations if:

(a) the AFM, an AFMS or OEM service letter states that the aircraft navigation system is approved for RNP APCH – LPV approach operations; or

(b) the aircraft is equipped with a GNSS stand-alone system approved for LP and LPV operations that is:

(i) in accordance with (E)TSO-C146 Class Gamma and operational Class 3; and

(ii) installed in accordance with AC 21-36; or

(c) the aircraft is equipped with a multi-sensor system (for example, FMS) with GNSS equipment that is:

(i) in accordance with (E)TSO-C145 ( ) Class Beta and operational Class 3; and

(ii) installed in accordance with AC 21-36 and AC 21-37.

4 RNP APCH system performance

4.1 The navigation system must meet the performance, monitoring and alerting requirements for RNP APCH operations as stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 5, *Implementing RNP APCH*. Part A for RNP APCH – LNAV and/or RNP APCH – LNAV/VNAV operations and Part B for RNP APCH – LP and/or RNP APCH – LPV operations.

4.2 Positioning data from non-GNSS navigation sensors may be integrated with GNSS data if:

(a) the non-GNSS data does not cause position errors exceeding the TSE budget; or

(b) if paragraph (a) does not apply — there is a means to deselect the non-GNSS inputs.

5 RNP APCH system functionality

5.1 Subject to subclause 5.2 of this Appendix, the system must, as a minimum, meet the standards of functionality stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 5, *Implementing RNP APCH*. Part A for RNP APCH – LNAV and/or RNP APCH – LNAV/VNAV operations and Part B for RNP APCH – LP and/or RNP APCH – LPV operations.

Note Guidance provided in AC 21-36, Global Navigation Satellite System (GNSS) Equipment: Airworthiness Guidelines, is also relevant.

5.2 The requirement for the display of lateral position relative to the desired path is:

(a) a digital indication in $1/10^{th}$ NM or less; or

(b) a relative indication which allows the pilot to determine deviation in proportion to a known indicator scale.

5.3 Where the minimum flight crew is 2 pilots, there must be a means for the pilot not flying to accurately verify the desired path and the aircraft position relative to that path.

Note To meet the intent of this requirement, in aircraft equipped with a single navigation system, both pilots must be able to access the system controls and view the system display(s) in accordance with the requirements of the applicable airworthiness standards.

5.4 Baro-VNAV authorised in accordance with Appendix 8 may be used in conjunction with RNP 0.3 under this Appendix.

5.5 Radius to Fix Path Terminators (***RF Legs***) authorised in accordance with Appendix 10 may be used in conjunction with RNP 0.3 under this Appendix.

5.6 If RF Legs are authorised for use in conjunction with RNP 0.3 under this Appendix, the aircraft must be equipped with a map display that depicts the computed aircraft flight path.

6 Operational standards – flight planning – general

6.1 Before an RNP APCH operation commences, consideration must be given to matters that may affect the safety of the operation, including the following:

(a) whether the aircraft, and each member of the flight crew, has relevant authorisations for RNP APCH;

(b) whether the navigation database is current and appropriate for the region of operation and includes the navaids and waypoints required for the route;

6.2 If the aircraft's essential RNP APCH equipment is functioning properly, the PBN capability of the aircraft must be indicated in the flight plan.

7 Operating standards – flight procedures – general

7.1 An operator must ensure that flight procedures described in this clause are complied with.

7.2 The following must be checked and confirmed:

(a) the waypoint sequence;

(b) the reasonableness of the tracks and distances;

(c) the VPA if using RNP APCH-LNAV/VNAV;

(d) that the GNSS sensor is used for position computation;

(e) if barometric aiding is used — that the current aerodrome barometric altimeter setting is entered.

7.3 The operator must ensure that the appropriate displays are selected to permit monitoring of the aircraft's:

(a) approach path; and

(b) position relative to the approach path (cross-track and, where applicable, vertical deviation).

7.4 The aircraft is to be established on the final approach course no later than the FAF.

7.5 Descent in the final segment is not to be commenced unless:

(a) the appropriate approach mode is annunciated, namely, LNAV, LNAV/VNAV, LP or LPV; and

(b) RNP 0.3 is selected and available.

7.6 A missed approach procedure must be conducted if:

(a) the navigation system display is flagged invalid; or

(b) there is a loss of integrity alert; or

(c) the integrity alerting function is not available before passing the FAF; or

(d) during a segment of a procedure, Cross-track Error/Deviation equals or is reasonably likely to equal the RNP for the segment of the procedure; or

(e) where NSE is available during a segment of a procedure, including NSE measured as Estimate of Position Uncertainty, NSE + FTE during the segment equals or exceeds the RNP specified for the segment; or

(f) if the aircraft is equipped with serviceable automated cross-track error alerting — when a Cross-Track Error/Deviation alert is received.

Note 1 NSE and FTE are the largest tracking errors for RNP APCH. ICAO Doc 9613, *Performance-based Navigation (PBN) Manual*, notes "cross-track error/deviation" as a component of FTE.

Note 2 ICAO Doc 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 5 – Section A, provides guidance on the use of RNP APCH procedures. Pilots are

advised to track along procedure centre lines unless authorised to deviate by ATC or under emergency conditions. So far as practicable, the cross-track error/deviation for normal operations should be limited to 0.5 NM (½ x RNP) for the initial segment, the intermediate segment and a missed approach, and to 0.15 NM (½ x RNP) for the final approach segment. Brief deviations are acceptable during and immediately after turns where accurate cross-track information is not provided during the turn. The use of a flight director or autopilot is recommended. Flight crew procedures and training should emphasise observance of turn anticipation commands and management of rate of turn.

7.7 In subclause 7.6, ***Estimate of Position Uncertainty***, or ***EPU***, means a measure of NSE provided by the navigation system of an aircraft based on a defined scale in NM that displays the current performance of the navigation system in accurately estimating the aircraft position.

Note Different system manufacturers assign specific names for EPU, including "Horizontal Protection Limit" or "HPL", "Actual Navigation Performance" or "ANP" and "Estimate of Position Error" or "EPE".

7.11 Transient deviations greater than 75 ft above the flight path are acceptable during aircraft configuration changes. Deviations greater than 75 ft below the flight path are not acceptable during aircraft configuration changes.

8 Contingency procedures for performance failure

The operator must ensure that the flight crew have and implement contingency procedures for a loss of RNP APCH capability during the approach.

Appendix 7 — Requirements for use of RNP AR

1 RNP AR navigation authorisation for I.F.R. flights

1.1 RNP AR procedures may only be used for PBN by an aircraft if the operator has an RNP AR navigation authorisation in writing from CASA.

1.2 RNP AR procedures may only be used for PBN by an aircraft for instrument approach and departure procedures that are supported by:

(a) a GNSS LNAV system; and

(b) an FMS supported by suitable flight control, cockpit control and display systems; and

(c) a Baro-VNAV system.

Note An aircraft equipped with an SBAS augmented GNSS system and operating within an SBAS service volume may use GNSS derived vertical guidance in lieu of Baro-VNAV.

1.3 An RNP AR navigation authorisation may only be issued to an operator who:

(a) applies in writing to CASA; and

(b) supplies the documents mentioned in clause 3 of this Appendix; and

(c) satisfies CASA that RNP AR operations for the navigation authorisation sought can, and are likely to continue to, meet the requirements of this Appendix, including in relation to the following:

(i) aircraft eligibility;

(ii) RNP AR equipment, system performance and system functionality;

(iii) operating standards, including flight planning and flight procedures;

(iv) approved flight crew training and recency;

(v) MEL procedures;

(vi) aircraft and RNP system maintenance;

(vii) continued integrity of the airborne navigation database;

(viii) navigation error reporting procedures;

(ix) FOSA.

1.4 An RNP AR navigation authorisation may not be issued unless the aircraft meets the requirements of this Appendix.

1.5 RNP AR procedures may be designed to either ICAO Doc. 9905 criteria or to proprietary standards. Proprietary RNP AR designs use different terminology for some points in the procedure compared to the Doc. 9905 designs; the paragraphs below explain the terms used.

(a) Final Approach Point (***FAP***) is the point in the procedure from which the vertical path is coded into the procedure. This point must be a named waypoint and is often coincident with the Final Approach Fix (FAF). In proprietary procedures the point equivalent to the FAP is the Vertical Intercept Point (VIP).

(b) Non-Normal Decision Point (***NNDP***) is a term used in proprietary design RNP AR approach procedures and defines the point where the flight crew must determine that the aircraft is capable of carrying out the approach in its current operative system configuration. For ICAO Doc. 9905 design procedures, the equivalent point to the NNDP is the Initial Approach Fix (***IAF***).

2 Conditions for RNP AR operations

2.1 An RNP AR navigation authorisation may be issued subject to conditions if CASA considers this is necessary in the interests of safety.

2.2 It is a condition of the issue of a navigation authorisation that the applicable operational requirements of this Appendix are complied with after the issue of the authorisation.

2.3 It is a condition of the issue of a navigation authorisation that where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

3 Application — documents

The application must be made on the approved form and be accompanied by the following documents:

(a) aircraft airworthiness documents which satisfy CASA that the aircraft is equipped for RNP AR operations, for example, the AFM, the AFMS or OEM service letters;

(b) a detailed description of relevant aircraft equipment for RNP AR operations, including a configuration list of the components and equipment;

(c) a detailed description of the proposed flight crew training for RNP AR operations, including a copy of the training syllabus, for approval by CASA;

(d) a detailed description of the operating procedures to be used for RNP AR operations (including flight planning and flight procedures) supported by relevant copies of, or extracts from, the following:

(i) the operations manual;

(ii) the checklists;

(iii) the contingency procedures;

(iv) the QRH;

(e) a FOSA as set out in clause 4 of this Appendix;

(f) copies of the sections of the MEL applicable to RNP AR operations;

(g) a detailed description of the maintenance program used to ensure the continuing airworthiness of the aircraft for RNP AR operations;

(h) a detailed description of the method used to ensure the continued integrity of the airborne navigation database;

(i) if requested in writing by CASA — a copy of any relevant document referred to in any of the documents mentioned in paragraphs (a) to (h).

4 FOSA

4.1 An operator must conduct a FOSA before applying to CASA to carry out either of the following:

(a) before conducting an RNP AR operation that requires an RNP value of less than 0.3 NM;

(b) before conducting an RNP AR operation in which the published procedure includes a procedure for one engine inoperative (***OEI***).

Note The FOSA is to be consistent with ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 6, *Implementing RNP AR APCH.* (See also the definition in paragraph 3.4 of this Order.)

4.3 The FOSA must set out details of the methods used by the operator to manage the risks associated with non-normal events arising from RNP AR operations.

4.4 The FOSA must include the mitigations implemented by the operator to reduce non-normal safety risks to the level of "As Low as Reasonably Practical (ALARP)".

Note 1 Suitable methods to mitigate non-normal safety risks include flight crew procedures (including contingency procedures), flight crew training, engineering modifications, operating limitations, and procedure design.

Note 2 Additional guidance on provision for non-normal operations is contained in FAA AC 120-29A, *Criteria for Approval of Category I and Category II, Weather Minima for Approach*.

4.5 The FOSA should set out details of the methods used by the operator to manage the risks associated with adding additional destinations where RNP AR operations will be conducted.

5 Aircraft eligibility

An aircraft is eligible for RNP AR operations only if:

(a) the OEM has documented that the aircraft is capable of RNP AR approach operations, or RNP AR departure operations or both RNP AR approach and departure operations; and

(b) the aircraft meets the requirements for RNP AR operations in accordance with ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 6, *Implementing RNP AR APCH*; and

(c) for an aircraft equipped with GNSS sensors which comply with (E)TSO-C129a, (E)TSO-C145a, (E)TSO-C146a, (E)TSO-C196a, or an equivalent standard, it carries the following minimum equipment:

(i) 2 FMS;

(ii) 2 GNSS sensors (which may be included in an MMR);

(iii) 1 IRS;

(iv) 2 flight directors;

(v) 2 flight mode annunciators;

(vi) 2 RADALTs;

(vii) duplicated primary flight and navigation displays;

(viii) duplicated alternating current power source (for which an APU may be used);

(ix) 1 autopilot channel;

(x) 1 TAWS appropriate to the class of operation; and

(d) all modifications, options or particular part numbers required by the original equipment manufacturer or the STC are installed in, or on, the aircraft or the relevant part.

6 RNP AR system performance

6.1 To meet the requirements of clause 5 of this Appendix, the system must meet the performance, monitoring and alerting requirements for RNP AR operations

as stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 6, *Implementing RNP AR APCH*.

6.2 Positioning data from non-GNSS navigation sensors may be integrated with GNSS data if:

(a) the non-GNSS data does not cause position errors exceeding the TSE budget; or

(b) if paragraph (a) does not apply — there is a means to deselect the non-GNSS inputs.

7 RNP AR system functionality

7.1 To meet the requirements of clause 5 of this Appendix, subject to this clause, an eligible aircraft's RNP AR system must, as a minimum, meet the standards of functionality stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 6, *Implementing RNP AR APCH*.

7.2 The system must be capable of executing leg transitions and maintain tracks consistent with an RF Leg.

Note ICAO Doc. 9613 includes this requirement only where approaches are designed with RF Legs. However, RNP AR procedures designed in accordance with proprietary design criteria for use by operators of Australian aircraft are dependent upon RF Leg capability.

7.3 The following requirements must be complied with for the display of cross-track deviation, namely, within the pilot's primary field of view there must be:

(a) a suitably scaled CDI; or

(b) a map display with a numeric indication of cross-track deviation with a resolution of 0.01 NM or less.

7.4 Despite subclause 7.3 of this Appendix, for an RNP AR approach or departure with an RNP of not less than 0.3, there must be within the pilot's primary field of view:

(a) a map display; and

(b) a numeric display of cross-track deviation with a resolution of 0.1 NM or less.

7.5 Despite subclause 7.3 of this Appendix, for an RNP AR approach or departure with an RNP of 0.3 or less, the means by which the flight crew monitor and manage cross-track deviations must be:

(a) demonstrated by the operator to be adequate for all normal and non-normal conditions within the FTE appropriate to the RNP to be used; and

(b) arrived at only after operator consideration of relevant factors, including the following:

(i) information displayed in the pilot's primary field of view;

(ii) information displayed outside the pilot's primary field of view;

(iii) the resolution, scaling, numeric and other cross-track indications available;

(iv) the predictive display of aircraft flight path;

(v) the crew procedures used to monitor and manage FTE;

(vi) operator procedures for initiation of a missed approach;

(vii) information provided by the aircraft manufacturer;

(viii) simulator demonstration of FTE management.

7.6 The navigation system is not required to provide an alert to the flight crew when GNSS updating is lost, provided there is an alert when the selected RNP no longer meets the criteria for continued navigation.

7.7 Subject to subclause 7.8 of this Appendix, the system must provide LNAV guidance throughout a go-round conducted at any point in the approach.

Note This function is commonly referred to as TOGA to LNAV.

7.8 Where continuous LNAV guidance is not available, an alternative means is acceptable only if:

(a) each flight crew member receives specific training in accurate track-keeping during a go-round; and

(b) the operator demonstrates to CASA that the lateral track can be accurately maintained under all normal and non-normal conditions.

8 Operational standards

8.1 Operating procedures for RNP AR must be in accordance with subclauses 8.2 to 8.17 of this Appendix.

Note The operating procedures contained in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 6, *Implementing RNP AR APCH* do not apply and are replaced by the operating standards in clauses 9 to 23 of this Appendix.

8.2 Subject to subclause 8.3 of this Appendix, before an RNP AR operation commences, availability of an RNP service must be predicted, taking into account relevant matters, including all of the following:

(a) aerodrome location;

(b) approach or departure operation;

(c) terrain masking;

(d) satellite serviceability (NOTAMs);

(e) installed avionics algorithms.

8.3 Subclause 8.2 of this Appendix does not apply if the aircraft can achieve LNAV accuracy that is at least equal to that required for the RNP AR operation using requisite GNSS satellites.

Note ***Requisite GNSS satellites*** is defined in paragraph 4.2 of this Order.

Radio updating

8.4 If radio updating may degrade the GNSS position, radio updating must be inhibited before commencement of the RNP AR operation.

Procedure selection

8.5 An approach or departure procedure must be retrievable by procedure identifier from the aircraft navigation database.

Procedure verification

8.6 Before an RNP AR operation commences, the following must be verified:

(a) that the correct approach or departure procedure has been selected;

(b) that the cockpit electronic displays correctly replicate the route, the waypoint sequence and significant operational details shown on the published IAL procedure chart.

8.7 However, paragraph 8.6 (b) of this Appendix must not be complied with for an RNP AR operation that is an OEI procedure.

Note Verification that cockpit electronic displays correctly replicate the route, the waypoint sequence and significant operational details shown on the published IAL procedure chart is specifically prohibited for an OEI procedure in order to avoid inadvertent activation of the wrong route.

Procedure modification

8.8.1 The flight crew must not modify the loaded procedure.

8.8.2 The lateral path must not be modified, with the exception of:

(a) accepting a clearance to go direct to a fix in the approach procedure that is before the FAF and that does not immediately precede an RF Leg.

(b) changing the altitude and/or airspeed waypoint constraints on the initial, intermediate, or missed approach segments of an approach (e.g. to apply cold temperature corrections or comply with an ATC clearance/instruction).

Vectoring

8.9 When vectored by an air traffic service, a procedure may be intercepted at a position inside the IAF but not later than the designated Latest Intercept Point (LIP), Final Approach Point (FAP) or Vertical Intercept Point (VIP), whichever occurs closest to the Final Approach Fix (FAF). However, descent on an approach procedure below the minimum vectoring altitude is not permitted until the aircraft is established within the vertical and lateral tolerances of the procedure, and the appropriate navigation mode is engaged.

Required equipment to be serviceable

8.10 Before an RNP AR operation commences, the required equipment must be serviceable and its serviceability confirmed.

Note A list of required equipment should be readily available to the flight crew on the flight deck.

Autopilot and flight director

8.11 The standard method of flight control for RNP AR operations is autopilot coupled. However, the use of a flight director instead of the autopilot is acceptable if:

(a) the aircraft manufacturer's recommended operating procedures permit such use of the flight director; and

(b) the operator has provided each member of the flight crew with:

(i) guidance on when a flight director may be so used; and

(ii) training in the conduct of RNP AR operations using the flight director; and

(c) the operator has demonstrated to CASA that when the aircraft is flown with the flight director, FTE can be maintained within the permitted tolerances during all normal, rare-normal and non-normal circumstances.

Note The FTE used by the aircraft manufacturer to demonstrate RNP capability may be dependent upon the use of a coupled autopilot. A lesser RNP capability may be applicable to procedures flown using the flight director.

RNP selection

8.12 Before an RNP AR operation commences, the appropriate RNP must be entered into the FMC and its appropriateness and accurate entry confirmed.

Note The appropriate RNP is determined by the flight crew after consideration of the published DA (or multiple DAs), the weather and other ambient conditions, the current RNP service, and the predicted RNP service. For RNP AR procedures designed in accordance with proprietary design criteria for use by operators of Australian aircraft, other than a system default value, RNP is not extracted from the navigation database.

GNSS updating

8.13.1 Before an RNP AR operation commences, GNSS updating must be operating and such operation confirmed.

8.13.2 Unless the AFM requires otherwise, if GNSS updating is lost during an approach, the approach may be continued if the navigation system continues to provide a solution consistent with the selected RNP.

Note The AFM may require an approach to be discontinued in the event of a loss of GNSS updating in which case the approach must be discontinued.

Track deviation monitoring

8.14.1 Deviation from the defined lateral path must not exceed 1 x RNP at all stages of flight.

8.14.2 To ensure compliance with subclause 8.14.1 of this Appendix, the operator's procedures must provide for the following:

(a) monitoring lateral tracking;

(b) track deviation alerts and callouts;

(c) flight crew intervention;

(d) regaining track;

(e) discontinuing the operation.

Note RNP AR procedures designed in accordance with proprietary design criteria for use by operators of Australian aircraft require that the standard for track-keeping is applied during turns and no allowance is made for overshoot or undershoot during entry or exit. All turns for these procedures are RF Legs.

Vertical deviation monitoring

8.15.1 After the aircraft has passed the FAP or VIP on an approach, deviation from the defined vertical path must not exceed the limiting value for vertical deviation stated in the operator's RNP AR operating procedures.

8.15.2 The operator must have RNP AR operating procedures containing the limiting value for vertical deviation.

8.15.3 The limiting value for vertical deviation may only be determined after the operator has considered the following:

(a) the aircraft manufacturer's data relating to vertical flight path accuracy;

(b) the cockpit display of vertical deviation;

(c) the value used by the designer of the IAL procedure.

8.15.4 The operator's determination of the limiting value for vertical deviation must not exceed 75 ft below the defined vertical flight path.

8.15.5 The operator's determination of the limiting value for vertical deviation above the defined vertical path must not exceed 75 ft unless a figure greater than 75 ft is determined as appropriate for the aircraft type after taking into account the following:

(a) aircraft flight characteristics;

(b) the effect that any deviation may have on the safe continuation of a stabilised approach;

(c) airspeed;

(d) energy management;

(e) aircraft height above ground level;

(f) autopilot vertical gain performance.

8.15.6 For the purposes of this clause, the operator must have flight crew procedures for the following:

(a) monitoring vertical deviation;

(b) deviation alerts and callouts;

(c) flight crew intervention;

(d) missed approach.

Maximum airspeeds

8.16.1 For approach procedures, the limiting indicated airspeeds by segment and category are:

(a) as stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 6, Implementing RNP AR APCH; or

(b) if other speeds are specified by the procedure designer — the other speeds.

8.16.2 For departure procedures, the limiting indicated airspeeds are as specified by the procedure designer.

Limiting temperature

8.17.1 Before an RNP AR operation commences, the operator must ensure that the flight crew of an aircraft are informed of the following:

(a) whether temperature limitations apply to the operation;

(b) for what purpose temperature limitations apply (if they apply);

(c) the circumstances when temperature limitations do not apply.

8.17.2 Temperature limitations do not apply to VNAV of an aircraft that is equipped with a temperature-compensated Baro-VNAV system.

8.17.3 Temperature limitations apply to an operation in which the DA is determined by consideration of the one engine inoperative missed approach performance.

8.17.4 The operator of an aircraft that is equipped with a temperature-compensated Baro-VNAV system must ensure that each member of the flight crew is trained in the use of the system.

Altimeter setting

8.18 The operator must not permit the use of remote altimeter settings.

9 Qualification flight

9.1 An RNP AR authorisation may be issued to an operator only after a qualification flight conducted by the operator demonstrates to CASA that:

(a) the operator meets all operating standards for RNP AR operations; and

(b) the aircraft navigation, flight control, cockpit display and other systems function correctly; and

(c) the operator's flight crew procedures are adequate; and

(d) procedure design, aircraft systems, airworthiness and flight crew procedures function correctly and interact appropriately; and

(e) the operator has the capability to safely operate the most complex procedures proposed to be flown.

Note Where the qualification flight does not demonstrate capability at the operator's most complex port, the RNP AR authorisation may include a condition or limitation on operations.

9.2 The qualification flight may be conducted in a Level D flight simulator only if:

(a) the flight simulator reasonably replicates the RNP AR related functions, software version and options of the aircraft in which the RNP AR operations will be conducted; and

(b) CASA is satisfied that any RNP AR related functions not replicated in the flight simulator are not safety critical, and are demonstrated by other means; and

(c) the flight simulation is carried out by a flight crew trained in accordance the operator's RNP AR approved training program.

9.3 Where the qualification flight is flown in an aircraft, the flight is to be conducted:

(a) in an aircraft of the same type and configuration as the aircraft in which the RNP AR operations will be conducted; and

(b) by a flight crew trained in accordance the operator's RNP AR approved training program; and

(c) in V.M.C. by day.

Note A qualification flight may be conducted on a scheduled revenue service.

10 Flight crew proficiencies

10.1 Subject to this subclause, an RNP AR operation may only be commenced if each member of the flight crew has the knowledge and training provided for in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 6, *Implementing RNP AR APCH*.

10.2 An RNP AR operation may only be conducted if each member of the flight crew has the proficiencies set out in this clause.

10.3 Each member of the flight crew must have sufficient ground training and flight training (whether in actual or simulated flight) in normal and abnormal operations to achieve operational competency.

10.4 RNP AR training proficiencies may only be acquired from successful completion of the knowledge and training elements of the operator's training course.

10.5 The required RNP AR training proficiencies to be acquired from the operator's training course are set out in Table 24-1 in Attachment 1 (***Table 24-1***) to this Appendix.

10.6 Subject to subclauses 10.8 and 10.9, each member of the flight crew must successfully complete each item of training proficiency listed in Table 24-1.

10.7 Each item of training proficiency listed in Table 24-1 must be delivered in accordance with each delivery method specified for the item.

Note A Delivery Method Legend in Table 24-1 explains the meaning of the symbols used in each item.

10.8 For the flight crew training for RNP AR operations approved by CASA, CASA may permit previous relevant RNP APCH-LNAV operational experience, including operational experience in FMC-based RNAV procedures, to exempt a pilot from some or all of an item specified in Table 24-1.

Note See paragraph 3 (c) of this Appendix for CASA approval of training. Exemption from an item of training because of prior learning is specifically noted in writing by CASA in approving an operator's training course.

10.9 If the flight crew training approved by CASA is for RNP AR APCH operations only, or for combined RNP AR APCH and RNP AR DEP operations only,

CASA may permit the pilot to be exempted from some or all of an item specified in Table 24-1 that is not relevant to the training.

Note See paragraph 3 (c) of this Appendix for CASA approval of training. Exemption from an item of training because of the exclusive nature of the operations is specifically noted in writing by CASA in approving an operator's training course.

11 Flight crew recency

11.1 Each member of the flight crew must satisfy recency requirements in accordance with this clause.

11.2 Subject to subclause 11.3 of this Appendix, recency requirements for RNP AR operations (for example, RNP AR APCH) are satisfied if relevant RNP AR procedures are included in the recurrent training program for pilots provided by the operator's training and checking organisation under regulation 217 of *Civil Aviation Regulations 1988* (***CAR 1988***).

11.3 Recency requirements for an RNP AR APCH operation (the ***operation***), for a pilot who is not a member of an operating crew mentioned in regulation 217 of CAR, are satisfied if the pilot has conducted an RNP AR APCH procedure during the 35 days before the operation.

11.4 For this clause, conduct of either an RNP APCH-LNAV, or an RNP APCH-LNAV/VNAV, or an RNP AR APCH, meets the recency requirement for RNP APCH-LNAV, RNP APCH-LNAV/VNAV and RNP AR APCH provided the approach is conducted in an FMS equipped aircraft.

11.5 Where RNP AR operations are to be at a restricted aerodrome, or are to involve operations in the vicinity of mountainous terrain, the pilot in command must successfully complete a Route Training and Restricted Minima Program.

11.6 For RNP AR operations that are not to be at a restricted aerodrome, or not to involve operations in the vicinity of mountainous terrain, a pilot in command who has not successfully completed a Route Training and Restricted Minima Program must successfully complete at least 1 RNP AR APCH at any airfield in V.M.C. before conducting unrestricted operations.

Note ***Restricted aerodrome*** is defined in paragraph 4.2 of this Order.

12 Navigation database

General

12.1 In addition to the requirements of subsection 13 of this Order, the requirements below apply.

Data process

12.2 The operator must identify the responsible manager for the data updating process within their procedures.

12.3 The operator must document a process for accepting, verifying and loading navigation data into the aircraft.

12.4 The operator must place their documented data process under configuration control.

Initial data validation

12.5 Before flying an RNP AR procedure in a type of aircraft in I.M.C. from an initial approach fix for the procedure, the operator must validate the navigation data for the procedure and the aircraft type by:

(a) flying the entire procedure from the initial approach fix through the approach (including vertical angle), the missed approach and the approach transitions for the selected aerodrome and runway; and

(b) confirming that the depicted procedure on the map display is the same as depicted on the published procedure; and

(c) observing the flight path and confirming on the basis of the observation that the path does not have any lateral or vertical path disconnects with the procedure data, and is consistent with the published procedure; and

(d) verifying that the aircraft navigation, flight control, cockpit display and other systems function correctly, and that the procedure is flyable.

12.5A A validation of an RNP AR procedure for an aircraft type mentioned in subclause 12.5 must be conducted in:

(a) an aircraft of the type, being flown by day in V.M.C.; or

(b) a level D flight simulation training device for the aircraft type.

12.5B A validation of an RNP AR procedure mentioned in subclause 12.5 that is conducted in an aircraft must not perform a non-normal operation unless:

(a) the flight is conducted as a private operation that does not carry a passenger, unless the passenger is a CASA officer who is on duty for the flight; or

(b) the non-normal operation is required for the safety of the flight.

Note Requirements for the validation of RNP AR procedures in non-normal operations are not regulated by clause 12 of Appendix 7 to this Civil Aviation Order.

12.5C If the matters mentioned in paragraphs 12.5 (b), (c) and (d) are confirmed for the procedure and the aircraft type, the operator must retain a copy of validated navigation data in such form that is sufficient to enable comparison with updated data in accordance with subclause 12.6.

Data updates

12.6 Upon receipt of each navigation data update for an RNP AR procedure, and before using the updated navigation data in a type of aircraft, the operator must:

(a) compare the updated data to the procedure validated under subclauses 12.5 to 12.5C and identify and resolve any discrepancies between the updated data and the validated procedure; and

(b) if any change affects the approach path or aircraft performance requirements for the procedure — confirm that the change is intended with the person with responsibility for maintenance of the procedure under Part 173 of CASR; and

(c) validate the amended procedure for the type of aircraft in accordance with subclauses 12.5 to 12.5C.

Aircraft modifications

12.7 Subject to subclause 12.8, if a system used in an aircraft type and required for an RNP AR procedure is modified (e.g. software change), the operator must validate the procedure for the aircraft type using the modified system in

accordance with subclauses 12.5 to 12.5C, noting that flight control computers, FMS OPS and display software changes are particularly critical.

12.8 The operator is not required to validate a procedure using a modified system for an aircraft type if the manufacturer of the modified system states in writing that the modification has no effect on the navigation database or path computation for the use of the procedure in the aircraft type.

13 Implementation program

13.1 RNP AR operations may only be conducted in accordance with the operator's approved implementation program.

13.2 If an operator that has not previously conducted RNP AR operations, or RNP AR operations using a particular aircraft type, the implementation program must include limits on operating minima until the operator is able to demonstrate to CASA the capability to safely conduct RNP AR operations without such limits.

Note The initial operating period with these limitations is determined after consideration of all relevant factors including operator RNAV and VNAV operating experience, the number and frequency of RNP AR operations conducted and the number of non-compliant incidents recorded.

13.3 The implementation program must have procedures to identify any negative trend in performance or operations, including procedures for monitoring RNP AR operations and collecting relevant data.

13.4 At intervals as specified in the operator's implementation program, the operator must submit to CASA a report containing a review of operations, including the following elements:

(a) the total number of RNP AR procedures conducted;

(b) the number of satisfactory approaches and departures by aircraft and navigation system;

Note ***Satisfactory*** means the approach or departure was completed as planned without any navigation or guidance system anomalies.

(c) the reasons for unsatisfactory operations, for example:

(i) UNABLE REQ NAV PERF – RNP, GPS PRIMARY LOST, or other RNP related messages; and

(ii) excessive lateral or vertical deviation; and

(iii) TAWS warning; and

(iv) autopilot system disconnect; and

(v) navigation data errors; and

(vi) pilot report of anomaly;

(d) comments, both oral and written, from the flight crew.

14 Conditions arising from the implementation program

14.1 Full RNP AR operational capability will not be achieved until the operator has demonstrated to CASA satisfactory operations at defined stages in accordance with the operator's approved implementation program.

14.2 An RNP AR authorisation may be issued subject to:

(a) conditions to be met for each stage of the operator's approved implementation program; and

(b) conditions under which the operator may progress to full operational capability.

Note A suitable implementation program will impose limits on RNP AR operations until sufficient operating experience and flight data has been collected to warrant progress (usually in stages) to full operational capability. Initial operations will normally be limited to day V.M.C., and subsequent phases will permit operations to I.M.C. operations with ceiling, visibility and RNP limits until full capability is achieved. It is intended that a navigation authorisation will be issued before commencement of the operator's implementation program, with specified conditions under which the operator is able to progress to full operational capability.

Table 24-1 RNP AR training proficiencies

Delivery method legend

A Paper-based training (see *Note 1*).

B Computer-based training (CBT) or instructor lead training,

\# Recognition of prior learning if qualified to conduct RNAV (GNSS) operations in the same aircraft and FMS type. A different FMS update status is considered to be the same FMS type.

S Level D flight simulator training.

P Proficiency check required (see *Note 2*).

Item	RNP AR training proficiencies	Delivery methods				
1	GNSS theory (architecture, accuracy, integrity, etc.)	A	B	#		
2	RNP APCH procedure design basics	A	B	#		
3	RNP AR procedure design basics	A	B			
4	Rare normal wind protection and maximum coded speeds	A	B			
5	RNP/ANP/EPE definitions and the navigational concept	A	B			
6	RNP DEP and one engine inoperative procedures (Only required for an RNP AR DEP navigation authorisation.)	A	B			
7	OEI procedure obstacle clearance areas (Only required for an RNP AR a navigation authorisation including OEI operations.)	A	B			
8	Missed approach extraction capability	A	B			
9	FMS system architecture	A	B	#		
10	Multi-sensor navigation and sensor blending	A	B	#		
11	FMS failure modes and indications	A	B			
12	Navigation performance displays (NPS, XTK, VDEV)	A	B			
13	Allowable lateral and vertical FTE's	A	B			
14	VSD (where fitted)	A	B	#		
15	MEL	A	B			
16	Critical system losses prior to the IAF or FAP (NNDP or VIP)	A	B			P
17	Critical system losses after the IAF or FAP (NNDP or VIP)	A	B		S	P

Item	RNP AR training proficiencies	Delivery methods				
18	Navigation system losses after the IAF or FAP (NNDP or VIP)	A	B		S	P
19	FMS database integrity	A	B			
20	RNP performance prediction	A	B			
21	Flight crew procedure review					
21.1	Selecting an RNP procedure	A	B		S	P
21.2	Changing an RNP procedure	A	B			
21.3	Briefing an RNP procedure	A	B		S	P
21.4	Checking an RNP procedure	A	B		S	P
21.5	RNP missed approach requirements	A	B		S	P
21.6	Navigation system failures	A	B		S	
21.7	FAP and VIP definition	A	B			
21.8	Runway changes inside the FAP or VIP	A	B			
21.9	Managing a non-normal prior to the FAP or VIP	A	B		S	P
21.10	Managing a non-normal after the FAP or VIP	A	B		S	P
21.11	Autopilot requirements	A	B		S	P
21.12	FMS default RNP values and alerts	A	B	#		
21.13	Effect of an incorrectly set local QNH	A	B	#	S	
21.14	Effect of non-standard temperature on nominal path	A	B	#		
21.15	Approach procedures including PF and PNF/PM duties	A	B		S	P
21.16	HUGS (if fitted)	A	B		S	
21.17	Monitoring and flying raw data	A	B	#	S	
21.18	FMS modes/functionality (on approach logic, VNAV PATH, FINAL APP MODE, SPD INTV, ALT INTV, Managed/Selected modes)	A	B	#	S	
21.19	FCC lateral and vertical go-round functionality	A	B			
21.20	RNP holding patterns and managing the FMS	A	B			
22	Flight simulator training					
22.1	Departure (Only required for an RNP AR DEP navigation authorisation.)				S	
22.2	Approach				S	P
22.3	Approach dual FMC failure				S	

Item	RNP AR training proficiencies	Delivery methods				
22.4	Departure with high drift condition (Only required for an RNP AR navigation authorisation including departure operations.)				S	
22.5	Approach with high drift condition				S	
22.6	Departure asymmetric thrust (Only required for an RNP AR navigation authorisation including departure operations.)				S	P
22.7	Approach IRS failure				S	
22.8	Approach with asymmetric thrust and missed approach				S	
22.9	Approach single GPS receiver failure			#	S	
22.10	Approach navigation system alerts			#	S	

Note 1 Where both paper-based and CBT methods appear, it is intended that the item is included in written study-material as well as ground school computer-based sessions.

Note 2 Not all proficiency requirements need to be demonstrated in a flight simulator. Some proficiency items may be demonstrated by written or oral examinations, including multi-choice questions and quiz tests.

Note 3 Some proficiencies apply to specific manufacturer/operator selected equipment options. These items must be covered if they are applicable to the aircraft type or the operator's equipment.

Note 4 Operators may choose to nominate an NNDP (in addition to the VIP) for the purpose of defining actions to be taken in the event of systems failures.

Appendix 8 — Requirements for use of Baro-VNAV

1 Baro-VNAV navigation authorisation for I.F.R. flights

1.1 Baro-VNAV may only be used for PBN by an aircraft if it meets the requirements of clause 2 below.

1.2 Baro-VNAV in accordance with this Appendix may be authorised and used in conjunction with RNAV 1, RNP 1, Advanced RNP, RNP APCH and RNP 0.3 operations.

2 Aircraft eligibility

2.1 An aircraft is eligible for Baro-VNAV operations if the aircraft is equipped with all of the following:

(a) a barometric VNAV system that meets the requirements set out in subclause 4.2 of this Appendix;

(b) a navigational database that permits the lateral and vertical path to be defined;

(c) navigation displays which enable vertical deviation from the defined VNAV path to be determined;

2.2 For paragraph 4.1 (a), a barometric VNAV system must meet the requirements of at least 1 of the following:

(a) *FAA AC 20-129 — Airworthiness Approval of Vertical Navigation (VNAV) Systems for use in the United States National Airspace System (NAS) and Alaska*;

(b) *FAA AC 20-138B — Airworthiness Approval of Positioning and Navigation Systems*;

(c) *FAA AC 90-105 — Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System*;

(d) *EASA AMC 20-27 — Airworthiness Approval and Operational Criteria for RNP APPROACH (RNP APCH) Operations, including BARO-VNAV Operations*;

(e) an approval issued in the aircraft's State of operation or registry, and which is assessed by CASA as meeting requirements that are the same as, or equivalent to, the standards of eligibility set out in this clause;

(f) a CASA assessment of the aircraft which results in a CASA determination that the aircraft meets the standards for eligibility set out in this clause.

3 Baro-VNAV system performance

3.1 To meet the requirements of clause 2 of this Appendix, an eligible aircraft's Baro-VNAV system used in Baro-VNAV operations must meet the following performance standards:

(a) the performance requirements set out in *FAA AC 20-129 — Airworthiness Approval of Vertical Navigation (VNAV) Systems for use in the United States National Airspace System (NAS) and Alaska*; or

(b) the performance requirements set out in *FAA AC 20-138B — Airworthiness Approval of Positioning and Navigation Systems*;

(c) a demonstration to CASA that the VNAV TSE, including altimetry errors, is less than 75 m (246 ft) for a probability of 99.99%.

3.2 For the purposes of the demonstration mentioned in paragraph 5.1 (c), the VNAV TSE analysis is to include all of the following:

(a) altimetry errors, including allowance for accuracy of reported barometric pressure (ATIS error);

(b) VNAV system error, including VPA resolution error;

(c) waypoint resolution error;

(d) FTE.

Note Provision for RNAV along-track system error is not included.

4 Baro-VNAV system functionality

4.1 To meet the requirements of clause 3 of this Appendix and subject to subclause 4.2, an eligible aircraft's Baro-VNAV system must have the following functionality in Baro-VNAV operations:

(a) the system must be able to load the entire procedure to be flown into the RNP system from the on-board navigation database, including the approach, the missed approach and the approach transitions for the selected aerodrome and runway;

(b) the system must make it impossible for the flight crew to modify instrument approach procedure data;

(c) the resolution of VPA entry (from the navigation database) and display must be no greater than 0.1;

(d) the vertical path must be defined by a waypoint and a vertical angle;

(e) vertical deviation from the defined VNAV path must be continuously displayed in the primary field of view of the pilot or each pilot, as the case requires;

(f) vertical deviation resolution must be not more than 10 ft;

(g) for aircraft with a flight crew of 2 pilots — a barometric altitude from 2 independent sources must be displayed, 1 in each pilot's primary field of view;

(h) there must be a means for the flight crew to readily determine:

(i) the VNAV mode of operation, including establishment or capture of the vertical path; and

(ii) any mode change or reversion.

4.2 As an alternative to meeting the system functionality specified in subclause 4.1 for the display and monitoring of vertical deviation, the following functionality may be met: an operational assessment that enables CASA to determine that the pilot flying the aircraft is able to readily distinguish vertical deviation not exceeding plus or minus 75 ft, such that timely corrective action (including a go-round) can be initiated.

4.3 For subclause 4.2, the operational assessment must include the following:

(a) digital display of vertical deviation;

(b) displays not in the primary field of view;

(c) aural or other warnings or annunciations;

(d) crew procedures and training;

(e) use of flight director or autopilot or both;

(f) flight trials, or other performance indicators, or both of these means of assessment.

5 Operating standards

The standards for the conduct of Baro-VNAV operations are as follows:

(a) operations must be conducted using an approved local barometric pressure source;

(b) before a Baro-VNAV approach operation may commence, the correct barometric pressure must be set and a method of cross-checking must be applied;

(c) a stabilised approach must be flown to a DA indicated on an approach chart by an LNAV/VNAV minima;

(d) the flight must limit deviations after the FAF below the defined vertical path to no more than 75 ft;

(e) a missed approach procedure must be conducted if the vertical deviation after the FAF exceeds 75 ft below the defined vertical path;

(f) any sustained deviations above the defined vertical path must not exceed 75 ft unless the operator determines that a figure greater than 75 ft is appropriate for the aircraft type after taking into account the following:

  (i) aircraft flight characteristics;

  (ii) the effect that any deviation may have on the safe continuation of a stabilised approach;

  (iii) airspeed;

  (iv) energy management;

  (v) aircraft height above ground level;

  (vi) autopilot vertical gain performance.

(g) temperature limitations, as published on the relevant approach chart, must be applied for an aircraft that is:

  (i) operating under a Baro-VNAV authorisation; and

  (ii) equipped with a Baro-VNAV system that does not provide temperature compensation in the determination of the vertical path;

(h) temperature limitations need not be applied for an aircraft that is:

  (i) operating under a Baro-VNAV authorisation; and

  (ii) equipped with a Baro-VNAV system that provides temperature compensation in the determination of the vertical path;

(i) the aircraft must be established on the vertical path no later than the FAF;

(j) if Baro-VNAV guidance is intended for use before the FAF operating procedures — the following requirements apply:

  (i) minimum altitudes must be displayed;

  (ii) the computed vertical flight path must not permit descent below any minimum altitude;

(k) the flight crew must have a means to determine the aircraft configuration and serviceability for Baro-VNAV operations.

6 Flight crew knowledge and training

A Baro-VNAV operation may only be commenced if each member of the flight crew has knowledge of, and approved training in, how to safely conduct a Baro-VNAV operation, with particular reference to the following:

(a) Baro-VNAV instrument approach charts, including LNAV/VNAV minima, temperature limitations, and vertical flight path angle;

(b) principles of Baro-VNAV vertical guidance, including path construction and the effect of temperature;

(c) basic Baro-VNAV instrument approach procedure design;

(d) use of MDA and DA for LNAV and LNAV/VNAV minima respectively;

(e) approach procedure selection;

(f) barometric datum selection (altimeter subscale setting), and cross-checking and verification procedures, including effect of incorrect setting;

(g) VNAV mode selection and monitoring;

(h) VNAV failure modes and mode reversions;

(i) VNAV flight tolerances.

Appendix 9 — Requirements for the use of Advanced RNP

1 Advanced RNP navigation authorisation for I.F.R. flights

1.1 Advanced RNP (***A-RNP***) may only be used for PBN by an aircraft if the operator has an Advanced RNP navigation authorisation in writing from CASA.

1.2 An operator may fly on a route or in airspace designated as A-RNP only if the operator holds an A-RNP navigation authorisation.

1.3 A-RNP requires GNSS as the primary navigation sensor.

1.4 An A-RNP navigation authorisation may only be issued to an operator who:

(a) applies in writing to CASA for it; and

(b) supplies the documents mentioned in clause 2 of this Appendix; and

(c) satisfies CASA that A-RNP operations can, and are likely to continue to, meet the requirements of this Appendix, including in relation to:

(i) aircraft eligibility; and

(ii) Advanced RNP equipment, system performance and system functionality; and

(iii) operating standards, including flight planning and flight procedures; and

(iv) approved flight crew training; and

(v) MEL procedures; and

(vi) aircraft and RNP system maintenance; and

(vii) validity and continuing integrity of the airborne navigation database (if carried); and

(viii) navigation error reporting procedures.

1.5 An A-RNP navigation authorisation may not be issued unless the aircraft meets the requirements of this Appendix.

1.6 Subject to subclause 1.12 of this Appendix, aircraft that meet the requirements of this Appendix meet the lateral accuracy and functional requirements for the navigation specifications listed below without further examination:

(a) RNAV 5; and

(b) RNAV 1; and

(c) RNAV 2; and

(d) RNP 2; and

(e) RNP 1; and

(f) RNP APCH Part A (LNAV/VNAV) and/or Part B (LP/LPV).

1.7 Aircraft that are equipped with dual independent navigation systems that meet the requirements of this Appendix meet the lateral accuracy and functional requirements for the navigation specifications listed below without further examination:

(a) RNAV 10 (RNP 10); and

(b) RNP 4 navigation element; and

(c) RNP 2 navigation element for oceanic/remote continental region use.

Note RNP 4 and RNP 2 for use in oceanic/remote continental regions, in addition to the navigation requirement, require CPDLC and ADS-C to qualify for the relevant navigation authorisation.

1.8 Aircraft that are approved for RNP AR operations meet the system performance monitoring and alerting requirements of this Appendix without further examination. However, this specification contains additional functional requirements that are not included in the RNP AR navigation specification e.g. RF Legs, RNAV holding, parallel offset, and fixed radius transition. If such capabilities have been demonstrated and are contained in an approved RNP AR system, documentation of compliance may be all that is necessary. If such capabilities are added to an RNP AR system, or part of a new RNP system, they will be subject to typical regulatory reviews, demonstrations, tests and approval.

1.9 An A-RNP navigation authorisation may be issued subject to conditions if CASA considers this is necessary in the interests of safety.

1.10 It is a condition of the issue of a navigation authorisation that the applicable operational requirements of this Appendix are complied with after the issue of the authorisation.

1.11 It is a condition of the issue of a navigation authorisation that where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

1.12 Although the airworthiness requirements of other navigation specifications may be covered by an aircraft A-RNP approval, the operational aspects of those approvals are not addressed by this Appendix. An individual navigation authorisation is required for each navigation specification that an operator uses.

2 Application — documents

The application must be made on the approved form and be accompanied by the following documents:

(a) aircraft airworthiness documents which satisfy CASA that the aircraft is equipped for A-RNP operations, for example, the AFM, the AFMS or OEM service letters;

(b) a detailed description of relevant aircraft equipment for A-RNP operations, including a configuration list of the components and equipment;

(c) a detailed description of the proposed flight crew training for A-RNP operations, including a copy of the training syllabus for approval by CASA;

(d) a detailed description of the operating procedures to be used for A-RNP operations (including flight planning and flight procedures) supported by relevant copies of, or extracts from, the following:

(i) the operations manual;

(ii) the checklists;

(iii) the contingency procedures;

(iv) the QRH;

(e) copies of the sections of the MEL applicable to A-RNP operations;

(f) a detailed description of the maintenance program used to ensure the continuing airworthiness of the aircraft for A-RNP operations;

(g) a detailed description of the method used to ensure the validity and continuing integrity of the airborne navigation database;

(h) if requested in writing by CASA — a copy of any relevant document referred to in any of the documents mentioned in paragraphs (a) to (g).

3 Aircraft eligibility

3.1 An aircraft is eligible for A-RNP operations if the aircraft's AFM, an AFMS or an OEM service letter states that the aircraft navigation system is approved for A-RNP operations.

3.2 An aircraft is eligible for A-RNP operations if the operator has demonstrated to CASA that the aircraft meets the requirements of ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 4, *Implementing Advanced RNP*.

Note The system performance and functional requirements for A-RNP operations are replicated in clauses 4 and 5 below.

4 Advanced RNP system performance

4.1 To meet the requirements of clause 3 of this Appendix, the system must meet the performance, monitoring and alerting requirements for A-RNP operations as stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 4, *Implementing Advanced RNP*.

4.2 Positioning data from non-GNSS navigation sensors may be integrated with GNSS data if:

(a) the non-GNSS data does not cause position errors exceeding the TSE budget; or

(b) if paragraph (a) does not apply — there is a means to deselect the non-GNSS inputs.

5 Advanced RNP system functionality

5.1 To meet the requirements of clause 3 of this Appendix, the system must, as a minimum, meet the standards of functionality stated in ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Chapter 4, *Implementing Advanced RNP*.

5.2 Additional functional and performance requirements for A-RNP are:

(a) the required inclusion of:

(i) Radius to fix path terminator; and

(ii) parallel offsets; and

(iii) RNAV holding; and

(b) the optional inclusion of:

(i) scalability; and

(ii) higher continuity; and

(iii) fixed radius transitions (FRT); and

(iv) time of arrival control.

5.3 Baro-VNAV authorised in accordance with Appendix 8 may be used in conjunction with A-RNP under this Appendix.

5.4 FRT authorised in accordance with Appendix 11 may be used in conjunction with A-RNP under this Appendix.

Note A map display depicting the aircraft computed flight path must be installed for operations using RF Legs and/or FRT so is required for an A-RNP airworthiness approval.

6 Operating standards – flight planning – general

6.1 Before an A-RNP operation commences, consideration must be given to matters that may affect the safety of the operation, including the following:

(a) whether the aircraft and the flight crew have relevant authorisations for A-RNP;

(b) whether the aircraft can be operated in accordance with the A-RNP requirements for:

(i) the planned route, including the route to any alternate aerodromes; and

(ii) minimum equipment requirements for the flight;

(c) whether the navaids required for the planned route are available and adequate for the period of the operation, including any non-RNAV contingencies;

(d) whether the navigation database is current and appropriate for the region of operation and includes the navaids and waypoints required for the route;

(e) whether operating restrictions, including time limits, apply to the operation.

6.2 If the aircraft's essential A-RNP equipment is functioning properly, the PBN capability of the aircraft must be indicated in the flight plan.

7 Operating standards — flight procedures – general

7.1 An A-RNP operation must comply with the instructions and procedures of the OEM in relation to the performance requirements of A-RNP.

7.2 At system initialisation, the following must occur:

(a) confirmation that the navigation database is current;

(b) verification of proper entry of the ATC-assigned route immediately after initial clearance from ATC to conduct the relevant A-RNP route;

(c) action to ensure the waypoints sequence, depicted by the navigation system, matches the route depicted on the appropriate charts and the assigned route.

7.3 The following steps must occur:

(a) selection of a SID or STAR by route name from the on-board navigation database;

(b) confirmation that the selected route conforms to the charted route, or the route as modified through the insertion or deletion of specific waypoints in response to ATC clearances;

(c) determination that the aircraft meets all specified criteria for the selected route or procedure and comply with the performance requirements of this Appendix.

7.4 Except in response to ATC clearances, the following must not occur:

(a) creation of new waypoints by manual entry; or

(b) making manual entry of latitude, longitude or rho/theta values; or

(c) changing an RNP SID or STAR database waypoint type from a fly-by to a flyover or vice versa.

7.5 The following checks and cross-checks must be made:

(a) a cross-check of the flight plan by comparing charts or other applicable resources with the navigation system flight plan and the aircraft map display (if applicable);

(b) if required, confirm the exclusion of specific navaids.

Note Small differences between charted navigation information and displayed navigation data may be noted. Differences of 3 degrees or less due to the equipment manufacturer's application of magnetic variation or leg track averaging are operationally acceptable.

7.6 For A-RNP routes, a moving map display, flight director or autopilot in LNAV mode must be used.

7.7 Where a lateral deviation indicator is used, scaling must be selected suitable for the navigation accuracy associated with the route or procedure, for example, full scale deflection equals plus or minus the RNP value.

7.8 Route centrelines must be maintained as close as practicable, as depicted by lateral deviation indicators or flight guidance, unless authorised to deviate by ATC or under emergency conditions.

7.9 Brief deviations from the standard mentioned in subclause 7.8 are acceptable during and immediately after turns, but only to the minimal extent that accurate cross-track information may not be provided during the turn.

Note 1 Flight crew procedures and training should emphasise observance of turn anticipation commands and management of rate of turn.

Note 2 Piloting standards usually require the aircraft to be flown to maintain lateral deviation not exceeding half the current accuracy requirement (RNP value) or half the lateral deviation scale. Whilst this standard should be observed, pilots must also be aware that Navigation System Error + Flight Technical Error (lateral deviation) may not exceed the specified navigation accuracy. When carrying out approach operations, if the GNSS Horizontal Protection Limit (HPL) exceeds 0.15 NM, the allowable lateral deviation will be limited to less than the half scale value.

7.10 If ATC issues a heading assignment taking the aircraft off a route, the navigation system flight plan may only be modified when:

(a) ATC clearance is received to rejoin the route; or

(b) ATC confirms a new clearance.

7.11 If the navigation system does not automatically retrieve and set the navigation accuracy from the on-board navigation database for each leg segment of a route or procedure, the flight crew's operating procedures must ensure the smallest navigation accuracy for the route or procedure is manually entered into the RNP system.

8 Operating standards – flight procedures – SID requirements

8.1 Before an eligible aircraft takes-off, the following A-RNP SID requirements must be verified:

(a) that the aircraft's RNP system is available, is operating correctly and the correct aerodrome and runway data is loaded;

(b) that the aircraft navigation system is operating correctly;

(c) that the correct runway and departure procedure (including any applicable en route transition) is entered in the navigation system flight plan and properly depicted;

(d) that, if an RNP departure procedure is assigned and the runway, procedure or transition is subsequently changed, the appropriate changes are entered in the navigation system flight plan, properly depicted and available for navigation.

Note It is recommended that, within the constraints of normal operations, there be a final check of proper runway entry and correct route depiction, shortly before take-off.

8.2 The operator must ensure that each member of the flight crew is aware of the functional limitations of relevant A-RNP systems and the correct application of manual tracking procedures.

8.3 The RNP system must be selected and available to provide flight guidance for lateral navigation no later than 153 m (or 500 ft) above the aerodrome field elevation.

Note The altitude at which navigation guidance begins on a given route may be higher, for example, "climb to 304 m (or 1 000 ft), then direct to X….".

8.4 For an RNP operation, an authorised method must be used to achieve an appropriate level of performance for the selected procedure, for example, lateral deviation indicator, navigation map display, flight director or autopilot.

8.5 The GNSS signal must be acquired before the take-off roll commences.

8.6 For aircraft using (E)TSO-C129a stand-alone equipment, the departure aerodrome must be loaded into the flight plan in order to achieve the appropriate navigation system monitoring and sensitivity.

8.7 For aircraft using (E)TSO-C146a stand-alone equipment, if the departure begins at a runway waypoint, then the departure aerodrome does not need to be in the flight plan to obtain appropriate monitoring and sensitivity.

9 Operating standards – flight procedures – RNP STAR requirements

9.1 The following must be checked and confirmed for an RNP STAR:

(a) that the aircraft navigation system is operating correctly;

(b) that the correct arrival procedure and runway (including any applicable transition) are entered in the system and properly depicted.

9.2 The following must be checked and confirmed:

(a) the active navigation system flight plan, by comparing the charts with the navigation displays;

(b) the sequence of waypoints;

(c) the reasonableness of track angles;

(d) distances, altitude or speed constraints;

(e) as far as practicable, which waypoints are fly-by and which are flyover.

9.3 The operator must ensure that updating will exclude a particular navaid, if so required by a route.

9.4 A route is not to be used if doubt exists as to its validity in the navigation database.

9.5 No member of the flight crew may create a new waypoint by manual entry into the RNP system.

9.6 If the operator's contingency procedures require reversion to a conventional arrival route, provision for that arrival route must be made before commencement of the RNP STAR.

9.7 Route modifications in the terminal area may take the form of radar headings or "direct to" clearances and may require the insertion of tactical waypoints from the navigation database. However, no member of the flight crew may make a manual entry or modification of the loaded route using temporary waypoints or fixes not contained in the database.

9.8 All relevant published altitude and speed constraints must be observed.

10 Contingency procedures for performance failure

ATC must be notified immediately if the system performance ceases to meet RNP requirements during an RNP operation in controlled airspace.

11 Flight crew knowledge and training

11.1 An A-RNP operation may only be commenced if each member of the flight crew has knowledge of the following:

(a) the meaning and proper use of aircraft equipment and navigation suffixes;

(b) the capabilities and limitations of the RNP system installed in the aircraft;

(c) the operations and airspace for which the RNP system is approved to operate;

(d) the limitations of the navaids to be used for the RNP operation;

(e) the required navigation equipment for operation on RNP routes with SIDs or STARs;

(f) depiction of waypoint types (flyover, fly-by and FRT), ARINC 424 Path Terminators, and associated aircraft flight paths;

(g) contingency procedures for RNP failures;

(h) the radiotelephony phraseology for the relevant airspace in accordance with the AIP for the State in which the aircraft is operating;

(i) the flight planning requirements for RNP operation;

(j) RNP procedure requirements as determined from chart depiction and textual description;

(k) A-RNP system-specific information, including:

(i) levels of automation, mode annunciations, changes, alerts, interactions, reversions and degradation; and

(ii) functional integration with other aircraft systems; and

(iii) monitoring procedures for each phase of the flight; and

(iv) types of navigation sensors, for example, DME, IRU, GNSS, utilised by the A-RNP system, and associated system prioritisation, weighting and logic; and

(v) aircraft configuration and operational conditions required to support A-RNP operations, including appropriate selection of CDI scaling (lateral deviation display scaling) and/or map scale; and

(vi) pilot procedures consistent with the operation; and

(vii) the meaning and appropriateness of route discontinuities and related flight crew procedures; and

(viii) turn anticipation with consideration of speed and altitude effects; and

(ix) interpretation of electronic displays and symbols; and

(x) automatic and/or manual setting of the required navigation accuracy.

11.2 Understand the performance requirement to couple the autopilot/flight director to the navigation system's lateral guidance on RNP procedures, if required.

11.3 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 FRT if the system can select the

procedure, but the aircraft is not suitably equipped (e.g. the aircraft does not have the required roll steering autopilot or flight director installed).

11.4 An A-RNP operation may only be conducted if each member of the flight crew has received training in, or has equivalent experience of, A-RNP equipment and operating procedures, including training or experience in how to do the following:

(a) verify that the aircraft navigation data is current;

(b) verify the successful completion of RNP system self-tests;

(c) initialise A-RNP system position;

(d) perform a manual or automatic update (with take-off point shift, if applicable);

(e) retrieve and fly a SID and STAR with appropriate transition;

(f) verify waypoints and navigation system flight plan programming;

(g) resolve route discontinuities;

(h) adhere to speed and altitude constraints associated with a SID or STAR;

(i) fly direct to waypoint;

(j) fly a course or track to waypoint;

(k) intercept a course or track;

(l) vector off and rejoin a procedure;

(m) fly radar vectors and rejoining an RNP route from a heading mode;

(n) determine cross-track error/deviation;

(o) determine allowable deviation limits and maintain flight within those limits;

(p) remove and reselect navigation sensor input;

(q) confirm exclusion of a specific navaid or navaid type;

(r) perform gross navigation error checks using conventional aids;

(s) change arrival aerodrome and alternate aerodrome;

(t) perform parallel offset function if capability exists, and advise ATC if this functionality is not available;

(u) perform RNAV holding function;

(v) carry out contingency procedures for RNP failures;

(w) manual setting of the required navigation accuracy;

(x) operator-recommended levels of automation for phase of flight and workload, including methods to minimize cross-track error to maintain route centreline.

Appendix 10 — Requirements for Radius to Fix (RF) Path Terminators

1 RF path terminator navigation authorisation for I.F.R. flights

1.1 The RF path terminator (commonly referred to as a RF Leg) provides the functionality for aircraft to fly a curved path with a defined radius when used in association with RNP 1, RNP 0.3, RNP APCH, and A-RNP specifications. RF Legs are an optional capability for use with RNP 1, RNP 0.3 and RNP APCH but are a minimum requirement for A-RNP.

Note RF Legs are used with RNP AR operations and have specific requirements included in the RNP AR operations specification in Appendix 7.

1.2 RF path terminators may only be used for PBN by an aircraft if the operator has a RF path terminator authorisation in writing from CASA unless subsection 9, 10 or 11 is applicable.

2 Requirements for RF path terminator

2.1 An RF path terminator navigation authorisation may only be issued to an operator who:

(a) holds an RNP 1, RNP 0.3, RNP APCH or A-RNP navigation authorisation; and

(b) complies with subclause 2.2 of this Appendix.

2.2 For paragraph 2.1 (b), an RF path terminator navigation authorisation may only be issued to an operator who:

(a) applies in writing to CASA for it; and

(b) supplies the documents mentioned in clause 3 of this Appendix; and

(c) satisfies CASA that RF path terminator operations can, and are likely to continue to, meet the requirements of this Appendix, including in relation to the following:

(i) aircraft eligibility;

(ii) RNP system equipment, system performance and system functionality;

(iii) operating standards, including flight planning and flight procedures;

(iv) approved flight crew training, and recency;

(v) MEL procedures;

(vi) aircraft and RNP system maintenance;

(vii) validity and continuing integrity of the airborne navigation database;

(viii) navigation error reporting procedures.

2.3 An RF path terminator navigation authorisation may not be issued unless the operator meets the requirements of this Appendix.

2.4 Despite subclauses 2.1, 2.2 and 2.3 of this Appendix, an RF path terminator navigation authorisation may be issued to an operator who:

(a) holds an RNP AR APCH navigation authorisation; and

(b) operates an aircraft which meets the aircraft eligibility requirements for an RNP AR APCH navigation authorisation; and

(c) applies in writing to CASA for an RF path terminator navigation authorisation.

2.5 An RF path terminator navigation authorisation may be issued, subject to conditions, if CASA considers this is necessary in the interests of safety.

2.6 It is a condition of the issue of a navigation authorisation that the applicable operational requirements of this Appendix are complied with after the issue of the authorisation.

2.7 It is a condition of the issue of a navigation authorisation that where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

2.8 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). 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 properly equipped (e.g. the aircraft does not have the required roll steering autopilot or flight director installed).

Note 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.

Note 2 Another acceptable means of compliance may be pilot training to identify and prohibit the use of procedures containing RF Legs.

3 Application — documents

The application must be made on the approved form and be accompanied by the following documents:

(a) aircraft airworthiness documents which satisfy CASA that the aircraft is equipped for RF path terminator operations, for example, the AFM, the AFMS or OEM service letters;

(b) a detailed description of relevant aircraft equipment for RF path terminator operations, including a configuration list of the components and equipment;

(c) a detailed description of the proposed flight crew training for RF path terminator operations, including a copy of the training syllabus, for approval by CASA;

(d) a detailed description of the proposed training for maintenance personnel in RF path terminator operations, including a copy of the training syllabus, for approval by CASA;

(e) a detailed description of the operating procedures to be used for RF path terminator operations (including flight planning and flight procedures) supported by relevant copies of, or extracts from, the following:

(i) the operations manual;

(ii) the checklists;

(iii) the contingency procedures;

(iv) the QRH;

(f) copies of the sections of the MEL applicable to RF path terminator operations;

(g) a detailed description of the maintenance program used to ensure the continuing airworthiness of the aircraft for RF path terminator operations;

(h) a detailed description of the method used to ensure the validity and continuing integrity of the airborne navigation database;

(i) revisions to the MEL;

(j) if requested in writing by CASA — a copy of any relevant document referred to in any of the documents mentioned in paragraphs (a) to (i).

4 Aircraft eligibility

4.1 An aircraft is eligible for RF path terminator operations if:

(a) the aircraft is equipped with an RNP 1, RNP 0.3, RNP APCH or A-RNP system and the OEM has documented that the aircraft is capable of RF path terminator operations; and

(b) the aircraft meets the requirements for RF path terminator operations in accordance with ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Appendix 1, *Radius to Fix (RF) Path Terminator*.

Note The system performance and functional requirements for RF Path Terminator operations are replicated in clauses 5 and 6 of this Appendix.

4.2 For paragraph 4.1 (a), an RNP system with an RF path terminator function must meet the requirements of at least 1 of the following:

(a) *FAA AC 90-105 — Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System*;

(b) *FAA AC 90-101A — Approval Guidance for RNP Procedures with AR;*

(c) *FAA AC 20-138B — Airworthiness Approval of Positioning and Navigation Systems;*

(d) *EASA AMC 20-26 — Airworthiness Approval and Operational Criteria for RNP Authorisation Required Operations*;

(e) an approval issued by the National Aviation Authority of the aircraft's State of Operation or Registry, and which is assessed by CASA as meeting requirements that are the same as, or equivalent to, the requirements of paragraph (a), (b), (c) or (d) of this clause;

(f) a CASA assessment of the aircraft which results in a CASA determination that the aircraft meets the standards for eligibility set out in the paragraphs of this clause.

4.3 The flight manual or referenced airworthiness eligibility document must contain the following information:

(a) a statement indicating that the aircraft meets the requirements for RNP operations with RF Legs and has demonstrated the established minimum capabilities for these operations. This documentation should include the phase of flight, mode of flight (e.g. FD on or off, and/or AP on or off, and applicable lateral and vertical modes), minimum demonstrated lateral navigation accuracy, and sensor limitations, if any;

(b) any conditions or constraints on path steering performance (e.g. A/P engaged, FD with map display, including lateral and vertical modes, and/or CDI/map scaling requirements) should be identified. Use of manual control with CDI only, is not allowed on RF Legs;

(c) the criteria used for the demonstration of the system, acceptable normal and non-normal configurations and procedures, the demonstrated configurations and any constraints or limitations necessary for safe operation.

5 RF path terminator system performance

To meet the requirements of clause 4 above, an eligible aircraft's RF path terminator system must meet 1 of the following performance standards:

(a) the performance requirements set out in one of the documents listed in subclause 4.2 of this Appendix;

(b) a demonstration to CASA that the navigation system has the capability to execute leg transitions and maintain track consistent with an RF Leg between 2 fixes. The lateral TSE must be within ±1 × RNP of the path defined by the published procedures for at least 95% of the total flight time for each phase of flight and each autopilot and/or flight director mode requested.

6 RF path terminator system functionality

To meet the requirements of clause 4 above, an eligible aircraft's RF path terminator system must have the following functionality:

(a) an autopilot or flight director with at least "roll-steering" capability that is driven by the RNP system. The autopilot/flight director must operate with suitable accuracy to track the lateral and, as appropriate, vertical paths required by a specific RNP procedure;

(b) an electronic map display depicting the RNP computed path of the selected procedure;

(c) the flight management computer, the flight director system, and the autopilot must be capable of commanding and achieving a bank angle up to 25 degrees above 400 feet AGL;

(d) the flight guidance mode should remain in LNAV while on an RF Leg, when a procedure is abandoned or a missed approach/go-round is initiated (through activation of TOGA or other means) to enable display of deviation and display of positive course guidance during the RF Leg. As an alternative means, crew procedures may be used that ensure that the aircraft adheres to the specified flight path throughout the RF Leg segment.

7 Operating standards

7.1 The standards for the conduct of RF path terminator operations are as follows:

(a) RF path terminator operations must be conducted in association with RNP 1, RNP 0.3, RNP APCH or A-RNP operations;

(b) when the intended route includes flying an RNP route with an RF Leg, the RNP system and autopilot/flight director must be operational on despatch;

(c) the route must be retrieved from the aircraft navigation database and conform to the charted procedure;

(d) the lateral path must not be modified except when complying with ATC clearances/instructions;

(e) the pilot must use either a flight director or autopilot and comply with any instructions or procedures identified by the manufacturer as necessary to comply with the performance requirements in this Appendix;

(f) the aircraft must be established on the procedure or route before beginning the RF Leg;

(g) where published, the pilot must not exceed maximum airspeeds associated with the fly-ability (design) of the RF Leg.

7.2 Route centrelines must be maintained as close as practicable unless authorised to deviate by ATC or under emergency conditions. Navigation System Error + Flight Technical Error (lateral deviation) must not exceed the specified navigation accuracy.

8 Flight crew knowledge and training

An RF path terminator operation may only be commenced if each member of the flight crew has knowledge of, and approved training in, how to safely conduct an RF path terminator operation, with particular reference to the following:

(a) the meaning and proper use of RF functionality in RNP systems;

(b) associated procedure characteristics as determined from chart depiction and textual description;

(c) associated levels of automation, mode annunciations, changes, alerts, interactions, reversions, and degradation;

(d) monitoring track-keeping performance;

Note Manually selecting aircraft bank limiting functions may reduce the aircraft's ability to maintain its desired track and are not permitted. Pilots should recognise that manually selectable aircraft bank-limiting functions may reduce their ability to satisfy ATC path expectations, especially when executing large angle turns.

(e) 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 Leg;

(f) the effect of ground speed on compliance with RF paths and bank angle restrictions impacting the ability to remain on the course centreline;

(g) interpretation of electronic displays and symbols;

(h) contingency procedures.

Note It is not required to establish a separate training program or regime if RNP and RF Leg training is already an integrated element of a training program. However, it should be possible to identify what aspects of RF Leg use are covered within a training program. Private operators should be familiar with the practices and procedures identified in CAO 20.91, section 17.

Appendix 11 — Requirements for Fixed Radius Transitions (*FRTs*)

1 FRT navigation authorisation for I.F.R. flights

1.1 The FRT provides the functionality for aircraft to fly a defined radius transition path when separation between parallel routes is required and the fly-by transition is not compatible with separation criteria.

Note FRT is likely to be a requirement for operation in European airspace from 2018.

1.2 FRT may only be used in conjunction with the RNP 4, RNP 2 and Advanced RNP navigation specifications.

1.3 FRT may only be used for PBN by an aircraft if the operator has an FRT navigation authorisation in writing from CASA unless subsection 9, 10 or 11 are applicable.

2 Requirements for FRTs

2.1 An FRT navigation authorisation may only be issued to an operator who:

(a) holds an RNP 2 or A-RNP navigation authorisation; and

(b) complies with subclause 2.2 and the other requirements of this Appendix.

2.2 For paragraph 2.1 (b) of this Appendix, an FRT navigation authorisation may only be issued to an operator who:

(a) applies in writing to CASA for it; and

(b) supplies the documents mentioned in clause 3 of this Appendix; and

(c) satisfies CASA that FRT operations can, and are likely to continue to, meet the requirements of this Appendix, including in relation to the following:

(i) aircraft eligibility;

(ii) RNP system equipment, system performance and system functionality;

(iii) operating standards, including flight planning and flight procedures;

(iv) approved flight crew training;

(v) MEL procedures;

(vi) aircraft and RNP system maintenance;

(vii) validity and continuing integrity of the airborne navigation database;

(viii) navigation error reporting procedures.

2.3 Despite subclauses 2.1 and 2.2 of this Appendix, an FRT navigation authorisation may be issued to an operator who:

(a) holds an RNP 2 or A-RNP navigation authorisation; and

(b) operates an aircraft which meets the aircraft eligibility requirements for an RNP 2 or A-RNP navigation authorisation; and

(c) applies in writing to CASA for an FRT navigation authorisation.

2.4 An FRT navigation authorisation may be issued, subject to conditions, if CASA considers this is necessary in the interests of safety.

2.5 It is a condition of the issue of a navigation authorisation that the applicable operational requirements of this Appendix are complied with after the issue of the authorisation.

2.6 It is a condition of the issue of a navigation authorisation that where an operational check, consideration, procedure or task (however described) is required under this Appendix, the operator must ensure that it is performed, given, followed or carried out, as the case may be.

Note The check, consideration, procedure or task may in practice be performed by the pilot in command, other members of the flight crew, the despatch officer or other operational personnel. However, legal responsibility for compliance is placed on the operator who must ensure that the performance occurs in accordance with his or her established procedures.

3 Application — documents

The application must be made on the approved form and be accompanied by the following documents:

(a) aircraft airworthiness documents which satisfy CASA that the aircraft is equipped for FRT operations, for example, the AFM, the AFMS or OEM service letters;

(b) a detailed description of relevant aircraft equipment for FRT operations, including a configuration list of the components and equipment;

(c) a detailed description of the proposed flight crew training for FRT operations, including a copy of the training syllabus, for approval by CASA;

(d) a detailed description of the proposed training for maintenance personnel in FRT operations, including a copy of the training syllabus, for approval by CASA;

(e) a detailed description of the operating procedures to be used for FRT operations (including flight planning and flight procedures) supported by relevant copies of, or extracts from, the following:

(i) the operations manual;

(ii) the checklists;

(iii) the contingency procedures;

(iv) the QRH;

(f) copies of the sections of the MEL applicable to FRT operations;

(g) a detailed description of the maintenance program used to ensure the continuing airworthiness of the aircraft for FRT operations;

(h) a detailed description of the method used to ensure the validity and continuing integrity of the airborne navigation database;

(i) revisions to the MEL;

(j) if requested in writing by CASA — a copy of any relevant document referred to in any of the documents mentioned in paragraphs (a) to (i).

4 Aircraft eligibility

4.1 An aircraft is eligible for FRT operations if:

(a) the aircraft is equipped with an RNP 2 or A-RNP system and the OEM has documented that the aircraft is capable of FRT operations; and

(b) the aircraft meets the requirements for FRT operations in accordance with ICAO Doc. 9613, *Performance-based Navigation (PBN) Manual*, Volume II, Part C, Appendix 2, *Fixed Radius Transition*.

Note The system performance and functional requirements for FRT operations are replicated in clauses 5 and 6 of this Appendix.

4.2 For paragraph 4.1 (a) of this Appendix, an RNP system with an FRT function must meet the requirements of at least 1 of the following:

(a) *AC 20-138B — Airworthiness Approval of Positioning and Navigation Systems*;

(b) an approval issued in the aircraft's State of Operation or Registry, and which is assessed by CASA as meeting requirements that are the same as, or equivalent to, the requirements of this clause;

(c) a CASA assessment of the aircraft which results in a CASA determination that the aircraft meets the standards for eligibility set out in this clause.

4.3 The flight manual or referenced airworthiness eligibility document should contain the following information:

(a) a statement indicating that the aircraft meets the requirements for RNP operations with FRT and has demonstrated the established minimum capabilities for these operations. This documentation should include the phase of flight, mode of flight (e.g. FD on or off, and/or AP on or off, and applicable lateral and vertical modes), minimum demonstrated L/NAV accuracy, and sensor limitations, if any;

(b) any conditions or constraints on path steering performance (e.g. A/P engaged, FD with map display, including lateral and vertical modes, and/or CDI/map scaling requirements) should be identified. Use of manual control with CDI only, is not allowed on FRT;

(c) the criteria used for the demonstration of the system, acceptable normal and non-normal configurations and procedures, the demonstrated configurations and any constraints or limitations necessary for safe operation should be identified.

5 FRT system performance

To meet the requirements of clause 4 of this Appendix, an eligible aircraft's FRT system must meet the following performance standards:

(a) the performance requirements set out in any of the documents listed in clause 4.2 of this Appendix;

(b) a demonstration to CASA that the navigation system has the capability to execute leg transitions and maintain track consistent with an FRT at each waypoint. The lateral Total System Error must be within ±1 × RNP of the path defined by the published procedures for at least 95% of the total flight time for each phase of flight and each autopilot and/or flight director mode requested.

6 FRT system functionality

To meet the requirements of clause 4 of this Appendix, an eligible aircraft's FRT system must have the following functionality:

(a) the system must have the capability to execute a flight path transition and maintain a track consistent with a fixed radius between 2 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;

(b) the system must have an electronic map display depicting the RNP computed path of the selected route with pilot selectable range and a numerical indication of the cross-track error value;

(c) the system must be able to define transitions between flight path segments using a 3-digit numeric value for the radius of turn (to 1 decimal place) in nautical miles e.g. 15.0, 22.5. The navigation database will specify the radius associated with a particular waypoint along an airway.

7 Operating standards

7.1 The standards for the conduct of FRT operations are as follows:

(a) FRT operations must be conducted in association with RNP 4, RNP 2 or Advanced RNP operations;

(b) when the intended route includes flying an RNP route with an FRT, the RNP system must be operational on despatch and autopilot/flight director should be operational;

(c) the route must be retrieved from the aircraft navigation database and conform to the charted procedure;

(d) the lateral path must not be modified except when complying with ATC clearances/instructions;

(e) the pilot should use either a flight director or autopilot and must comply with any instructions or procedures identified by the manufacturer as necessary to comply with the performance requirements in this Appendix.

7.2 Route centrelines must be maintained as close as practicable unless authorised to deviate by ATC or under emergency conditions. NSE + FTE (lateral deviation) must not exceed the specified navigation accuracy.

8 Flight crew knowledge and training

An FRT operation may only be commenced if each member of the flight crew has knowledge of, and approved training in, how to safely conduct an FRT operation, with particular reference to the following:

(a) the meaning and proper use of FRT functionality in RNP systems;

(b) associated procedure characteristics as determined from chart depiction and textual description;

(c) associated levels of automation, mode annunciations, changes, alerts, interactions, reversions, and degradation;

(d) monitoring track-keeping performance;

Note Manually selecting aircraft bank limiting functions may reduce the aircraft's ability to maintain its desired track and are not permitted. Pilots should recognise that manually selectable aircraft bank-limiting functions may reduce their ability to satisfy ATC path expectations, especially when executing large angle turns.

(e) the effect of wind on aircraft performance during execution of FRT 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 FRT;

(f) the effect of ground speed on compliance with FRT and bank angle restrictions impacting the ability to remain on the course centreline;

(g) interpretation of electronic displays and symbols;

(h) contingency procedures.

Note It is not required to establish a separate training program or regime if RNP and FRT training is already an integrated element of a training program. However, it should be possible to identify what aspects of FRT use are covered within a training program.

Appendix 12 — Requirements for Time of Arrival Control

Reserved pending standards development by ICAO.

Appendix 13 — Use of suitable area navigation systems on conventional routes and procedures

1 Purpose

The purpose of this Appendix is to define the requirements for using GNSS-based area navigation systems as either a substitute means of navigation or as an alternate means of navigation while operating on, or transitioning to, conventional (not RNAV or RNP) routes and procedures in Australia.

2 Applicability

This Appendix is applicable to operators and pilots using GNSS-based area navigation systems as substitute or alternate means of navigation when operating on, or transitioning to, conventional routes or procedures.

3 Suitable GNSS-based area navigation systems

3.1 (E)TSO-C129, (E)TSO-C145, (E)TSO-C146 or (E)TSO-C196 GNSS when either a stand-alone system or part of a multi-sensor navigation system where the operator holds, or is deemed to hold, a navigation authorisation for RNP 2 in accordance with the requirements of Appendix 3 are suitable for use as substitute means of navigation or alternate means of navigation during the en route phase of flight.

3.2 (E)TSO-C129, (E)TSO-C145, (E)TSO-C146 or (E)TSO-C196 GNSS when either a stand-alone system or part of a multi-sensor navigation system where the operator holds, or is deemed to hold, a navigation authorisation for RNP 1 and RNP APCH in accordance with the requirements of Appendix 4 and Appendix 6 are suitable for use as substitute means of navigation or alternate means of navigation during the terminal and approach phases of flight provided that they have been verified as capable of flying the procedures as published.

3.3 Many GNSS-based area navigation systems have been shown to be not capable of flying conventional terminal and approach procedures in Australia as published. Terminal and approach operations using GNSS-based area navigation systems as substitute or alternate means of navigation are not permitted when the procedure includes either a “tear drop turn” or a “DME arc” unless approved in the AFM.

Note Some departure procedures will also be difficult to fly using GNSS-based navigation systems as a substitute or alternate means of navigation, particularly when the first turn occurs at an altitude. Departures need to be carefully verified.

4 Use of suitable GNSS-based area navigation systems

4.1 Subject to the operating requirements of this Appendix, operators may use suitable GNSS-based area navigation systems to:

(a) determine the aircraft position relative to, or its distance from, a VOR, NDB, DME fix, a named fix defined by a VOR/DME location, VOR radial, or NDB bearing; and

(b) navigate to or from a VOR or NDB; and

(c) hold over a VOR, NDB or DME fix.

Note The operational uses of GNSS described in this clause apply even when a navigation aid is identified as required on a procedure.

5 Use of suitable GNSS-based area navigation systems not permitted

An otherwise suitable GNSS-based area navigation system is not permitted to be used for:

(a) **NOTAMed procedures**. Unless otherwise specified, navigation on procedures that are identified as not authorised without exception by a NOTAM. For example, an operator may not use a suitable GNSS-based area navigation system to navigate on a procedure that is based on a recently decommissioned navigation aid;

(b) **Lateral navigation on LOC-based courses**. Lateral navigation on LOC-based courses (including LOC back-course guidance) without reference to raw LOC data.

6 Operating requirements

General operating requirements

6.1.1 Pilots must comply with the AFM, AFMS, operating manual, QRH or pilot's guide when operating the aircraft navigation system.

6.1.2 Pilots may not use the GNSS-based area navigation system as a substitute or alternate means of navigation if the aircraft has an AFM or AFMS with a limitation to monitor the underlying navigation aids for the associated operation.

6.1.3 Pilots of aircraft with an AFM limitation that requires the aircraft to have other equipment appropriate to the route being flown may only use the area navigation system as a substitute means of navigation for out-of-service navigation aids, but not for inoperative or not installed equipment.

Navigation database requirements

6.2.1 Pilots must ensure that the installed navigation database is:

(a) current (except as provided for by subsection 13 of this CAO); and

(b) appropriate for the region of intended operation and includes the waypoints, navigation aids, and fixes for departure, arrival and alternate aerodromes; and

(c) has been obtained from a supplier holding a Letter of Acceptance in accordance with paragraph 13.3 of this CAO.

6.2.2 For en route and terminal area operations, pilots must:

(a) extract the routes or procedures from the on-board navigation database by name; or

(b) extract waypoints, navigation aids, and fixes by name from the on-board navigation database; and

(c) comply with the charted route or procedure. Heading-based legs associated with procedures may be flown using manual technique (based on indicated magnetic heading) or, if available, extracted from the aircraft database and flown using area navigation system guidance.

6.2.3 For approach procedures, pilots must:

(a) extract the procedure from the on-board navigation database by name; and

(b) comply with the charted procedure. Heading-based legs associated with procedures may be flown using manual technique (based on indicated magnetic heading).

Procedure validation

6.3.1 Procedures used with suitable GNSS-based area navigation systems, as either a substitute means of navigation or as an alternate means of navigation, must be

verified for navigation data and operability using 1 of the following processes before being used:

(a) on-going, system-wide checks of navigation data and operability;

(b) as-needed, procedure specific checks of navigation data and operability.

6.3.2 These processes must ensure navigation data (e.g. waypoint names, waypoint sequence, distance between waypoints, heading/course/track information, and vertical path angles) used in airborne equipment conform to published information. The following methods to check the operability of procedure(s) are acceptable:

(a) suitable desktop analysis;

(b) simulator evaluation; or

(c) flight (in visual meteorological conditions).

Operating requirements

6.4.1 Pilots may not manually enter published procedure or route waypoints via latitude/longitude, place/bearing, or place/bearing/distance into the aircraft navigation system.

6.4.2 Route centrelines must be maintained as close as practicable, as depicted by lateral deviation indicators or flight guidance systems during all operations described in this Appendix unless authorised to deviate by ATC or under emergency conditions.

Note 1 Brief deviations from the standard mentioned above are acceptable during and immediately after turns, but only to the minimal extent that accurate cross-track information may not be provided during the turn.

Note 2 Piloting standards usually require the aircraft to be flown to maintain lateral deviation not exceeding half the current accuracy requirement (RNP value) or half the lateral deviation scale. While this standard should be observed, pilots must also be aware that Navigation System Error + Flight Technical Error (lateral deviation) may not exceed the specified navigation accuracy. When carrying out approach operations, if the GNSS Horizontal Protection Limit (HPL) exceeds 0.15 NM, the allowable lateral deviation will be limited to less than the half scale value.

6.4.3 Operation on NDB or VOR procedures authorised under this Appendix requires navigation system accuracies of less than or equal to:

(a) 2 NM for en route operations (RNP 2);

(b) 1 NM for initial, intermediate and Missed Approach Segments (RNP 1); and

(c) 0.3 NM for Final Approach Segments (RNP APCH).

Note GNSS system as a substitute for VOR may not be approved within 8 NM of the VOR and within 4 NM from the NDB.

6.4.4 RAIM or other approved integrity monitor must be available during these operations.

Equipment requirements

6.5.1 Operators conducting regular passenger transport, or charter, operations must be equipped with at least 1 other independent navigation system in addition to the installed and operative GNSS-based area navigation system.

6.5.2 This additional system must be suitable for the intended route so that, in the event of an area navigation system failing, the aircraft is capable of proceeding safely to an aerodrome and completing an instrument approach. For example:

(a) for an aircraft equipped with (E)TSO- C145 ( ), (E)TSO-C146 ( ) or (E)TSO-C196 ( ) GNSS-based area navigation systems, an acceptable

installation requires dual GNSS but no additional navigation equipment is required; and

(b) an aircraft equipped with (E)TSO-C129 GNSS-based area navigation systems requires operative VOR and/or ADF navigation equipment suitable for the intended en route, terminal, and approach operations, including any alternates.

6.5.3 ADF equipment need not be installed and operative, although operators of aircraft without an ADF will be bound by the operational requirements defined in this Appendix and may not have access to some procedures (that is, there may be instances when some operations might not be conducted without ADF equipment).

6.5.4 Use of an area navigation system as a substitute means of navigation may be applicable to normal in-flight use, to continuation of flight after failure, or to dispatch with inoperative conventional capability if consistent with the applicable MMEL for the aircraft type and an applicable CASA approved operator's MEL.

Alternate aerodrome requirements

6.6 For the purposes of flight planning, any required alternate aerodrome must have an available instrument approach procedure that meets the requirements of this Appendix for the equipment installed in the aircraft.

6.7 For aircraft equipped with (E)TSO-C129 ( ) GNSS systems, the alternate aerodrome must have a non-GNSS approach procedure available and the aircraft must have the requisite equipment installed and operative.

6.8 For aircraft equipped with (E)TSO-C145 ( ), (E)TSO-146 ( ) or (E)TSO-196 ( ) equipment, the approach procedures at an alternate aerodrome may be GNSS based.

7 GNSS requirements

7.1 GNSS-based area navigation systems may be used as an alternate means of navigation without restriction providing the aircraft is fitted with the equipment for the underlying navigation aid, the system is operative and the ground-based navigation aid is operative.

7.2 As part of flight planning, a prediction for GNSS integrity availability must be obtained where GNSS will be used as a substitute or alternate means of navigation.

Notes to *Civil Aviation Order 20.91 (Instructions and directions for performance-based navigation) Instrument 2014*

The Civil Aviation Order (in force under the *Civil Aviation Regulations 1988*, the *Civil Aviation Safety Regulations 1998* and the *Acts Interpretation Act 1901*) as shown in this document comprises *Civil Aviation Order 20.91 (Instructions and directions for performance-based navigation) Instrument 2014* amended as indicated in the Tables below.

Table of Orders

Year and number	Date of registration on FRL	Date of commencement	Application, saving or transitional provisions
CAO 20.91 Instrument 2014	15 December 2014 (*see* F2014L01703)	15 December 2014 (*see* s. 3)	—
CAO 20.91 Am Instrument 2017 (No. 1)	15 November 2017 (*see* F2017L01471)	16 November 2017 (*see* s. 2)	—
CAO 20.91 Am Instrument 2018 (No. 1)	1 November 2018 (see F2018L01527)	2 November 2018	—

Table of Amendments

ad. = added or inserted am. = amended rep. = repealed rs. = repealed and substituted

Provision affected	How affected
subs. 3	am. F2017L01471, F2018L01527
subs. 4	am. F2018L01527
subs. 5	am. F2018L01527
subs. 6	am. F2018L01527
subs. 7	am. F2018L01527
subs. 8	am. F2018L01527
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