

PRINCIPLE

(OPS.04) Navigation authorisations

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OFFICIAL



Acknowledgement of country

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Terminology

Acronyms and abbreviations

Table 1. List of acronyms and abbreviations

Acronym/abbreviation	Description
AAMA	Australian Airspace Monitoring Agency
AEB	Airworthiness & Engineering Branch
AFM	aircraft flight manual
AMP	aircraft maintenance program
ANP	actual navigation performance
ANSP	air navigation service provider
AOC	air operator's certificate
APV	approach with vertical guidance
AR	authorisation required
ATA	Air Transport Association
ATC	air traffic control
AWI	airworthiness inspector
Baro-VNAV	barometric vertical navigation
FIR	flight information region
FMC	flight management computer
FOI	flying operations inspector
FOSA	flight operational safety assessment
FRT	fixed radius transition
GNSS	global navigation satellite system
IRU	inertial reference unit
LNAV	lateral navigation
MEL	minimum equipment list
MMEL	master minimum equipment list
MOS	Manual of Standards
OEM	original equipment manufacturer

Acronym/abbreviation	Description
PBN	performance based navigation
RAIM	receiver autonomous integrity monitoring
RF Leg	radius to fix path terminator (commonly referred to as RF Leg)
RNAV	area navigation
RNP	required navigation performance
RNP APCH	RNP approach
RNP AR APCH	RNP authorisation required approach
RVSM	reduced vertical separation minimum
SB	service bulletin
SBAS	space based augmentation system
SID	standard instrument departure
SRM	structural repair manual
STAR	standard terminal arrival route
STC	supplemental type certificate
тс	type certificate
TCDS	type certificate data sheet
TSO	technical standard order

Reference to regulations

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this Principle are references to the *Civil Aviation Safety Regulations 1998* (CASR).

1. Assessment scope

Division 91.D.8 of the *Civil Aviation Safety Regulations* 1998 (CASR) requires an approval under regulation 91.045 for operations with a reduced vertical separation minimum (RVSM), and the following performance-based navigation (PBN) specifications:

- RNP AR APCH
- RNP AR DP.

Note: When an RNP AR application is allocated to an inspector, the inspector must contact the <u>CNS</u> advisory panel before proceeding with the assessment.

Although the following performance-based navigation specifications do not require an approval under regulation 91.045, the operator must declare the navigational capability in its exposition/operations manual:

- RNAV / RNP 10
- RNP 4
- RNAV 5
- RNAV 1 & 2
- RNP 2
- RNP 1
- RNP APCH
- RNP 0.3
- APV Baro-VNAV
- Advanced RNP.

CASA will assess the exposition / operations manual as part of an initial air operator's certificate (AOC) application or a significant change – such as the addition of an aircraft. For applications for approval to operate into North Atlantic high level airspace (NAT HLA), refer to <u>Protocol (OPS.07) North Atlantic High-Level Airspace (NAT HLA)</u>.

Note: some elements of the NAT HLA assessment may require reference to this principle.

Operators may apply for an amendment to their navigation authorisations; adding a new specification, aircraft type, or an aircraft of the same type with different equipment. In all cases, the scale of the amendment will need to be considered by the inspectors involved. Some areas require both airworthiness inspectors (AWIs) and flying operations inspectors (FOIs) to evaluate sections of the application. In this instance, the appropriate inspector is required to assess individually and endorse as appropriate.

The minimum required processes are detailed below.

- 1. Addition of aircraft to an existing navigation authorisation:
 - RVSM approval is specific to the aircraft. Therefore, additional aircraft will require assessment and approval.
 - For PBN operations:
 - » additional aircraft of the same make and model as the previously approved aircraft the inspector must determine aircraft eligibility and whether there are any significant differences. Where practicable, use previously accepted data and focus on any differences
 - » additional aircraft of a different make and/or model the inspector must determine the aircraft eligibility and the continuing airworthiness requirements.

- 2. Addition of new navigation specifications to an existing navigation authorisation:
 - if the aircraft equipment and capability are unchanged, the inspectors must assess the continuing airworthiness compliance, pilot qualifications, training and operational procedures against the requirements for the new navigation specification
 - if the aircraft is a new model and/or type, the inspectors must conduct a full assessment.

Note: This protocol suite does not cover the certification of navigation systems to support operations under a navigation authorisation. Questions relating to certification must be referred to the Airworthiness & Engineering Branch (AEB).

1.1 Assessment worksheet user instructions

Typically, a navigation authorisation application for RVSM or RNP AR will require an FOI and AWI to complete the worksheet.

This principle provides guidance to the inspector when using the associated (OPS.04) worksheet. The worksheet provides inspectors with a regulation-based tool for recording the outcomes of the assessment. It is set out as follows:

- user instructions
- assessment worksheets
- assessment summary
- approval data sheet.

2. Aircraft eligibility

An operator's application must include documentation to identify the aircraft model and serial number, and must demonstrate that the instruments/systems equipped are of an appropriate standard. The inspector must confirm that the aircraft, as built or modified, is capable of undertaking the requested navigation specifications and authorisations. Figure 1 illustrates the decision path for assessing aircraft eligibility.





If the following conditions cannot be met, or the application includes an RNP AR request, a more detailed analysis of the equipment fitted needs to be undertaken.

- If the equipment was installed by the aircraft manufacturer, the aircraft flight manual (AFM) or AFM supplements will demonstrate compliance.
- Documents submitted must accurately identify the aircraft for which authorisation is sought.
- Conditions and limitations that are included in the aircraft eligibility documentation, but not included in the AFM, may need to be included in any CASA issued navigation specifications and authorisations.
- The inspector should check that the appropriate aircraft systems have been maintained, calibrated and certified in accordance with the approved maintenance program / systems of maintenance.

The inspector should ensure the application and supporting documents accurately identify the aircraft by serial number.

2.1 New aircraft

For new aircraft, the inspector must ensure the requested navigation specification is certified by the aircraft manufacturer. The documentation may be extracts from the applicable AFM or AFM supplements. If the operator adopts the original equipment manufacturer (OEM) documentation, the assessment process will be relatively simple. If the inspector has any concerns about the certification they should refer the matter to AEB.

For example, if the operator has developed their MEL from the MMEL, the inspector does not need to complete a full assessment, but rather would simply need to confirm that the relevant navigation specifications have been included.

2.2 Older or modified aircraft

For older or modified aircraft, the inspector must ensure the requested navigation specification has the required airworthiness approval/certification by the appropriate authority.

If the aircraft OEM, the avionics OEM(s) or another manufacturer offers a modification for a system the aircraft requires for RNP AR operations eligibility—such as a software or hardware change—or offers a modification impacting the controllability and flyability of the aircraft, the operator is responsible for validating the modification's impact(s) on the aircraft's eligibility for RNP AR operations, before accepting the modification and conducting RNP AR operations with a modified aircraft.

If no documentation is available from the manufacturer directly stating the impacts of their modification on the aircraft's RNP capability, the operator must then validate the performance of the modified aircraft – noting any changes to flight control computers, the flight guidance systems, the RNP system's functions and any other operational software impacts on the aircraft performance.

Evidence of airworthiness approval/certification may be one of the following:

- for an aircraft that has a post-production OEM approval, either:
 - a service information letter (SIL)
 - a service bulletin (SB)
 - other equivalent document, including the type certificate data sheet (TCDS), that shows airworthiness approval.
- a copy of a foreign airworthiness authorisation for that aircraft
- for modified aircraft:
 - the supplemental type certificate (STC) or engineering order (or other similar Part 21 accepted document) that modified the aircraft (the inspector should confirm applicability if the STC is an approved model list STC)
 - an appropriate maintenance certification for its incorporation, by serial number, and modification certifier
 - a copy of the associated AFM supplement for the fitment, documenting its operational capabilities
 - a copy of the completed post-installation evaluation sheet (Appendix B to CASA AC 21-36) if modified in Australia, or the equivalent if not modified in Australia.

The installed major components list should match the eligibility documents. Software is to be treated the same as a standard aeronautical product.

3. Continuing airworthiness

The operator is required to ensure all aircraft intended to be used in PBN or RVSM operations are maintained to conform and comply with type design. All required equipment, processes and procedures are to be put in place and well documented to ensure the integrity of the aircraft is demonstrated.

The operator should be able to demonstrate that the navigation system will be maintained in compliance with the type design. For navigation system installations there are specific continuing airworthiness requirements, such as database and configuration management, and system modifications and software revisions. This element is included for completeness and consistency with other CNS/ATM operational approvals (e.g. RVSM).

The key elements of continued airworthiness are:

- aircraft continuing airworthiness and configuration management systems, including practices, documents and equipment
- configuration management, including software management
- approved maintenance program or system of maintenance
- oversight of maintenance organisations, including training
- minimum equipment list (MEL) or dispatch deviation guide (DDG).

The inspector must confirm that the operator's continuing airworthiness management procedures and documentation sets out details of all routine maintenance tasks to be carried out on the aircraft and navigational systems. The operator must demonstrate that the aircraft will be maintained in accordance with its type design and current maintenance data. The inspector must ensure the approved maintenance program (AMP) for Part 42 aircraft, or the system of maintenance (SOM) for non-Part 42 aircraft, covers all PBN and RVSM requirements.

3.1 Configuration management

In order to remain compliant with its type design, the aircraft must remain properly configured, in accordance with the AMP (Part 42 aircraft) or the aircraft's SOM (non-Part 42 aircraft), or have approved relief authorised (i.e. MEL or PU).

Aircraft specific equipment list

The specific aircraft equipment list must include the required navigation equipment as specified by the operator and/or in the AFM, AFM supplement, SB, SIL, EO and/or TCDS. If the specific aircraft list does not match the other specifications, then the deficiency must be identified and rectified by the RO.

The aircraft-specific equipment list must include appropriate part/version identification.

Minor installation differences are acceptable provided there is no significant operational impact. For the system software, minor version differences are acceptable provided there are no significant functional differences.

Electrical load analysis (ELA)

The ELA must accord with the specific aircraft equipment list. That is, the ELA must have considered all post-production modifications, including installation of navigation equipment, and be compliant with regulatory requirements and OEM limits.

Each operator must have procedures to ensure that the ELA is maintained to reflect the actual aircraft configuration, and ensure that the electrical power system complies with regulatory requirements and any OEM limits.

Software and database configuration

The database must be provided by a supplier with appropriate regulatory approval.

For operators conducting RNP APCH operations – the navigation database should be obtained from a supplier holding a Type 2 Letter of Acceptance (LOA) (i.e. equipment specific) from their regulatory authority. A Type 1 LOA (i.e. not equipment specific) is acceptable, except that, for RNP AR operations, the navigation database supplier must hold a Type 2 LOA.

The processes must ensure that the aircraft software and databases are compliant with section 14.07 of the Part 91 MOS (software is to be treated like any aeronautical product).

The processes must ensure that aircraft software is current within AIRAC cycles.

The processes must ensure that software versions are identical or have no significant differences in dual installations.

3.2 Maintenance program

The operator must demonstrate their ability to maintain the aircraft in an airworthy condition, specifically addressing maintenance procedures designed to maintain conformity and integrity of the applicable navigation equipment and systems.

The inspector should consider the following:

- The maintenance program must include a set of complete instructions for continuing airworthiness for each applicable navigation equipment issued by the type certificate (TC) or STC holder:
 - this may include the AMP, aircraft maintenance manual (AMM), structural repair manual (SRM), wiring diagram manual (WDM), component maintenance manual (CMM), SB(s) or other applicable documents
 - the applicant should supply applicable extracts or documents.
- The maintenance program must include practices to maintain the accuracy and integrity of the autopilot and automatic altitude control system.
- The aircraft may have a stand-alone reliability program that monitors the health of the navigation equipment fitted to the aircraft. If not required, the maintenance program must include a reliability program section for monitoring the applicable navigation equipment.
- Parts substitution may only be used when there is technical data that authorises the substitution.
- The operator's configuration management procedures must ensure that all parts—including software meet the standard specified to the current maintenance data.
- The operator must have processes in place to ensure the ELA is maintained and continued compliance is assured; any changes in the electrical load must be incorporated into the ELA.
- The AMP or the SOM must include provisions to ensure that the aircraft remains capable of operating in RVSM airspace.
 - The provisions must include an RVSM checklist for maintenance personnel to action.
 - The provisions include the relevant sections of the maintenance manual (aircraft or component) for RVSM. For example:
 - » maintenance practices, such as alignment of pitot static, probes or dents/deformation around static plates
 - » calibration practices (built in test equipment (BITE) is not acceptable)
 - » waviness checks within RVSM tolerances and following repair
 - » existing maintenance practices for altitude alert, air traffic control (ATC) altitude reporting, altimetry systems and the automatic altitude control system, maintain RVSM approval integrity
 - » leak check after static system disturbance
 - » static systems maintained in accordance with manufacturer's standards
 - » autopilot and automatic altitude control system accuracy and integrity.

- The provisions must include cautions regarding repairs in RVSM critical areas.
- The operator's maintenance procedures must ensure that the software in each system is maintained in a configuration that is compatible with other systems in the aircraft and has no significant operational differences between systems.
- Software is to be treated like as an aeronautical product.

3.3 Maintenance training general

It is the operator's responsibility to ensure that the approved maintenance organisation (AMO) that maintains the operator's fleet has appropriately trained personnel to ensure the fleet are compliant to the navigation specifications or authorisations sought (including RVSM). The inspectors may request confirmation from the operator, in writing, that this has been assured and the AMO's training is in line with Part 145 of CASR and/or Part 30 of CAR. For AMO's that only have a CAR 30 certificate, the operator must submit a description of the training programs for engineering personnel. Documentation should also include evidence of initial, upgrade and recurrent training. Evidence of initial training for maintenance personnel must be appropriate to the navigation specifications and authorisations sought.

The operator must maintain training and competency records. The training syllabi must cover all maintenance training programs, maintenance practices and procedures.

The maintenance controller / HAAMC / continuing airworthiness manager may have, if applicable, undertaken additional training relevant to RVSM/PBN.

3.3.1 Maintenance training for RVSM aircraft

- For RVSM aircraft, the training must include:
 - aircraft geometric inspection techniques
 - test equipment calibration / usage techniques
 - pitot-static tests
 - any special documentation or procedures introduced by RVSM authorisation.
- Maintenance staff must be made aware of the critical nature of RVSM airworthiness serviceability. Any
 repairs to areas within the critical area must be assessed and certified to ensure the aircraft is still RVSM
 compliant. This may require areas to be mapped prior to flight.

3.4 Test equipment¹

Tools and test equipment are required for maintaining systems that are subject to operational authorisations. Operators must ensure that the in-house or contracted approved maintenance organisation (AMO) / certificate of approval holder (COA) have the necessary test equipment to maintain the authorisation requirements, and ensure they are calibrated in accordance with the regulatory requirements.

Note: If required, test equipment and tools are specific to the aircraft—usually by model.

¹ Calibration of equipment is outside of CASA regulations and is the responsibility of National Measurement Institute. CASA regulations require proof of calibration to a standard (usually NATA) and not expired.

3.5 Minimum equipment list

The operator should ensure that, for equipment pertinent to the elected PBN specifications and authorisations, operational and maintenance procedures are incorporated within the MEL.

Where a system interfaces to other systems, the inspector must ensure the MEL contains notes or references to those other systems. For example, global navigation satellite system (GNSS) interfaces to automatic dependant surveillance – broadcast (ADS-B) and terrain avoidance warning system (TAWS). Therefore, GNSS—being inoperative—makes those systems inoperative as well.

The inspector should review Air Transport Association (ATA) Chapters 22, 24, 27, 30, 31 and 34 to ensure MEL compliance, with special attention to PBN and RVSM operations.

Refer to AC 91-05 for further information.

4. Flight operations

To verify a navigation specification or obtain an authorisation, the operator must demonstrate that the aircraft can be operated safely and in accordance with relevant regulatory requirements.

4.1 Exposition/operations manual

Operators must provide supporting documentation of the processes and procedures that manage the required operational aspects for the navigation specifications and authorisations sought. Operators who are not required to have an exposition/operations manual, but operate an aircraft with an integrated GNSS/flight management computer (FMC), should have operating procedures available to crew, who under CASR Part 61 must be competent in the application of the procedures.

The operator's procedures and processes must adequately document and manage the following for the applicable navigation specification and authorisation sought:

- standard operating procedures and applicable checklists
- flight crew training and competency assessments
- navigation database management and validation (for PBN only)
- error and incident reporting procedures
- contingency procedures
- MEL
- route guide or other similar document
- aircraft equipment requirements for specific routes
- operating limitations (may be route specific)
- crew qualification requirements for specific routes.

4.1.1 RNP 0.3 operations – rotorcraft

This specification may be used for rotorcraft RNP 0.3 operations enroute and in the terminal airspace of airports, as well as operations to and from heliports and for servicing offshore rigs. RNP 0.3 may also be needed enroute to support operations at low level in mountainous remote areas and, for airspace capacity reasons, in high density airspace.

The inspector will follow the same assessment process as for other PBN specifications. (Chapter 7 of ICAO Doc 9613 provides further information)

4.1.2 Specific considerations for PBN aircraft

In addition to the above, the inspector should ensure that the operators exposition/operating manual includes procedures to ensure:

- the flight crew maintain the route centreline at all times—except for minor deviations at waypoint transitions and when authorised by ATC—unless under emergency conditions
- the following procedural checks are undertaken:
 - the aircraft navigation system is available and operating correctly prior to take-off
 - the correct airport and runway data has been loaded and properly depicted on the aircraft navigation system
 - for aircraft using a TSO C129 / C129a system, procedures to ensure the departure airport is loaded into the flight plan to achieve the appropriate navigation system monitoring and sensitivity.
- SID operating procedures include:
 - crew pre-take-off procedures that verify the following RNAV / RNP SID requirements:

- » the aircraft's navigation system is available, is operating correctly and the correct aerodrome and runway data are loaded
- » the correct runway and departure procedure (including any applicable en route transition) are entered in the navigation system flight plan and properly depicted
- » if a 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
- » the GNSS signal has been acquired before the take-off roll commences.
- crew procedures requiring lateral guidance to be selected and available to provide flight guidance for LNAV at no later than 500 ft above the aerodrome field elevation.
- STAR operating procedures include:
 - procedures for the crew to verify the following RNAV / RNP STAR requirements:
 - » the aircraft navigation system is operating correctly
 - » the correct arrival procedure and runway (including any applicable transition) are entered in the system and properly depicted.
 - procedures for the crew to check and confirm the following:
 - » the active navigation system flight plan through the process of comparing the charts with the navigation displays
 - » the sequence of waypoints
 - » the reasonableness of track angles
 - » distances, altitude or speed constraints
 - » as far as practicable, which waypoints are fly-by and which are flyover.
 - procedures containing instructions to ensure the following:
 - » navigation system updates and excludes a particular navaid (if required)
 - » a route is not used if doubt exists as to its validity in the navigation database
 - » no member of the flight crew creates a new waypoint by manual entry into the navigation system
 - » if the operators contingency procedures require reversion to a conventional arrival route, provision for that arrival route can be made before commencement of the RNAV / RNP STAR
 - 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 can make a manual entry or modification of the loaded route using temporary waypoints or fixes not contained in the database
 - » all relevant published altitude and speed constraints are observed.
- Contingency procedures include:
 - notifying ATC immediately when the navigation performance ceases to meet the requirements for the navigation specification or authorisation in use during an operation in controlled airspace
 - when GNSS is used as the sole source of position data, a procedure for dealing with loss of integrity for more than 5 minutes.

RNP 0.3 availability prediction

Receiver autonomous integrity monitoring (RAIM) prediction is not required where the equipment uses a space based augmentation system (SBAS) and the planned operations are within the service volume of the SBAS. In areas and regions where SBAS is not usable or available, RAIM availability for the intended route should be checked prior to flight. Operators can verify the availability of RAIM to support RNP 0.3 operations via NOTAMs (where available) or through GNSS prediction services. The operating authority may provide specific guidance on how to comply with this requirement. Operators should be familiar with the prediction information available for the intended ATS route. RAIM availability prediction should take into account the

latest GNSS constellation NOTAMs and avionics model (when available). The air navigation service provider (ANSP), avionics manufacturer, or the RNP system may provide this service.

4.1.3 Specific considerations for RVSM aircraft

The operator's exposition/operating manuals should:

- ensure checklists include or reference information/guidance on the standard operating procedures detailed in section 8 of AIP 1.1
- include a statement of the airspeeds, altitudes and weights considered in RVSM aircraft authorisation
- · identify any operating restrictions established for that aircraft group
- ensure pre-flight inspection procedures of static sources and surrounding skin are included
- include RVSM contingency procedures detailed in section 8 of AIP 1.1

4.2 Flight crew training

Flight crews are required to be trained and competent in the use of the relevant navigation equipment and operating procedures. Where deeming provisions apply, pilot training is satisfied by Part 61. If RNP APCH LNAV / VNAV, APCH LPV, APCH LP or RNP AR navigation specifications are requested, the operator will be required to provide compliant dedicated training programs.

The operator should submit training syllabi and other appropriate material to show that operating practices, procedures and training items, related to PBN / RVSM operations, are incorporated in the initial and, where warranted, recurrent training programs for the following:

- flight crew qualification
- flight planning
- pre-flight
- in-flight procedures
- reporting errors
- monitoring programs
- MEL
- RNP / RNAV SID requirements
- RNP / RNAV STAR requirements
- post-flight procedures.

Pilots flying in private operations are required to hold the relevant qualifications, consistent with Part 61.

The operator's exposition / operations manual training syllabus must define the method of delivery, means of assessment, and competency level required for the applicable navigation specification or authorisation. RVSM and PBN operating practices and procedures must be incorporated into initial and recurrent training programs to ensure ongoing competency.

When an operator's PBN/RVSM syllabus requires the use training devices, they must replicate the actual aircraft installation and functioning, and meet the requirements of the applicable MOS.

4.2.1 PBN training syllabus

The operator should provide evidence that their training syllabus covers:

- the flight planning requirements for the RNAV/RNP operations
- the capabilities and limitations of the navigation systems installed
- knowledge of each of the navigation specifications to be used by the aircraft
- the meaning and proper use of aircraft equipment/navigation suffixes and functionality

- route, airspace and procedure characteristics as determined from chart depiction and textual description
- depiction of waypoint types (fly-over, fly-by and FRT) and path terminators
- knowledge of the required navigation equipment in order to conduct various RNAV and RNP operations, including MEL provisions
- contingency procedures for RNAV/RNP failures
- for RNAV operations, knowledge of techniques for checking navigation performance with reference to conventional navigation aids
- navigation system-specific information, including:
 - levels of automation, mode annunciations, changes, alerts, interactions, reversions and degradation
 - recognition of when the aircraft is no longer able to navigate and meet the performance requirements for the navigation specification in use
 - use of autopilot, auto throttle and flight director
 - functional integration with other aircraft systems
 - flight guidance (FG) mode behaviour
 - the meaning and appropriateness of lateral and vertical route discontinuities, as well as related pilot procedures
 - monitoring procedures for each phase of the flight (e.g. monitor PROG or LEGS page)
 - lateral and vertical path management
 - types of navigation sensors utilised by the navigation system and associated system (e.g. DME, IRU and GNSS)
 - prioritisation / weighting / logic
 - turn anticipation with consideration given to speed and altitude effects
 - interpretation of electronic displays and symbols
 - understanding of the aircraft configuration and operational conditions required to support PBN operations (e.g. appropriate selection of CDI scaling, lateral deviation display scaling)
 - understanding the performance requirement to couple the autopilot / flight director to the navigation system's lateral guidance on RNP procedures (if required)
 - automatic and/or manual setting of the required navigation accuracy.
- RNP system operating procedures, as applicable, including how to perform the following actions:
 - verify currency and integrity of the aircraft navigation data
 - verify the successful completion of RNP system self-tests
 - initialise navigation system position
 - retrieve and fly a route, SID or a STAR, or approach by name with appropriate transition, and be familiar with procedures to deal with a runway change (RNP 1, RNAV 1 and RNAV 2 only)
 - retrieving a LP or LPV approach procedure from the database (e.g. using its name or the SBAS channel number) (LP and LPV only)
 - adhere to speed and/or altitude constraints associated with routes and procedures
 - where applicable, the importance of maintaining the published path and maximum airspeeds while performing RNP operations with RF Legs or FRTs
 - impact of pilot selectable bank limitations on the aircraft/rotorcraft's ability to achieve the required accuracy on the planned route
 - the effect of wind on aircraft performance during execution of RF legs and the need to remain within the RNP containment area (the training program should address any operational wind limitations and aircraft configurations essential to safely complete the RF turn)

- the effect of ground speed on compliance with RF paths and bank angle restrictions impacting the ability to remain on the course centreline
- verify waypoints and flight plan programming
- fly direct to a waypoint
- fly a course/track to a waypoint
- intercept a course/track
- intercept a course/track (fly vectors and re-join an RNP route/procedure from the 'heading' mode)
- fly interception of the extended final approach segment (e.g. using the VTF function) (RNP APCH only)
- determine cross-track error/deviation more specifically, the maximum deviations allowed to support each navigation specification and authorisation sought must be understood and respected
- resolve route discontinuities
- insert and delete route discontinuity
- remove and reselect navigation sensor input
- when required, confirm exclusion of a specific NAVAID or NAVAID type
- change arrival airport and alternative airport
- perform parallel offset function if the system capability exists pilots should be capable in applying the offset function of their particular RNP system and aware of their responsibility to advise ATC if this functionality is not available
- perform RNAV holding function
- perform a conventional holding pattern
- perform gross navigation error checks using conventional NAVAIDs
- perform a manual or automatic runway update with take-off point shift, if applicable (A-RNP only)
- operator-recommended levels of automation for phase of flight and workload, including methods to minimise cross-track error to maintain route centreline.
- a clear understanding of crew requirements for comparisons of primary altimeter information, altitude cross-checks (e.g. altimetry comparisons of 30 m [100 ft]), temperature limitations for instrument procedures using barometric VNAV, and procedures for altimeter settings for approach
- discontinuation of a procedure based upon loss of systems or performance and flight conditions (e.g. inability to maintain required path tracking, loss of required guidance) (Baro-VNAV only).

4.2.2 RVSM training syllabus

The operator should provide evidence that their training syllabus covers:

- the RVSM flight planning requirements
- knowledge of the required operational equipment in order to conduct RVSM operations, including MEL provisions
- RVSM pre-flight procedures at the aircraft for each flight
- procedures prior to RVSM airspace entry
- in-flight procedures, standard phraseology and the RVSM monitoring requirements
- contingency procedures after entering RVSM airspace
- post flight procedures, including reporting requirements.

4.3 RNP AR operations

RNP AR operations allow the use of small navigation tolerances (<0.3 NM) for both normal and non-normal operations. The navigation tolerances allow flight paths within close proximity to terrain and other obstacles and also allow development of relatively complex flight paths for terrain avoidance in the event of an engine being inoperative on a multi-engine aircraft. Because of this complexity and high regulatory oversight required to implement procedures and navigation authorisations for RNP AR (proprietary), operations will initially be limited to operators holding a training and checking system approval (or equivalent approval from another State).

Due to the higher standard of operation, an RNP AR APCH (proprietary) navigation authorisation entitles an operator to also receive an RNP AR APCH (ICAO) navigation authorisation.

Comprehensive hazard identification, risk assessment and risk mitigation are required to ensure safe operations. This is undertaken by means of a flight operational safety assessment (FOSA), consistent with ICAO Document 9613 - PBN Manual. The scope of the FOSA is outlined in Ch. 6 of Section 6.4 of Part C, Vol. II of ICAO Document 9613 - PBN Manual.

The FOSA should be conducted before:

- applying to CASA for an RNP engine out standard instrument departure (EOSID)
- conducting and RNP AR operation that required an RNP value of less than 0.3 NM
- conducting an RNP AR operation in which it is planned to have least one engine inoperative.

An operator applying for RNP AR approval must provide the following documentation:

- a FOSA consistent with ICAO Document 9613 PBN Manual that meets all aspects of the RNP AR navigation authorisation:
 - flight crew procedures (including contingency procedures)
 - flight crew training
 - engineering modifications
 - operating limitations
 - procedure design where a proprietary procedure is used
 - procedures to determine GNSS availability and effects of terrain, turbulence, wind and temperature.
 - evidence the aircraft is equipped with the minimum equipment
- for operators who intend to use flight director instead of autopilot during RNP AR operations:
 - the aircraft manufacturer's recommended operating procedures and flight crew guidance and training documentation
 - documentation demonstrating to CASA that the flight technical error can be maintained within permitted tolerances during all circumstances when flown with the flight director.
- evidence the operators aircraft display functionality complies with the requirements specified in AC 91-05.
- RNP availability prediction documentation
- an implementation program, including qualification flight and a proposed method to monitor RNP AR operation acceptable to CASA
- a program to provide CASA with periodic reports on the implementation
- flight crew training program that addresses the proficiencies identified in Table 2 of AC 91-05 and ensures ongoing competency.

Past performance

For RNP AR operations and APV Baro-VNAV aircraft, the operator will be required to monitor and collect data of RNP AR operations conducted. This information will be submitted as part of the RNP AR operations implementation program. (This data will enable any negative trend in performance or operations to be identified. Alternatively, applicants may be able to demonstrate expertise with other aircraft of a different type

for which they presently hold an RNP AR authorisation. In this case, the inspector must examine the operators data collection for any negative trends.

For RNP 10 and RNP 4 aircraft, the operator must include an aircraft operating history to address any incidents related to navigation errors. Any incidents should be covered in new or revised training programs and contingency procedures – which must be submitted with the operator's application. Alternatively, applicants may demonstrate past performance with other aircraft of the same type that have been approved by providing:

- details of any modifications made to the aircraft as a result of past performance statistics
- any operating history showing any significant events or incidents that indicate poor navigation performance
- if there is evidence of significant errors or poor performance, ensuring at least the following have been addressed:
 - revised training program (operational and/or maintenance)
 - contingency procedures reviewed and revised (if required)
 - aircraft modifications or aircraft maintenance practices (if required).

Navigation database - standards and discrepancies

Operators must include operational procedures to ensure that the navigation database is provided from a supplier that holds a letter of acceptance from their regulatory authority.

RNP AR operators must have procedures for validating each RNP AR APCH procedure prior to use for each AIRAC cycle.

Note: This section does not apply to aircraft conducting only RNP 10 and/or RNAV 5 operations that do not have a navigation database installed in the aircraft.

If an aircraft is authorised to conduct RNP 10 or RNAV 5 operations, and the navigation system is equipped with a navigation database, the provisions of this section apply — even though there is no requirement for a navigation database in these navigation specifications.

For navigation database management and reporting requirements compliance, refer to Ch 14.07 of the Part 91 MOS.

During RNP system initialisation, the flight crew must confirm the on-board navigation database is current and will remain so for the duration of the flight. If the AIRAC cycle changes during flight, operators and pilots must establish procedures to ensure the accuracy of the navigation data. The flight crew must not use an outdated database to conduct RNP AR operations, unless flight crew procedures ensure any amendments to the on-board navigation database have no material impact on the desired procedure. If there is a published, amended chart for the RNP AR procedure, the flight crew must not use the database to conduct the operation and must consider the procedure unavailable.

When RNP systems can store two on-board navigation databases on the aircraft, the flight crew must ensure the currency of each database during pre-flight. There is no need to recheck the currency of the new database once it is done during pre-flight. RNP system documentation from the OEM should confirm the RNP system's selection of the new on-board navigation database and any necessary flight crew procedures

RNP AR operations implementation program

For RNP AR operations aircraft, the operator will be required to submit a report to CASA containing a review of operations that include, but are not limited to, the lists in CASA AC 91-05. This report must be submitted at intervals that would have been specified in the operator's implementation program that was developed in consultation with CASA.

An operator that has not previously conducted RNP AR or APV Baro-VNAV operations, or has not conducted the operation with a particular aircraft type, will have an implementation program with limits on operating minima until the operator has demonstrated the capability to safely conduct the specific authorisations to the specifications required.

For further information on implementation programs, inspectors should refer to the following documentation:

- <u>CASA AC 91-05 Performance-Based Navigation</u>
- ICAO Document 9613 PBN Manual Vol. II, Part C: Ch. 6
- ICAO Document 9613 PBN Manual Vol. II, Att A.

4.4 Monitoring and reporting programs

4.4.1 **RVSM**

RVSM minimum monitoring requirements (MMRs) have been adopted for global application by all ICAO Regional Monitoring Agencies (RMAs) and are the basis for implementation of the ICAO Annex 6 requirements.

The MMR are located in <u>RVSM Minimum Monitoring Requirements</u> as of 25 June 2021.

The AAMA Aircraft Height Keeping Performance Monitoring databases contain information regarding date of last successful monitoring and date by which an operator is to have a specific airframe monitored in accordance with the MMR.

RVSM approved aircraft, as notified by CASA, are listed alphabetically by operator. The date of last monitoring information is received from ADS-B monitoring conducted by Airservices Australia, GMU monitoring conducted by approved support organisations, or as advised by other RMAs. To assist operators with planning a forward date (based on two years from last successful monitoring) the 'To be Monitored by Date' is provided. If this is not updated, in accordance with the MMR requirements, it will be flagged as overdue. Airservices publish this information on the following websites:

AAMA Aircraft Height Keeping Performance Monitoring Database (Australia) effective 14 August 2023

AAMA Aircraft Height Keeping Performance Monitoring Database (Indonesia) effective 14 August 2023

AAMA Aircraft Height Keeping Performance Monitoring Database (PNG Solomon Islands and Vanuatu) effective 14 August 2023

Operators must implement an ongoing program, acceptable to CASA, to monitor or verify aircraft heightkeeping performance with their state of registration. The program must include procedures to monitor total vertical error (TVE), assigned altitude deviation (AAD) and to produce a companion altimetry system error (ASE) estimate for each TVE measure. The program should entail a check of at least a portion of the operators aircraft by an independent height-monitoring system.

ADS-B Height-Keeping Monitoring System (AHMS)

The use of ADS-B, as a means to estimate ASE and comply with the ICAO Annex 6 Long Term Heightkeeping Monitoring Requirements, has been endorsed by ICAO following extensive joint research by Australia (AAMA) and the United States (FAA). With the global implementation of long term height monitoring requirements, such a system provides a significantly low cost, efficient means to undertake long-term heightkeeping monitoring without any operational impact on ADS-B equipped aircraft.

Area of implementation

Currently, use of the AAMA AHMS is restricted to aircraft observed within the Australian ADS-B network. The AAMA is planning to extend the implementation to include the Indonesian flight information region (FIR) in the future.

ADS-B monitoring description

ADS-B monitoring is undertaken by the AAMA through the monthly processing of large data sets of ADS-B messages captured in the Australian network. The data is processed to enable the calculation of altimetry system errors for each ADS-B message obtained from a specific aircraft or group of aircraft. A final assessed ASE value is then calculated for each observed aircraft.

ADS-B messages, used for height-keeping monitoring, must include geometric height. Operators wishing to participate in ADS-B height-keeping monitoring must ensure that geometric height is included in transmitted ADS-B messages.

4.4.2 PBN

PBN operations require the operator to have a reliable monitoring program that accurately monitors the ability of the aircraft's navigation system and its achieved navigation performance, and to correctly identify to the pilot whether the operational requirements are being met during an operation. For each navigation specification and authorisation, the operator's monitoring program must include:

- flight crew procedures for monitoring of aircraft navigation performance (ANP) against the required navigational performance (RNP)
- procedures in place to report navigation (including database) performance deficiencies to CASA
- RNAV 1, 2 and 5: while operating in or on the designated RNAV route the lateral total system error and the along-track error must be within the specification distance (1, 2 or 5 NM) for at least 95 per cent of the total flight time
- RNP 4: procedures for monitoring RNP 4 required equipment performance and reporting deficiencies; this includes the CPDLC and ADS-C systems
- RNP APCH:
 - during initial intermediate segments, and for the RNAV missed approach of an RNP APCH, both the lateral total system and along-track errors and must be within ± 1 NM for at least 95 per cent of the total flight time
 - while conducting final approach segment operations of an RNP APCH, both the lateral total system and along-track errors must be within ± 0.3 NM for at least 95 per cent of the total flight time
 - operators must have procedures for loss of RAIM or RAIM warnings, including missed approach (refer AIP ENR 1.5).
- RNP AR operations: the operator must have an RNP AR operations monitoring system in place that
 accurately monitors the requirements detailed in ICAO Document 9613 -PBN Manual. The program
 should be an active flight operations quality assurance (FOQA) program. However, the operator may
 propose an alternate monitoring program which must be acceptable to CASA
- APV Baro-VNAV: the operator must submit a description of the method that is intended to be used to
 monitor APV Baro-VNAV operations to identify, report and investigate any failure or potential failure in
 the Baro-VNAV system or operating procedures
- RNP 0.3, RF Legs and FRT aircraft: refer to CASA AC 91-05 and ICAO Document 9613 PBN Manual Vol II, Att C. Ch. 7.

Inertial system performance monitoring RNP 10

Operators must monitor the drift rate of inertial systems on every flight to determine that the drift rate does not exceed 2 NM/hour. Crew operating procedures must detail that the crew check the final inertial position and residual groundspeed before any inertial system self-calibration action takes place (e.g. groundspeed automatic zeroing).

Reporting navigation / height-keeping errors

The operator is required to have reporting procedures for all PBN navigation (including databases) and RVSM height-keeping errors—immediately to ATC while en route and subsequently to CASA, ATC, Airservices Australia and/or AAMA within 72 hours, as specified in AIP ENR 1.14.

Reportable errors are an event in which the operator's aircraft has exhibited any of the following:

- RVSM aircraft has exhibited any of the following altitude-keeping performance:
 - total vertical error of 300 ft or more
 - altimetry system error (ASE) of 245 ft or more

- assigned altitude deviation of 300 ft or more.
- PBN aircraft has exhibited any of the following navigation performance:
 - a lateral or longitudinal navigational error that exceeds the required accuracy value, that is the RNAV
 or RNP value, for other than a transient duration during a turn
 - an aircraft system failure that results in the aircraft losing the currently active navigation capability, which is a loss of the navigation function.
- APV Baro-VNAV aircraft performance standards are listed in ICAO Doc. 9613 PBN Manual Vol. II, Att A – S. 4:
 - the operator should report any system failures or potential failures to CASA as soon as possible after the occurrence
 - the aircraft must meet the APV Baro-VNAV performance standard on a regular basis.

5. Revision history

Amendments/revisions for this principle are recorded below in order of the most recent first.

Table 2.Revision history table

Version No.	Date	Parts / Sections	Details
1.2	November 2023	Various	Added additional clarity to requirements and RNP 0.3 for rotorcraft. Content transferred to new template. Various minor edits throughout.
1.1	June 2022	(OPS.04) Worksheet A (OPS.04) Worksheet B (OPS.04) Worksheet C	Additional Parts 121, 133, 135 and 138 legislation references added to the assessment questions.
1.0	May 2022	All	First Issue Content transitioned from PBN— Navigation Specifications and Authorisations Technical Assessor Handbook v2.0.